



Financial Highlights

As of or for the year ended December 31,

(in millions, except per share, ratio data and headcount)

	2018	2017	2016
Reported basis^(a)			
Total net revenue	\$ 109,029	\$ 100,705	\$ 96,569
Total noninterest expense	63,394	59,515	56,672
Pre-provision profit	45,635	41,190	39,897
Provision for credit losses	4,871	5,290	5,361
Net income	\$ 32,474	\$ 24,441	\$ 24,733
Per common share data			
Net income per share:			
Basic	\$ 9.04	\$ 6.35	\$ 6.24
Diluted	9.00	6.31	6.19
Cash dividends declared	2.72	2.12	1.88
Book value	70.35	67.04	64.06
Tangible book value (TBVPS) ^(b)	56.33	53.56	51.44
Selected ratios			
Return on common equity	13%	10%	10%
Return on tangible common equity (ROTCE) ^(b)	17	12	13
Common equity Tier 1 capital ratio ^(c)	12.0	12.1	12.2
Tier 1 capital ratio ^(c)	13.7	13.8	13.9
Total capital ratio ^(c)	15.5	15.7	15.2
Selected balance sheet data (period-end)			
Loans	\$ 984,554	\$ 930,697	\$ 894,765
Total assets	2,622,532	2,533,600	2,490,972
Deposits	1,470,666	1,443,982	1,375,179
Common stockholders' equity	230,447	229,625	228,122
Total stockholders' equity	256,515	255,693	254,190
Market data			
Closing share price	\$ 97.62	\$ 106.94	\$ 86.29
Market capitalization	319,780	366,301	307,295
Common shares at period-end	3,275.8	3,425.3	3,561.2
Headcount	256,105	252,539	243,355

(a) Results are presented in accordance with accounting principles generally accepted in the United States of America, except where otherwise noted.

(b) TBVPS and ROTCE are each non-GAAP financial measures. For further discussion of these measures, refer to Explanation and Reconciliation of the Firm's Use of Non-GAAP Financial Measures and Key Financial Performance Measures on pages 57-59.

(c) The ratios presented are calculated under the Basel III Fully Phased-In Approach, and they are key regulatory capital measures. For further discussion, refer to "Capital Risk Management" on pages 85-94.

JPMorgan Chase & Co. (NYSE: JPM) is a leading global financial services firm with assets of \$2.6 trillion and operations worldwide. The firm is a leader in investment banking, financial services for consumers and small businesses, commercial banking, financial transaction processing and asset management. A component of the Dow Jones Industrial Average, JPMorgan Chase & Co. serves millions of customers in the United States and many of the world's most prominent corporate, institutional and government clients under its J.P. Morgan and Chase brands.

Information about J.P. Morgan's capabilities can be found at jpmorgan.com and about Chase's capabilities at chase.com. Information about JPMorgan Chase & Co. is available at jpmorganchase.com.



#1

#1 in U.S. retail deposit growth



89%
YOU INVEST

89% of You Invest customers are first-time investors with Chase



TOP 10

Ranked Top 10 on *Fortune* magazine's World's Most Admired Companies list



20,000
FINANCING/AFFORDABLE
PROPERTIES

Financing for 20,000 affordable properties for low-income individuals across the U.S.



#1

#1 most visited banking portal in the U.S.
• 49 million active digital customers
• 33 million active mobile customers



#1

#1 U.S. multifamily lender



#1

#1 in global investment banking fees for the 10th consecutive year



\$1T OF M&A

Advisor on more than \$1 trillion of announced M&A transactions



FIRST
U.S. BANK
WITH DIGITAL COIN

First U.S. bank with a digital coin



\$500M
ADVANCINGCITIES INITIATIVE

\$500 million *AdvancingCities* initiative to create economic opportunity in cities around the world



83%
RANKED IN TOP TWO QUARTILES

83% of long-term mutual fund assets under management ranked in the top two quartiles over the 10-year period



10%
WAGE INCREASE

10% wage increase, on average, to \$15-\$18 per hour for 22,000 employees

Dear Fellow Shareholders,



Jamie Dimon,
Chairman and
Chief Executive Officer

Once again, I begin this annual letter to shareholders with a sense of pride about our company and our hundreds of thousands of employees around the world. As I look back on the last decade – a period of profound political and economic change – it is remarkable how much we have accomplished, not only in terms of financial performance but in our steadfast dedication to help clients, communities and countries all around the world.

In 2018, we continued to accelerate investments in products, services and technology. For example, for the first time in nearly a decade, we extended our presence in several states with new Chase branches (we plan to open another 400 new branches in the next few years). In addition, we started a new digital investing platform: You Invest; we launched our partnership with Amazon and Berkshire Hathaway in healthcare; we broadened our commitment to create opportunities for jobs and prosperity and reduce the wealth gap for black Americans with Advancing Black Pathways (announced in February 2019); and we launched our

*Advancing*Cities initiative to support job and wage growth in communities most in need of capital. While it is too soon to assess the impact of these efforts, we're seeing terrific results so far.

2018 was another strong year for JPMorgan Chase, with the firm generating record revenue and net income, even without the impact of tax reform. We earned \$32.5 billion in net income on revenue¹ of \$111.5 billion, reflecting strong underlying performance across our businesses. Adjusting for the enactment of the Tax Cuts and Jobs Act, we now have delivered record results in eight of the last nine years, and we have confidence that we will continue to deliver in the future. Each line of business grew revenue and net income for the year while continuing to make significant investments in products, people and technology. We grew core loans by 7%, increased deposits in total by 3% and generally grew market share across our businesses, all while maintaining credit discipline and a fortress balance sheet. In total, we extended credit and raised capital of \$2.5 trillion for businesses, institutional clients and U.S. customers.

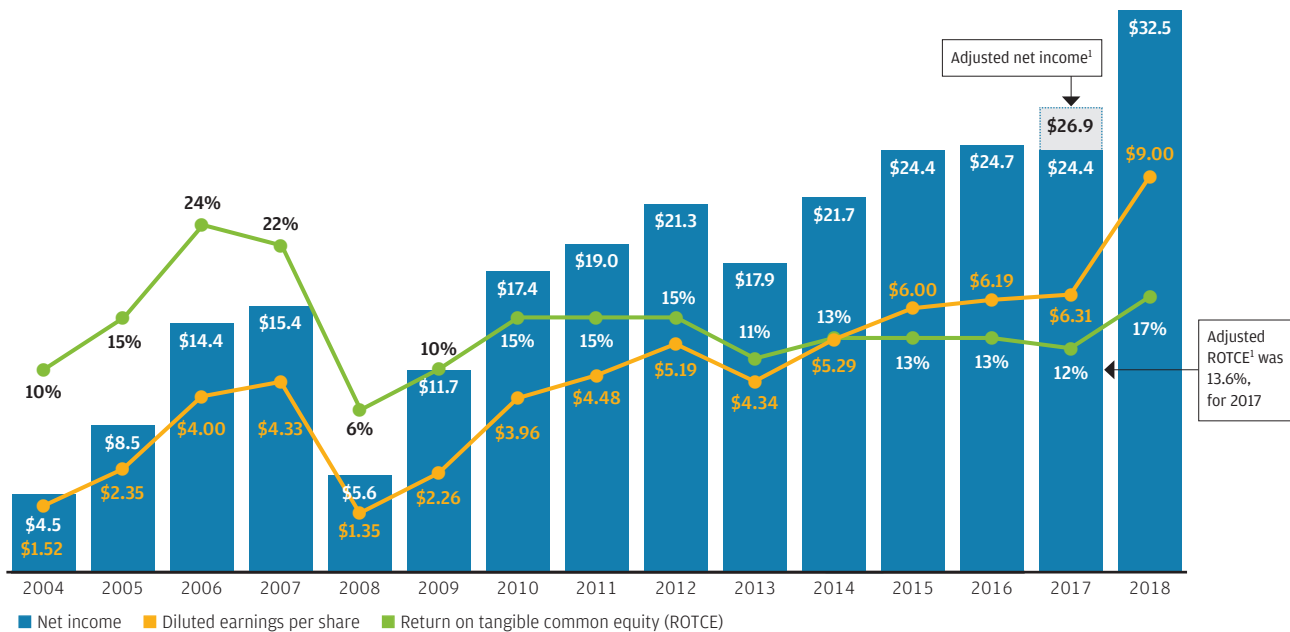
In last year's letter, we emphasized how important a competitive global tax system is for America. Over the last 20 years, as the world reduced its tax rates, America did not. Our previous tax code was increasingly uncompetitive, overly complex, and loaded with special interest provisions that created winners and losers. This drove down capital investment in the United States, which reduced domestic productivity and wage growth. The new tax code establishes a business tax rate that will make the United States competitive around the world and frees U.S. companies to bring back profits earned overseas. The cumulative effect of capital retained and reinvested over many years in the United States will help cultivate strong businesses and ultimately create jobs and increase wages.

For JPMorgan Chase, all things being equal (which they are not), the new lower tax rates added \$3.7 billion to net income. For the long term, we expect that some or eventually most of that increase will be erased as companies compete for customers on products, capabilities and prices. However, we did take this opportunity in the short term to massively increase our investments in technology, new branches and bankers, salaries (we now pay a minimum of \$31,000 a year for full time entry-level jobs in the United States), philanthropy and lending (specifically in lower income neighborhoods).

¹Represents managed revenue.

Earnings, Diluted Earnings per Share and Return on Tangible Common Equity 2004-2018

(\$ in billions, except per share and ratio data)



¹ Adjusted results, a non-GAAP financial measure, exclude a \$2.4 billion decrease to net income, for 2017, as a result of the enactment of the Tax Cuts and Jobs Act.

Tangible Book Value and Average Stock Price per Share 2004-2018



As you know, we believe tangible book value per share is a good measure of the value we have created for our shareholders. If our asset and liability values are appropriate – and we believe they are – and if we can continue to deploy this capital profitably, we think we can continue to exceed 15% return on tangible equity for the next several years (and potentially at or above 17% in the near term), assuming there is not a significant downturn. If we can earn these types of returns, our company should ultimately be worth considerably more than tangible book value. The chart on the bottom of the opposite page shows that tangible book value “anchors” the stock price.

Bank One/JPMorgan Chase & Co. tangible book value per share performance vs. S&P 500 Index			
	Bank One (A)	S&P 500 Index (B)	Relative Results (A) – (B)
Performance since becoming CEO of Bank One (3/27/2000–12/31/2018)¹			
Compounded annual gain	11.6%	4.7%	6.9%
Overall gain	615.8%	136.4%	479.4%
Performance since the Bank One and JPMorgan Chase & Co. merger (7/1/2004–12/31/2018)			
Compounded annual gain	12.4%	7.8%	4.6%
Overall gain	442.3%	196.8%	245.5%
Tangible book value over time captures the company's use of capital, balance sheet and profitability. In this chart, we are looking at heritage Bank One shareholders and JPMorgan Chase & Co. shareholders. The chart shows the increase in tangible book value per share; it is an after-tax number that assumes all dividends were retained vs. the Standard & Poor's 500 Index (S&P 500 Index), which is a pre-tax number that includes reinvested dividends.			
¹ On March 27, 2000, Jamie Dimon was hired as CEO of Bank One.			

In the last five years, we have bought back almost \$55 billion in stock or approximately 660 million shares, which is nearly 20% of the company's common shares outstanding. In prior letters, I explained why buying back our stock at tangible book value per share was a no-brainer. Seven years ago, we offered an example of this: If we bought back a large block of stock at tangible book value, earnings and tangible book value per share would be substantially higher just four years later than without the buyback. While we prefer buying back our stock at tangible book value, we think it makes sense to do so even at or above two times tangible book value for reasons similar to those we've expressed in the past. If we buy back a big block of stock this year, we would expect (using analysts' earnings

estimates) earnings per share in five years to be 2%-3% higher and tangible book value to be virtually unchanged. We want to remind our shareholders that we much prefer to use our capital to grow than to buy back stock. I discuss stock buybacks later in this letter.

Stock total return analysis			
	Bank One	S&P 500 Index	S&P Financials Index
Performance since becoming CEO of Bank One (3/27/2000–12/31/2018)¹			
Compounded annual gain	11.2%	4.7%	3.1%
Overall gain	638.9%	136.4%	76.3%
	JPMorgan Chase & Co.	S&P 500 Index	S&P Financials Index
Performance since the Bank One and JPMorgan Chase & Co. merger (7/1/2004–12/31/2018)			
Compounded annual gain	9.4%	7.8%	2.4%
Overall gain	268.0%	196.8%	40.5%
Performance for the period ended December 31, 2018			
Compounded annual gain/(loss)			
One year	(6.6)%	(4.4)%	(13.0)%
Five years	13.6%	8.5%	8.1%
Ten years	14.5%	13.1%	10.9%
These charts show actual returns of the stock, with dividends reinvested, for heritage shareholders of Bank One and JPMorgan Chase & Co. vs. the Standard & Poor's 500 Index (S&P 500 Index) and the Standard & Poor's Financials Index (S&P Financials Index).			
¹ On March 27, 2000, Jamie Dimon was hired as CEO of Bank One.			

While we don't run the company worrying about the stock price in the short run, in the **long run** our stock price is a measure of the progress we have made over the years. This progress is a function of *continual* investments, in good and bad times, to build our capabilities – our people, systems and products. These important investments drive the future prospects of our company and position it to grow and prosper for decades. Whether looking back over five years, 10 years or since the JPMorgan Chase/Bank One merger (approximately 14 years ago), our stock has significantly outperformed the Standard & Poor's 500 Index and the Standard & Poor's Financials Index. And this growth came during a time of unprecedented challenges for banks – both the Great Recession and the extraordinarily difficult legal, regulatory and political environment that followed.

JPMorgan Chase stock is owned by large institutions, pension plans, mutual funds and directly by individual investors. However, it is important to remember that in almost all cases, the ultimate beneficiaries are individuals in our communities. Well over 100 million people in the United States own stock, and a large percentage of these individuals, in one way or another, own JPMorgan Chase stock. Many of these people are veterans, teachers, police officers, firefighters, retirees, or those saving for a home, school or retirement. Your management team goes to work every day recognizing the enormous responsibility that we have to perform for our shareholders.

In the first section of this letter, I try to give a **comprehensive** understanding of how we run our company, including how we think about building shareholder value for the long run. In that section, I highlight our strong belief that building shareholder value can only be done in conjunction with taking care of employees, customers and communities. This is **completely** different from the commentary often expressed about the sweeping ills of naked capitalism and institutions only caring about shareholder value.

In the second section of this letter, I comment on important forward-looking issues. While we remain optimistic about the long-term growth of the United States and the world, the near-term economic and political backdrop is increasingly complex and fraught with risks – both known and unknown. And we face a future with less overall confidence in virtually all institutions, from corporations to governments to the media. The extremely volatile global markets in the fourth quarter of 2018 might be a harbinger of things to come – creating both risks for our company and opportunities to serve our clients.

The third section of this letter is about public policy, specifically American public policy, which is a major concern for our country and, therefore, our company. Again, I try to give a **comprehensive**, multi-year overview of what I see as some of our problems and suggest a few ways they can be addressed. One consistent theme is completely clear: Businesses, governments and communities need to work as partners, collaboratively and constructively, to analyze and solve problems and help strengthen the economy for everyone's benefit.

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1. First and foremost, we look at our business from the point of view of the customer. Page 10
2. We endeavor to be the best at anything and everything we do. Page 15
3. We will maintain a fortress balance sheet – and fortress financial principles. Page 16
4. We lift up our communities. Page 18
5. We take care of our employees. Page 22
6. We always strive to learn more about management and leadership. Page 24
7. We do not worry about some issues. Page 25

II. Comments on Current Critical Issues Page 26

1. We need to continue to restore trust in the strength of the U.S. banking system and global systemically important financial institutions. Page 26
2. We have to remind ourselves that responsible banking is good and safe banking. Page 29
3. We believe in good regulation – both to help America grow and improve financial stability. Page 31
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III. Public Policy

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1. The American Dream is alive – but fraying for many. Page 41
2. We must have a proper diagnosis of our problems – the issues are real and serious – if we want to have the proper prescription that leads to workable solutions. Page 42
3. All these issues are fixable, but that will happen only if we set aside partisan politics and narrow self-interest – our country must come first. Page 46
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I. JPMORGAN CHASE PRINCIPLES AND STRATEGIES

In this section, I want to give the reader a *comprehensive view of how we run the company*. We manage the company consistently with these principles in mind – and they have stood the test of time. We also strive to satisfy, and even exceed, the requirements of our regulators and governments around the globe – and we think these principles are a critical component of that.

1. First and foremost, we look at our business from the point of view of the customer.

Customer needs are what gets our attention. We believe that in a hyper-competitive world (from competitors known and unknown), the best strategy – both offensive and defensive – is to give the customer more: something better, faster or more efficiently. We are always on a quest to improve our products and services, and, for the most part, this is done with enhancements in technology and through the continual training of our people. Most fundamental of all is doing the right thing for our customers – in all cases.

We energetically drive organic growth.

We continue to drive good and healthy organic growth (meaning good customers, products and services they need and want at fair and reasonable prices), and while we are happy with our progress, we recognize that we won't meet every goal we set for ourselves and can always do better. In past letters, we have identified many areas of organic growth. Our achievements with these initiatives are detailed in the CEO letters in this Annual Report, but a few of the critical strategies are highlighted in the sidebar below.

ORGANIC GROWTH OPPORTUNITIES ACROSS OUR LINES OF BUSINESS

Consumer & Community Banking

- By 2022, we expect 93% of the U.S. population to be in our Chase footprint as we expand our branch network to new markets with an integrated physical and digital approach. In addition to entering the Washington, D.C., Philadelphia and Boston markets in 2018, we recently announced nine new markets for 2019, including Charlotte, Minneapolis, Nashville and St. Louis.
- The onboarding experience for new customers is being simplified. Customers can open a new deposit account digitally in three to five minutes, functionality that added approximately 1.5 million new accounts since its February 2018 launch; we're expanding this functionality inside our branches as well. We also recently announced Chase MyHome, our new digitally enabled mortgage fulfillment process that prefills applications for our existing customers. It's 20% faster than our paper-based process, allowing us to close a mortgage within three weeks. Our confidence in our enhanced approach is reflected in our money-back guarantee.

-
- Customers recently began receiving personalized merchant offers and discounts from ChaseOffersSM. This program ramped up rapidly, with customers activating 25+ million offers across 7 million cards in the initiative's first three months. CreditJourneySM, with more than 15 million users enrolled, has also been a tremendously successful way to engage customers through access to credit score information and identity protection.
 - And later this year, we'll make it easier for our credit card customers to borrow on their existing lines through two new products – My Chase PlanSM, allowing customers to finance a specific purchase at a reasonable cost at the point of sale; and My Chase LoanSM, letting customers borrow against their unused credit limit and pay back their debt in fixed amounts at a competitive rate. These products enable us to compete for the approximately \$250 billion in card loans that our existing customers have with competitors.

Corporate & Investment Bank

- We have been #1 in investment banking for the past decade and finished 2018 with 8.7% of global wallet share, the industry's best. Still, we believe we can increase our share over time as we continue to add bankers selectively and leverage technology to provide better data and insights to our clients.
- Our Treasury Services business grew revenue by 13% last year. As we further implement our wholesale payments model, which includes merchant services, we will be able to deliver a unique value proposition to our clients. We see opportunities in every customer segment from middle market and small businesses to large corporate clients and their business outside of the United States.
- We have consistently grown share in Markets – including in businesses where the wallet has shrunk. We are prioritizing investments in products and technology to stay ahead of our clients' needs. As companies expand their businesses and acquire assets – increasingly across borders – our global expertise in hedging risks and protecting capital can be as important to them as the actual acquisition.
- Our Securities Services business has transformed itself into an industry powerhouse, and it sits alongside the world's leading trading businesses. As asset managers face ongoing pressures from passive investing and margin compression in the coming years, we think we have a unique opportunity to help them become more efficient by outsourcing support functions and using our innovative technology platforms.
- Our Corporate & Investment Bank is one of the few truly global businesses in the financial services industry. As emerging countries take their place on the global stage, we will be there to support them. The investments we are making in China and in other emerging markets today will result in our international growth for years to come.

Commercial Banking

- Being able to deliver the broad-based capabilities of JPMorgan Chase at a very local level is a key competitive advantage. Since launching our Middle Market expansion efforts, we are now local in 39 new markets and have added 2,800 clients, resulting in 22% compounded revenue growth over the last three years. Our growth potential for Middle Market business isn't just limited to our expansion markets. Through data-driven analysis, we've identified nearly 38,000 prospective clients nationally. Some of our most exciting opportunities are within our legacy markets like New York, Chicago, Dallas and Houston, where we have been for over a century.
- Chase's retail branch expansion amplifies our opportunity to deepen relationships with clients who already are in those markets by giving them access to branches and the additional resources that come with that access. In addition, the expansion opens the opportunity to serve more public sector customers in new U.S. markets through our Government Banking business, deepening community engagement and broadening our work with cities, states, public universities and other municipal clients.
- Commercial Banking's partnership with the Corporate & Investment Bank continues to be highly successful and is a key growth driver for both businesses. Being able to deliver the #1 investment bank locally enhances our strategic dialogue with our clients and separates us from our competitors. In 2018, 39% of the firm's North America investment banking fees came from Commercial Banking clients, totaling \$2.5 billion in revenue, up from \$1 billion 10 years ago. We expect that number to continue to grow.

Asset & Wealth Management

- We are using data and technology to transform how we interact with clients. By integrating our human expertise with distinctive digital offerings like You Invest, we have been able to attract new clients, 89% of whom are first-time investors with Chase.
- We are expanding our footprint to capture more of the opportunity across the U.S. wealth management spectrum – from mass affluent (\$500,000 to \$3 million) to high-net-worth (\$3 million to \$10 million) to ultra-high-net-worth (\$10 million or greater). By the end of 2019, we expect to have 6,500 advisors globally on the ground where our clients need us most.
- We have continued to innovate our product lineup by adding 47 index funds and exchange-traded funds (ETF) over the last three years.

The charts below show JPMorgan Chase's fairly consistent growth over the years. This kind of growth only comes from

happy, repeat customers. They have plenty of other choices.

Client Franchises Built Over the Long Term

	2006	2017	2018		
Consumer & Community Banking	Deposits market share ⁵	3.6%	8.7%	9.0%	<ul style="list-style-type: none"> ■ Serve 62 million U.S. households, including 4 million small businesses ■ 49 million active digital customers¹, including 33 million active mobile customers² ■ 99 million debit and credit card accounts³ ■ #1 in new primary bank relationships nationally⁴ ■ #1 U.S. credit card issuer based on sales and outstandings⁶ ■ #2 jumbo mortgage originator⁹
	# of top 50 Chase markets where we are #1 (top 3)	11 (25)	16 (40)	16 (42)	
	Average deposits growth rate	8%	9%	5%	
	Active mobile customers growth rate	NM	13%	11%	
	Credit card sales market share ⁷	15.9%	22.0%	22.3%	
	Merchant processing volume ²⁰ (\$B)	\$661	\$1,192	\$1,366	
	# of branches	3,079	5,130	5,036	
	Client investment assets (\$B)	~\$80	\$273	\$282	
	Business Banking primary market share ²¹	5.1%	8.7%	8.8%	
	Corporate & Investment Bank	Global investment banking fees ¹⁰	#2	#1	
Market share ¹⁰		8.7%	8.1%	8.7%	
Total Markets revenue ¹¹		#8	#1	#1	
Market share ¹¹		6.3%	10.7%	11.6%	
FICC ¹¹		#7	#1	#1	
Market share ¹¹		7.0%	11.1%	11.9%	
Equities ¹¹		#8	co-#1	co-#1	
Market share ¹¹		5.0%	9.9%	11.2%	
Assets under custody (\$T)	\$13.9	\$23.5	\$23.2		
Commercial Banking	# of top 50 MSAs with dedicated teams	26	50	50	<ul style="list-style-type: none"> ■ 133 locations across the U.S. ■ 26 international locations ■ 17 specialized industry coverage teams ■ #1 traditional Middle Market Bookrunner¹⁷ ■ 20,000 affordable housing units financed in 2018
	Bankers	1,203	1,766	1,922	
	New relationships (gross)	NA	1,062	1,232	
	Average loans (\$B)	\$53.6	\$198.1	\$205.5	
	Average deposits (\$B)	\$73.6	\$177.0	\$170.9	
	Gross investment banking revenue (\$B) ¹⁶	\$0.7	\$2.4	\$2.5	
	Multifamily lending ¹⁵	#28	#1	#1	
Asset & Wealth Management	Ranking of 5-year cumulative net client asset flows ²³	NA	#2	#2	<ul style="list-style-type: none"> ■ Serve clients across the entire wealth spectrum ■ Business with 55% of the world's largest pension funds, sovereign wealth funds and central banks ■ Fiduciaries across all asset classes ■ 83% of 10-year long-term mutual fund assets under management (AUM) performed above peer median¹⁹ ■ Revenue and long-term AUM balance growth ~90% since 2006
	North America Private Bank (<i>Euromoney</i>) ¹⁸	#1	#1	#1	
	Client assets (\$T)	\$1.3	\$2.8	\$2.7	
	Active AUM market share ²⁴	1.8%	2.5%	2.5%	
	North America Private Bank client assets market share ²⁵	3%	4%	4%	
	Average loans (\$B)	\$26.5	\$123.5	\$138.6	
	# of Wealth Management client advisors	1,506	2,605	2,865	

For information on footnotes 1-19, refer to slides 32-33 in the JPMorgan Chase 2019 Investor Day – Firm Overview presentation, which is available on JPMorgan Chase & Co.'s website (https://www.jpmorganchase.com/corporate/investor-relations/document/2019_firm_overview_ba56d0e8.pdf), under the heading Investor Relations, Events & Presentations, JPMorgan Chase 2019 Investor Day, and on Form 8-K as furnished to the U.S. Securities and Exchange Commission (SEC) on February 26, 2019, which is available on the SEC's website (www.sec.gov).

²⁰ 2006 reflects First Data joint venture.

²¹ Source: Barlow Research Associates, Primary Bank Market Share Database as of 4Q18. Rolling eight quarter average of small businesses with revenue of \$100,000 - <\$25 million.

²² Source: Ranks for Banking - Dealogic as of January 1, 2019, and ranks for Markets, Treasury Services and Securities Services - Coalition, preliminary 2018 rank analysis based on JPMorgan Chase's business structure.

²³ Source: Company filings and JPMorgan Chase estimates. Rankings reflect competitors in the peer group with publicly reported financials and 2018 client assets of at least \$500B as follows: Allianz Group, Bank of America Corporation, Bank of New York Mellon Corporation, BlackRock, Inc., Credit Suisse Group AG, Franklin Resources, Inc., The Goldman Sachs Group, Inc., Invesco Ltd., Morgan Stanley, T. Rowe Price Group, Inc. and UBS Group AG. JPMorgan Chase's ranking reflects AWM client assets, Chase Wealth Management investments and new-to-firm Chase Private Client deposits.

²⁴ Source: Strategic Insight as of February 2019. Reflects active long-term mutual funds and exchange-traded funds only. Excludes fund of funds and money market funds.

²⁵ Source: Cappemini World Wealth Report 2018. Market share estimated based on 2017 data (latest available).

NM = Not meaningful

B = Billions

NA = Not available

T = Trillions

FICC = Fixed Income, Currencies and Commodities

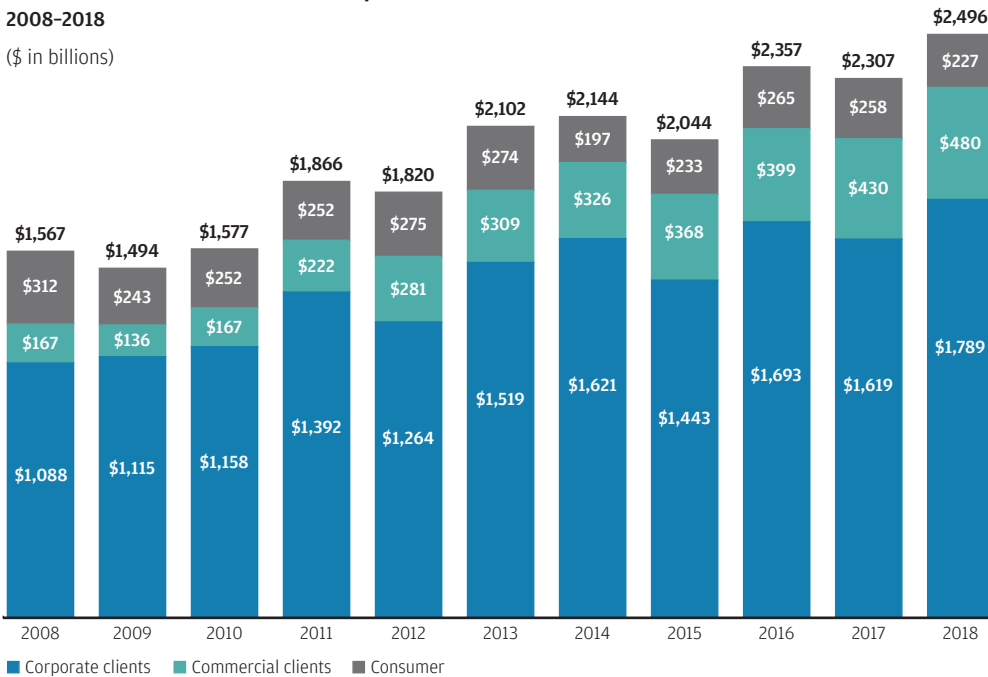
MSAs = Metropolitan statistical areas

USD = U.S. dollar

New and Renewed Credit and Capital for Our Clients

2008-2018

(\$ in billions)

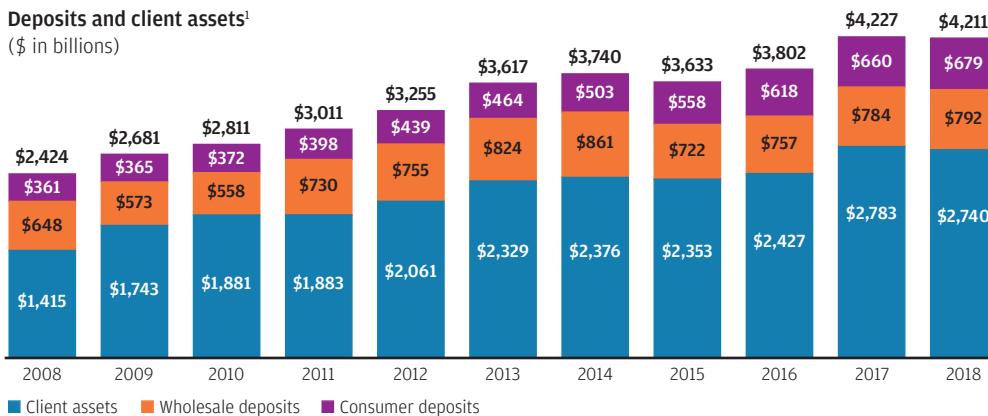


Assets Entrusted to Us by Our Clients

at December 31,

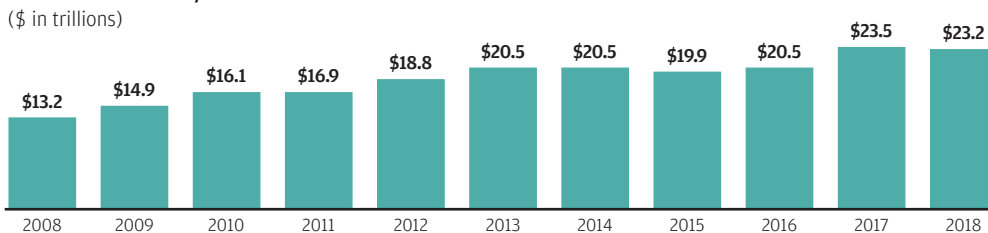
Deposits and client assets¹

(\$ in billions)



Assets under custody²

(\$ in trillions)



¹ Represents assets under management, as well as custody, brokerage, administration and deposit accounts.

² Represents activities associated with the safekeeping and servicing of assets.

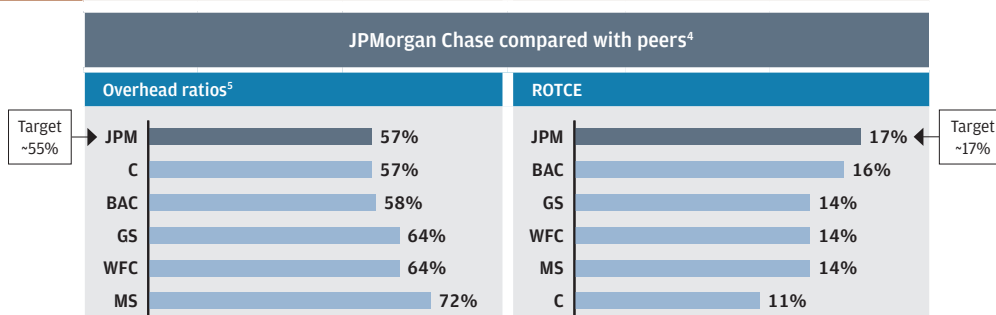
2. We endeavor to be the best at anything and everything we do.

While we never expect to be best-in-class every year in every business, we normally compare well with our best-in-class peers.

The chart below shows our performance generally, by business, versus our competitors in terms of efficiency and returns.

JPMorgan Chase Is in Line with Best-in-Class Peers in Both Efficiency and Returns

	Efficiency			Returns		
	JPM 2018 overhead ratios	Best-in-class peer overhead ratios ¹	JPM medium-term target overhead ratio	JPM 2018 ROTCE	Best-in-class peer ROTCE ^{2,3}	JPM medium-term target ROTCE
Consumer & Community Banking	53%	47% BAC-CB	50%+/-	28%	33% BAC-CB	25%+
Corporate & Investment Bank	57%	54% BAC-GB & GM	54%+/-	16%	16% BAC-GB & GM	~16%
Commercial Banking	37%	42% USB-C&CB	35%+/-	20%	17% FITB	~18%
Asset & Wealth Management	74%	60% CS-PB & TROW	70%+/-	31%	37% MS-WM & TROW	25%+



¹ Best-in-class overhead ratio represents comparable JPMorgan Chase (JPM) peer business segments: Bank of America Consumer Banking (BAC-CB), Bank of America Global Banking and Global Markets (BAC-GB & GM), U.S. Bancorp Corporate and Commercial Banking (USB-C&CB), Credit Suisse Private Banking (CS-PB) and T. Rowe Price Group, Inc. (TROW).

² Best-in-class ROTCE represents implied net income minus preferred stock dividends of comparable JPM peers and peer business segments when available: BAC-CB, BAC-GB & GM, Fifth Third Bancorp (FITB), Morgan Stanley Wealth Management (MS-WM) and TROW.

³ Given comparisons are at the business segment level, where available, allocation methodologies across peers may be inconsistent with JPM's.

⁴ Bank of America Corporation (BAC), Citigroup Inc. (C), The Goldman Sachs Group, Inc. (GS), Morgan Stanley (MS), Wells Fargo & Company (WFC).

⁵ Managed overhead ratio = total noninterest expense/managed revenue; revenue for GS and MS is reflected on a reported basis. ROTCE = Return on tangible common equity

On an ongoing basis, we analyze and compare ourselves with our competitors at a very detailed level. The analysis we do is on more than 50 sub-lines of business and hundreds of products, incorporating not just financial data but also operational

data, customer satisfaction and many other measures. Our management will always be very critical of its own performance: Acknowledging our shortcomings and mistakes and studying them intensely and learning from them make for a stronger company.

We also never lose sight of the fact that we have an extraordinary number of strong competitors – we cannot be complacent. There are many capable financial technology (fintech) companies in the United States and around the world – technology always creates opportunities for disruption. We have acknowledged that companies like Square and PayPal have done things that we could have done but did not. They looked at clients’ problems, improved straight through

processing, added data and analytics to products, and moved quickly. We recently sent one of our senior teams to China to study what’s being achieved there with artificial intelligence (AI) and fintech, and it’s hard not to be both impressed and a little worried about the progress China has made – it made our management team even more motivated to move quickly. Suffice it to say, no matter what our current performance is, we cannot rest on our laurels.

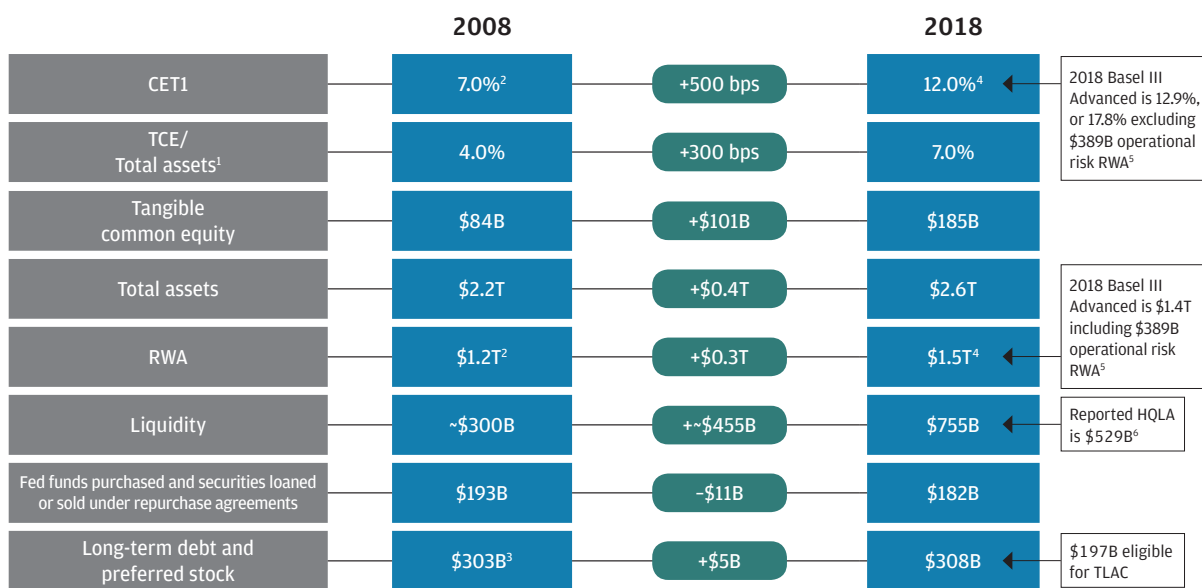
3. We will maintain a fortress balance sheet – and fortress financial principles.

A fortress company starts with a fortress balance sheet.

You can see in the chart below that our balance sheet is extraordinarily strong.

Our Fortress Balance Sheet

at December 31,



¹ Excludes goodwill and intangible assets.

² CET1 reflects Tier 1 common; reflects Basel I measure.

³ Includes trust preferred securities.

⁴ Reflects Basel III Standardized measure which is the firm's current binding constraint.

⁵ Operational risk RWA is a component of RWA under Basel III Advanced measure.

⁶ Represents the amount of HQLA included in the liquidity coverage ratio.

For additional information, refer to LCR and HQLA on page 96.

B = Billions
T = Trillions
bps = basis points

CET1 = Common equity Tier 1 ratio. For additional information, refer to Regulatory capital on pages 86-91
TCE = Tangible common equity
RWA = Risk-weighted assets
Liquidity = HQLA plus unencumbered marketable securities, which includes excess liquidity at JPMorgan Chase Bank, N.A.
HQLA = High quality liquid assets. Predominantly includes cash on deposit at central banks and highly liquid securities including U.S. agency mortgage-backed securities, U.S. Treasuries and sovereign bonds
LCR = Liquidity coverage ratio
TLAC = Total loss absorbing capacity

We have an incredibly well-capitalized bank with enormous liquidity.

But a fortress balance sheet isn't enough.

To be a fortress company, we believe that you also need to have strong, properly diversified earnings and margins. It is capital and liquidity combined with strong earnings and margins that provide the ability to withstand extreme stress. I want to remind shareholders that we run hundreds of stress tests internally each month, some of which are far more severe than the Federal Reserve's (the Fed) annual stress test. We also believe that we should have strong earnings *after* making investments for the future – which may reduce earnings in the short run. We are cost- and capital-efficient; we rigorously allocate our capital; and we continually analyze our businesses, both to maximize their individual performance and to make sure they are contributing to the health of the whole company.

We like to use our capital to grow.

We *much* prefer to use our capital to grow than to buy back stock. We believe buying back stock should be considered only when either we cannot invest (sometimes as a result of regulatory policies) or we are generating excess capital that we do not expect to use in the next few years. Buybacks should not be done at the expense of investing appropriately in our company. Investing for the future should come first, and at JPMorgan Chase, it does.

However, when you cannot see a clear use for your excess capital over the short term, buying back stock is an important capital tool – as long as you are buying it back at a reasonable price. And when companies buy back stock (which we only do when it is at a price that we think adds value to our **remaining** shareholders), the capital is redistributed to investors who can put it to good use elsewhere. It does not disappear. We currently have excess capital, but we hope in the future to be able to invest more of it to grow our businesses.

Good financial management is also critical.

We have always believed that a deep and detailed understanding of a company's financial and operational statements, including all assets and liabilities and all revenue and expenses (without netting and regardless of whether they are on- or off-balance sheet), is critical to running a safe and sound organization. However, accounting, and therefore earnings, is not a perfect measure of performance or economics. I would like to discuss a few reasons why:

- **Accounting rules can be counterintuitive, but you can't make business decisions based on them.** While we are rigorous about proper accounting and disclosure, sometimes accounting can distort the actual economics of a business. A few examples will suffice. In credit card accounting, for instance, new card customer costs are expensed over the course of a year and inexplicably as a contra-revenue item (i.e., as a reduction of revenue rather than an expense). In addition, under upcoming accounting rules, losses that are expected over the life of the card balance are accounted for upfront. Meanwhile, the earnings from the card are booked over the life of the card, which averages approximately seven years. In connection with mortgage loans we don't own but instead service (i.e., by sending statements and receiving payments on behalf of the mortgagor), the accounting standard requires that we present-value expected revenue and expenses and book everything upfront. But in cash management, asset management and many other products that have a similar, somewhat predictable annuity-like revenue stream, the practice is different. The reason I am making this point is that you need to understand the *economics* of decisions. Accounting can easily make people do silly things.

- **Conservative accounting is better.** While we always try to make intelligent economic decisions, I do believe that appropriately conservative accounting is a better way to manage your business. For example, recognize problems early, write off software that is not valuable, don't book revenue that is uncertain and so on. Aggressive accounting leads to trouble, and while it may help increase performance measures in the short run, it will most certainly be uncovered and reversed at precisely the wrong time.
- **Earnings guidance can be very damaging.** Let's be very clear: Transparency with shareholders, proper disclosures and guidance on certain revenue, expense and balance sheet items all are good. However, earnings themselves in any one quarter are a function of decisions made over many, many years. Quarterly earnings are dependent upon many factors, like cost of goods sold and market prices, which often change, as well as unexpected events, the weather, and wage and gross domestic product (GDP) growth. No CEO can predict all of those things, and any analyst with an earnings estimate has made his or her own specific assumptions around them.

The real damage to an organization comes from the *cumulative corrosiveness* of trying to "make" its numbers. This can be exacerbated by compensation deals and models that can be manipulated to change quarterly results. It's easy to change earnings in a quarter by doing stupid things that help earnings in the short term but are bad in the long term. Examples include asking customers to inappropriately buy more products before the end of the quarter so you can show revenue growth, reducing marketing, not opening that new branch or not investing in technology that won't have a payback for a year or two. I could go on and on. And this could spiral within a company, as loyal, well-meaning employees do what they can to help a company meet its "earnings goal."

Importantly, in the next section, I speak in detail about responsible banking, client selection and intensive risk management. Proper management is as critical as anything else we do, but I did not want to repeat the messages here.

4. We lift up our communities.

We will never forget that the most important thing we do is to run a healthy and vibrant company that is here to constantly serve our clients with responsible banking. But we want our shareholders and all of our constituents to understand the tremendous amount we do, in addition to traditional banking, to help the communities in which we operate.

Our effort is substantial, permanent and supported by the whole company.

One of the reasons for JPMorgan Chase's enduring success is we have always recognized that long-term business success depends on community success. When

everyone has a fair shot at participating in and sharing in the rewards of growth, the economy will be stronger and our society will be better. We are making significant, long-term, data-driven business and philanthropic investments aimed at opening doors to opportunity for those being left behind.

Most people consider corporate responsibility to be enhanced philanthropy. While we are devoted to philanthropy (we are on our way to spending \$350 million a year on these efforts), corporate responsibility is far more than just that. We finance more than \$2 billion in affordable housing each

year; we do extensive lending in low- and moderate-income neighborhoods; we lend to and finance small businesses around the country; and we design products and services in financial education for lower income individuals. And importantly, these efforts are supported by senior leadership, managed by some of our best people (these efforts are not an afterthought) and are sustainable. We try to be creative, but we analyze everything, including philanthropy, based on expected results.

We are huge supporters of regional and community banks, which are critical to many cities and small towns around the country.

In an op-ed published by *The Wall Street Journal* in 2016, I wrote: “In this system, regional and smaller community banks play an indispensable role. They sit close to the communities they serve; their highest-ranking corporate officers live in the same neighborhoods as their clients. They are able to forge deep and long-standing relationships and bring a keen knowledge of the local economy and culture. They frequently are able to provide high-touch and specialized banking services.” JPMorgan Chase, as a traditional “money center bank” and “bankers’ bank,” in fact, is the largest banker in America to regional and community banks. We bank approximately 530 of America’s 5,200 regional and community banks. In 2018, we made loans to them or raised capital for them totaling \$4 billion. In addition, we process payments for them, we finance some of their mortgage activities, we advise them on acquisitions, and we buy and sell securities for them. We also provide them with interest rate swaps and foreign exchange both for themselves – to help them hedge some of their exposures – and for their clients.

Over the past five years, we have developed and refined a model that may be a blueprint for urban revitalization and inclusive growth. Our head of Corporate Responsibility describes our significant measures in more detail in his letter, but I highlight a few examples here, including the sidebar on page 20 that describes our focused effort to support black advancement in a number of the communities we serve:

- **Detroit exemplifies the challenges many cities wrestle with, as well as the strategies for solving them.** Since 2014, JPMorgan Chase has been combining its philanthropy and business expertise to address some of Detroit’s biggest economic hurdles, ranging from catalyzing development, building infrastructure and affordable housing, and boosting small business growth to revitalizing education and preparing Detroiters with the skills to secure well-paying jobs. We are deeply proud of our \$150 million commitment and the impact we have made to date – the city has been the proving ground for our model for driving inclusive growth, which has made a real difference in Detroit’s comeback and the lives of its citizens. Over the past five years, we have taken lessons learned and applied them to other cities facing similar challenges.
- **The Entrepreneurs of Color Fund (EOCF) is another example of how we are turning our insights into action.** In 2015, JPMorgan Chase helped launch the Entrepreneurs of Color Fund in Detroit to provide underserved entrepreneurs with access to capital and assistance needed to grow and thrive. From 2015 to 2018, the fund made or approved loans totaling \$6.6 million to 79 minority small businesses, resulting in over 830 new or preserved jobs. Since then, the Detroit fund has more than tripled in size to over \$22 million. Building on the success of Detroit’s EOCF, we expanded this model to San Francisco, the South Bronx, the Greater Washington region and Chicago, where it is also making a real impact. In total, these funds are now approximately \$40 million and growing.



MELLODY HOBSON



JAMIE DIMON

Melody Hobson and Jamie Dimon: Black Americans are still worse off financially. Businesses can help.

For all the positive economic trends in America, the racial wealth gap continues to prevent growth from benefiting everyone. While this is not a new crisis, it is one we must urgently address so that economic opportunity is equally extended to black Americans.

Racism, intolerance, and poverty strangle economic opportunity. The racial wealth gap is stark: For single black Americans, the median wealth is \$200 to \$300, compared to \$15,000 to \$28,000 for single white Americans. This divide undermines financial stability for many black Americans.

Closing the racial wealth gap is good for Americans, and it makes good business sense. We know employees from diverse backgrounds offering different perspectives drive better corporate outcomes. A recent study showed that businesses with diverse leadership generate 19% more revenue than non-diverse companies.

Diversity can also reduce turnover. Nearly seven in 10 millennials reported they would continue to work at a company for five or more years if it is diverse.

As leaders in business as well as the broader community, we know we have a responsibility to society. Not to mention, as financial services executives, we can help to foster widespread prosperity.

To this end, we have both worked to empower black Americans to achieve personal and professional success. For example, After School Matters, a nonprofit founded in 2000, provides enrichment programs to thousands of inner-city high school students in Chicago. Meanwhile, JPMorgan Chase's Fellowship Initiative, founded in 2010, offers hands-on college access and academic support to young men of color in Los Angeles, New York, Chicago and Dallas. The scale and success of these efforts are impressive – but not enough. There is much more work to be done.

Recently, we announced Advancing Black Pathways – a new program at JPMorgan Chase that seeks to build on existing efforts to bridge the racial wealth divide and ultimately help black families build wealth. We urge more businesses to join us as we attempt to close this divide.

Our current initiative, Advancing Black Leaders, seeks to hire and promote more black senior executives and junior-level employees at JPMorgan Chase. We know investing in our employees is key to our company's future. In addition to recruiting more African-American leaders, we also need to focus on retaining them. Since 2016, the firm has increased the number of black managing directors by 41% and black executive directors by 53%. A good start – but just the beginning.

Advancing Black Pathways will create a dedicated talent pipeline that will start young black professionals on an early career path and foster a corporate culture that further encourages diversity at all levels. We plan to hire more than 4,000 black students in full-time positions, apprenticeships, and internships over the next five years. JPMorgan Chase will also help create job training programs that are aligned with growing industries in the broader communities we serve.

We are also investing in the financial success of black Americans through a focus on savings, homeownership, and entrepreneurship. For example, the largest wealth gaps lie in racial disparities among entrepreneurs. If people of color owned businesses at the same rates as whites, 9 million more jobs and \$300 billion in income would be created.

As part of this effort, we are helping to create a \$6.65 million Entrepreneurs of Color Fund with local partners in the Washington, D.C. region to expand access to capital, improve business services, and streamline supplier diversity programs for small, minority-owned businesses. To date, we have launched similar low-cost loan funds in four other U.S. cities, bringing other investors to the table, and leveraging nearly \$40 million to support underserved entrepreneurs. Thus far, Entrepreneurs of Color Funds have created or saved more than 1,200 jobs in critical neighborhoods lacking needed resources to grow.

Businesses of every size have an important role to play in expanding opportunity. By working together, we can give people a fair and equal chance to succeed, no matter their zip code or skin color.

- **In 2018, we launched *AdvancingCities*, JPMorgan Chase's \$500 million, five-year initiative to drive inclusive growth in cities around the world.** Through this effort, we are combining our business and philanthropic resources and expertise to expand opportunity for those being left behind in today's economy. This is a global program. Marking our firm's 150th anniversary in France last year, we announced a \$30 million, five-year commitment – the first *AdvancingCities* investment – to support underserved small businesses and provide skills training to residents in Seine-Saint-Denis and other areas in Greater Paris with high levels of poverty and unemployment.
- **Our recent \$350 million *New Skills at Work* commitment is focused on how we prepare people to succeed in our transformed workplaces and changing global economy.** Over the past five years, we have supported worker education and training around the world – collaborating with nearly 750 partners and nonprofits in 37 countries and 30 U.S. states, affecting 150,000 individuals. We are now bolstering our strategy by promoting better ways for business and education to collaborate, scaling the best education and job training programs.

While we know a fundamental disconnect still remains between business and the average citizen, we also believe that the only solution is to remain relentless in our efforts to earn trust from every customer in every community. We believe that is the best we can do. As the largest financial institution in the country, JPMorgan Chase understands our responsibility to earn public trust with everyone, every day.

When disaster strikes, we give special care to our customers.

When disaster strikes – we are there for our customers. After Hurricane Florence and Hurricane Michael devastated the Carolinas and the Gulf Coast, respectively, after wildfires destroyed large parts of California and after a number of other tragic events, we stepped up for our communities and our customers. We also provided relief to customers affected by the recent government shutdown – and kept at it until they received their back pay. Here's a list of the kinds of things we did when disaster struck:

- Re-entered damaged areas, often as the first bank, filling our ATMs and quickly reopening our branches to give customers access to cash, as well as crucial documents in their safe deposit box.
- Activated our special-care line with specialists to quickly help customers.
- Refunded customers' overdraft fees.
- Extended and deferred payments on customers' car loans.
- Provided necessary relief on customers' mortgage loans.
- Removed minimum payments on credit cards, reducing cash payments and limiting the impact on customer credit reports.
- In addition, in 2018, donated more than \$4 million to emergency assistance agencies around the world, which included immediate help following the earthquake and tsunami in Indonesia, wildfires in Greece, and devastating floods and landslides in western Japan.
- Over the past five years, contributed more than \$22 million to support immediate and long-term recovery from disasters.

5. We take care of our employees.

Our employees are fundamental to the vibrancy and success of our company. At the end of the day, everything we do – from operations and technology to service and reputation – is completely based upon the abilities and character of our employees.

Inclusion and diversity

- We have more than 256,000 employees globally, with over 170,000 in the United States. Our commitment to creating an inclusive organization is not only about doing the right thing; it's about doing what makes our company stronger. In 2016, we introduced Advancing Black Leaders, an expanded diversity strategy focused on increased hiring, retention and development of talent from within the black community. We magnified that effort in 2019 with our Advancing Black Pathways initiative (which is outlined in the sidebar on page 20). Now, in the United States, 50% of our firm's workforce is ethnically diverse. That said, we know we have work to do to increase the representation of ethnically diverse employees at senior levels of the company.
- On gender diversity, women represent 30% of our firm's senior leadership globally. These are women who run major businesses and functions – several units on their own would be among Fortune 1000 companies. Investing in the advancement of women is a key focus for our company, and we have established a global firmwide initiative called Women on the Move that empowers female employees, clients and consumers to build their career, grow their businesses and improve their financial health.

- To encourage diversity and inclusion in the workplace, we have 10 Business Resource Groups (BRG) across the company to connect approximately 100,000 participating employees around common interests, as well as foster networking and camaraderie. Groups are defined by shared affinities, including race and cultural heritage, generation, gender, sexual orientation, disability and military status. For example, some of our largest BRGs are Adelante for Hispanic and Latino employees, Access Ability for employees who have a disability, AsPIRE for Asian and Pacific Islander employees, NextGen for early career professionals, PRIDE for our LGBT+ employees, BOLD for black employees and Women on the Move, our largest group, which has more than 30,000 members globally.

Wages

- We have been raising wages for our 22,000 employees at the lower end of the pay range. For those earning between \$12 and \$16.50 an hour in the United States, we have been increasing hourly wages to between \$15 and \$18, depending on the local cost of living. For employees making \$40,000 a year or less in the United States, our average pay increases are around \$4,800. This is the right thing to do, and we now offer well above the average hourly wage for most markets. Remember, these jobs are often the first rung on the ladder, and many of these employees soon move on to higher paying positions.
- These increases are on top of the firm's comprehensive benefits package, with an average value of \$12,000 for employees in the lower wage tier.

401(k) – Retirement

- We provide comprehensive retirement benefits, including a competitive 401(k) plan and dollar-for-dollar match on 5% of pay. For 2018, the 401(k) plan match, totaling approximately \$482 million, enhanced the retirement savings of 135,000 employees.
- We recognize that many employees who earn under \$60,000 a year often do not invest in a 401(k) plan because they cannot afford the lost cash flow and, therefore, do not receive the match. For these employees, we make a discretionary \$750 Special Award to them. This provided 56,000 U.S. employees with \$40 million in additional retirement funds – and this money is granted whether or not they make their own contribution to a 401(k) plan.

Health benefits and wellness programs

- We offer a comprehensive health benefits package in the United States, including a medical plan that covers over 296,000 individuals (138,000 employees, 106,000 children and 52,000 spouses/domestic partners). In 2018, we covered \$1.3 billion in medical costs (net of employee payroll contributions). We care very much about our employees' health.
- We subsidize the health benefit costs of lower wage earners up to 90% of the total cost – for higher paid employees, we subsidize approximately 60%. In addition, recognizing the hardship that deductibles cause for lower paid employees, effective January 1, 2018, we lowered the deductible in the medical plan by \$750 for employees earning less than \$60,000. For these employees, if they do their wellness screenings, their effective deductible could be zero.
- Enrolled employees and spouses/domestic partners earned collectively about \$100 million toward their Medical Reimbursement Accounts in 2018, funded by JPMorgan Chase, for completing wellness activities.

- Outside the United States, we provide medical coverage to 80,000 employees and their families under local medical insurance plans.
- 62% of employees around the globe have access to our 54 on-site Health & Wellness Centers, which are staffed with doctors, nurses, nurse practitioners and other health professionals. These centers are extensively visited – in excess of 600,000 encounters a year. And over 100 visits were potentially life-saving interventions (involving, for example, urgent cardiac or respiratory issues).

Training

- We extensively invest in employee benefits and training opportunities so that our workers can continue to increase their skills and advance their career. Our total direct investment in training and development is approximately \$250 million a year. What's more important and hard to measure is the on-the-job training that just about every employee gets from their manager – education that leads to deep knowledge and promotion opportunities (and, unfortunately, lots of recruiting from our competitors). In 2018, we delivered 9 million hours of training to our employees worldwide, augmented by several new digital learning innovations.
- Since inception of the program in 2015, 26,500 managers (approximately 60% of all managers) have attended one or more Leadership Edge programs. These offer critical training in leadership and management. While this initiative is costly, we are starting to see results in terms of reduced attrition, higher satisfaction from employees and better management.

Volunteer and Employee Engagement Paid Time Off policy

- Effective January 1, 2019, we implemented a new Volunteer and Employee Engagement Paid Time Off policy, which provides up to eight hours of paid time off each calendar year for volunteer and other firm-sponsored activities.

- The new policy increases opportunities for employees to participate in volunteer activities and give back to our communities.
- JPMorgan Chase has hired more than 14,000 U.S. veterans since 2011 – including over 1,100 in 2018 alone – with more than 50% coming from diverse backgrounds.

Parental Leave policy

- In 2017, we increased paid parental leave for the primary caregiver to 16 weeks, up from 12 weeks, for eligible employees in the United States. In 2018, we extended the leave for non-primary parental caregivers to six weeks of paid time off (up from two weeks).
- We offer internship and rotational entry programs to ease the transition from military service to the financial services industry. Once at our firm, veterans can count on the support of our Office of Military and Veterans Affairs, which sponsors mentorship programs, acclimation and development initiatives, recognition events and other programs to help bridge the gap between military and corporate cultures.

Supporting veterans

- Our veteran-focused efforts are centered on facilitating success in veterans' post-service lives primarily through employment and retention. In 2011, JPMorgan Chase and 10 other companies launched the 100,000 Jobs Mission, setting a goal of collectively hiring 100,000 veterans. The initiative has resulted in the hiring of more than 500,000 veterans by over 200 member companies of the Veteran Jobs Mission, with the ultimate goal of employing 1 million veterans.
- More than 1,000 mortgage-free homes have been awarded to military families through nonprofit partners as part of our firm's Military Home Awards Program.
- We completely support the U.S. military. We cannot understand how any U.S. citizen does not support the extraordinary sacrifice and hardship borne by the military to help protect this great nation.

Needless to say, our success is impossible without our employees, and we strive mightily to help them in both their professional and personal lives.

6. We always strive to learn more about management and leadership.

At the end of the day, everything we do is done by human beings. In my annual letter to shareholders, I always enjoy sharing what we have learned about management, leadership and organizations over time.

Great management is critical, though true leadership requires more.

For any large organization, great management is critical to its long-term success. Great management is disciplined and rigorous. Facts, analysis, detail ... facts, analysis, detail ... repeat. You can never do enough, and it does not end. Complex activity requires hard work and not guessing. Test, test, test

and learn, learn, learn. And accept failure as a "normal" recurring outcome. Develop great models but know that they are not the answer – judgment has to be involved in matters related to human beings. You need to have good decision-making processes, with the right people in the room, the proper dissemination of information and the appropriate follow-up – all to get to the right decision. Force urgency and kill complacency. Know that there is competition everywhere, all the time. But even if you do all of this well, it is not enough.

Real leadership requires heart and humility.

It's possible to be very good at the type of management described above, but as managers rise in an organization, they depend on others more and more. The team is increasingly important – many team members know more than their managers do about certain issues – a team working together can get to a better outcome. I have seen many senior managers ascend into big new roles with a bad reaction to their increasing dependence on other people – by hoarding information, never allowing themselves to be embarrassed and demanding personal loyalty versus loyalty to the organization and its principles. They don't grow into the new job – they swell into it. I have often felt that dependency on their teams makes these folks feel paranoid or insecure – leading to this bad behavior.

Good leaders have the humility to know that they don't know everything. They foster an environment of openness and sharing. They earn trust and respect. There are no "friends of the boss" – everyone gets equal treatment. The door is universally open to everybody.

7. We do not worry about some issues.

Since we shared issues that are high priorities, it is almost as important to describe the issues we don't worry about daily – and why. A few are listed below:

- We do not worry about the stock price in the short run. If you continue to build a great company, the stock price will take care of itself.
- We do not worry about quarterly earnings. Build the company for the future, and you will maximize earnings over the long run.
- While we worry extensively about all of the risks we bear, we essentially do not worry about things like fluctuating markets and short-term economic reports. We simply manage through them.
- We do not worry about loan growth. It is most definitely an outcome of how we manage credit and client decisions. We will not stretch, ever, to show growth in loans.
- While we fanatically manage our company, we do not worry about missing revenue or expense budgets for good reasons. This is not a mixed message. We want our leaders to do the right thing for the long term and explain it if they have good reasons to diverge from prior plans.
- We do not worry about charge-offs increasing in a recession – we fully expect it, and we manage our business knowing there will be good times and bad times.

Everyone knows that these leaders are only trying to do the right thing for customers and clients. They share the credit when things go well and take the blame when it does not.

And true leaders don't just show they care – they actually do care. While they demand hard work and effort, they work as hard as anyone, and they have deep empathy for their employees under any type of stress. They are patriots not mercenaries; they have the heart to wear the jersey every day.

You need to stay hungry and scrappy.

Competition is everywhere, but, often, very successful companies are lulled into a false sense of security. Having worked at a number of companies not nearly as successful as ours (I have to confess that I kind of liked being the underdog), we fought every day to even try to get to the major leagues. All companies are subject to inertia, insipid bureaucracy and other flaws, which must be eradicated. If a company isn't staying on edge, maintaining a fire in its belly and pushing forward, it will eventually fail.

Suffice it to say, we stay devoted to these principles.

II. COMMENTS ON CURRENT CRITICAL ISSUES

In this section, I review and analyze some of the current critical issues that affect our company.

1. We need to continue to restore trust in the strength of the U.S. banking system and global systemically important financial institutions.

An enormous amount has been accomplished in the last decade.

The strength, stability and resiliency of the financial system have been fundamentally improved over the course of the last 10 years. While I don't agree with all of the Wall Street Reform and Consumer Protection Act (Dodd-Frank) regulations, the bill did give regulators needed authority to fix our financial system's most critical flaws. These post-crisis reforms have made banks much safer and sounder in the three most important areas: capital, liquidity, and resolution and recovery.

Large banks, defined as global systemically important financial institutions, have more than doubled their highest quality capital to protect against losses, and they have tripled their liquid assets to total assets ratio to protect against unexpected net cash outflows. This allows healthy banks to weather extreme stress while continuing to provide credit and support to their clients (see message to employees on

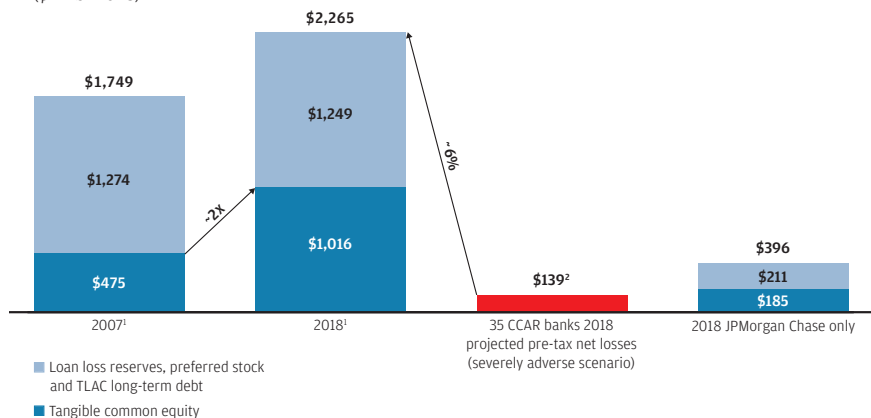
pages 27-28 that describes many of the lessons learned from the crisis and the extensive steps we took to help our clients).

Here's an eye-opening example of how much capital is now in the system: Under the Fed's most extreme stress-testing scenario, where 35 of the largest American banks bear extreme losses (as if each were the worst bank in the system), the combined losses are about 6% of the total loss absorbing resources of those 35 banks. JPMorgan Chase alone has nearly three times the loss absorbing resources to cover the projected losses of *all of these 35 banks* (see chart below).

In addition, resolution and recovery regulations have given regulators both the legal authority and the tools to manage a failing or failed institution (see my comments in the sidebar on page 29 about how Lehman Brothers would have played out under today's new rules). This allows regulators to minimize the impact of a major failed institution on both taxpayers and the system.

Loss Absorbing Resources of U.S. SIFI Banks Combined

(\$ in billions)



¹ Includes only the 18 banks participating in CCAR in 2013, as well as Bear Stearns, Countrywide, Merrill Lynch, National City, Wachovia and Washington Mutual.

² Federal Reserve Dodd-Frank Act Stress Test 2018: Supervisory Stress Test Methodology and Results, June 2018.

Source: SNL Financial; Federal Reserve Bank, February 2019

SIFI = Systemically important financial institution

CCAR = Comprehensive Capital Analysis and Review

TLAC = Total loss absorbing capacity



Looking back on the financial crisis

September 2018 message to employees 10 years after the financial crisis

Dear Colleagues,

A decade has passed since the collapse of Lehman Brothers so now is a good time to reflect on the financial crisis that was raging 10 years ago this month. A lot has been written – and far more is still to be written – on this crisis, but I would like to share a few thoughts with you on that extraordinary period of time and everything that all of you at JPMorgan Chase did to try to help.

The gathering storm hit with a vengeance.

While the collapse of Lehman in September 2008 was the epicenter of the crisis, it was actually far more complex than that – the roots go back to before 2006. By late 2006, we already saw problems in subprime mortgages, leveraged lending and quantitative investing. With the onset of Basel II, leverage at investment banks (not commercial banks) more than doubled, as did shadow banking (think structured investment vehicles, collateralized debt obligations, money market funds and so on). This was often funded by unsecured, undependable short-term wholesale borrowing. Then the biggest problem of all presented itself: It was not just subprime mortgages that were flawed – but all mortgages. This happened, in hindsight, by bad underwriting, government policy that fueled and fostered inappropriate mortgage lending (higher and higher loan-to-values, less and less cash down, weaker appraisals and insufficient income certification), unscrupulous brokers and cavalier investors. The banks, though not the worst actors in mortgages, joined the party, too. When the world realized that \$1 trillion would ultimately be lost in mortgages, panic ensued. There were multiple failures – mortgage brokers, savings and loans (S&L), including Washington Mutual (WaMu) and IndyMac, as well as Fannie Mae and Freddie Mac (which were the largest financial failures of all time) – culminating in the dramatic failure of Lehman, followed by the extraordinary bailouts of AIG and other major financial institutions.

JPMorgan Chase did everything it possibly could do to help during this time.

On March 16, 2008, we announced our acquisition of Bear Stearns, a company with \$300 billion of assets, which had collapsed and had fatal problems (we were essentially buying a house ... but it was a house on fire). And we did this at the request of the U.S. government (thinking at the time that this could help head off a terrible crisis). On September 25, 2008, **10 days after** the collapse of Lehman Brothers, we bought the largest S&L – WaMu – another company that had \$300 billion of assets. We took other extraordinary actions – often at calculated but great risk to JPMorgan Chase – to support clients, including governments, and to support the markets in general. We loaned \$70 billion in the global interbank market when it was needed most. With markets in complete turmoil, we were the only bank willing to single-handedly lend \$4 billion to the state of California, \$2 billion to the state of New Jersey and \$1 billion to the state of Illinois. Additionally – and frequently – we loaned or raised for our clients \$1.3 trillion at consistent and fair rates, in many cases far below what the market would have demanded, and we provided more than \$100 billion to local governments, municipalities, schools, hospitals and not-for-profits over the course of 2009. Many other banks did the same. You probably will be surprised to find out that we lent a tremendous amount of money to Lehman before the crisis – and even more after the crisis. In fact, at the request of the Federal Reserve, we took extraordinary risk to lend more than \$80 billion (on a secured basis) to Lehman after its bankruptcy to help facilitate sales of assets in as orderly a way as possible to minimize disruption in the markets.

This was a traumatic, historic period of time not just for the financial system but for the world as a whole. We endured a once-in-a-generation economic, political and social storm, and because of you, we have emerged 10 years after this crisis as a company of which we can all be proud.

The aftermath and lessons learned.

Many people still ask me about the Troubled Asset Relief Program (TARP), a government program that provided funding to banks in the midst of the crisis. JPMorgan Chase did not want or need TARP money, but we recognized that if the healthy banks did not take it, no one else could – out of fear that the market would lose confidence in them. And while it helped create the false rallying cry that all the banks needed support, the government, both the Federal Reserve and the Treasury, was trying everything it could in addition to TARP. And the Federal Reserve and the Treasury should be congratulated for the extraordinary actions they took to stave off a far worse crisis. In hindsight, it is easy to criticize any specific action, but, in total, the government succeeded in avoiding a calamity.

There were many lessons learned from the crisis: the need for plenty of capital and liquidity, proper underwriting and regulations that are constantly refined, fair and appropriate. In fact, regulators should take a victory lap because Lehman, Bear Stearns, AIG and multiple other failures effectively could not happen today because of the new rules and requirements.

We entered the crisis with the capital, liquidity, earnings, diversity of businesses, people and a risk management culture that enabled us to avoid most – but, unfortunately, not all – of the issues exposed by the crisis. These strengths also helped us to weather the economic crisis and to continue to play a central role in supporting our clients and our communities and rebuilding the U.S. economy. Counter to what most people think, many of the extreme actions we took were not done to make a profit: They were done to support our country and the financial system.

What stood out most was our character and capabilities – which make JPMorgan Chase what it is today.

When the global financial crisis unfolded in 2008, the people of JPMorgan Chase understood the vital role our firm needed to play and felt a deep responsibility to those who rely on us. It was this sense of responsibility that enabled us to move beyond the challenges we were facing at that time and maintain a focus on what really matters: Taking care of our clients, helping the communities in which we operate – all while under extreme pressure from both the markets and the body politic – and protecting our company.

How we managed through the crisis is a testimony to the collective strength of character and commitment of our people. During those chaotic days throughout the crisis and its aftermath, many of our people had to work around the clock, seven days a week, for months on end. And they did it without complaint. The biggest lesson of the crisis: The quality, character, culture and capabilities of your partners are paramount.

Looking back and then looking around at the company we are today, I am filled with awe and admiration. For JPMorgan Chase, these past 10 years have been part of a challenging, yet defining, decade. Today, JPMorgan Chase is among the leaders in most of our businesses. I can't tell you how proud I am to be your partner and to witness your extraordinary performance. I can't thank our current and former employees enough for helping us get through those turbulent times and for the company we have become.



LEHMAN REDUX – IT SIMPLY WOULD NOT HAVE FAILED, BUT IT WOULD HAVE BEEN EASILY MANAGEABLE IF IT DID FAIL

As I mentioned in my shareholder letter in 2016, it is instructive to look at what would happen if Lehman were to fail in today's regulatory regime. First of all, it is highly unlikely the firm would fail because under today's capital rules, Lehman's equity capital would be approximately \$45 billion instead of \$23 billion, which it was in 2007. In addition, Lehman would have far stronger liquidity and "bail-inable" debt. And finally, the firm would be forced to raise capital much earlier in the process. Lehman simply would not have failed.

However, if by the remotest, shooting-star possibility Lehman failed anyway, regulators would now have the legal authority to put the firm in receivership (they did not have that ability back in 2007-2008). At the moment of failure, unsecured debt of approximately \$120 billion would be immediately converted to equity. "New Lehman" would be the best-capitalized bank in the world. In addition, derivatives contracts would not be triggered, and cash would continue to move through the pipes of the financial system. Legislators and regulators should be applauded for what they have done to solve the Too Big to Fail problem, though I should point out that this was accomplished by putting some basic rules in place – not the thousands of other rules layered atop them.

2. We have to remind ourselves that responsible banking is good and safe banking.

One of the critical responsibilities of banks is to take a rigorous and disciplined approach to allocating capital in the financial system – whether they do it directly through loans or through public and private capital markets. Banks need to do this knowing there will be recessions and that they should plan to support their clients through their most difficult times. We did exactly that throughout the 2008 crisis (again, see message to employees on pages 27-28). While many people focus on market making, which of course entails risk (we buy and sell about \$2 trillion a day of various securities around the world), this risk taking is carefully monitored and largely hedged. To put risk taking and market making a little bit in perspective – in the last five years, we have lost money trading on only 11 days, and the loss was usually small and never more than about

two times the average normal trading day revenue. Overall, loans are still the biggest risk that banks take. Our loan losses last year were \$5 billion, and in the worst year of the Great Recession, our loan losses were approximately \$24 billion.

Responsible banks cannot always give customers what they want.

Making bad and unworthy loans ultimately is bad for both the bank and the customer. Being a responsible bank means you can't always give customers what they want, and, therefore, it is unlikely that all of your customers are going to like you. We are fundamentally not in the same position as most businesses. If a customer has the money, most businesses will sell their goods and services to that customer. Banks can't do that. Sometimes we have to say no or enforce

rules that may be unpopular. I have always believed that this necessary discipline with customers is one of the reasons that, historically, banks have not been popular.

Banks are under constant pressure, including political pressure, to make loans (remember subprime mortgages?) even when they should not. But when and if something goes wrong with loans, even when proper and responsible underwriting is done, banks will come under a lot of legal, regulatory and political scrutiny and should expect to be blamed for potentially causing the problem. These conflicting pressures – to make or not make loans – will always exist and need to be properly navigated by a good bank.

Client selection is critical.

Client selection is one of the most important things we do. If one bank builds a book of business with clients of high character and another bank builds its business with clients of low character (who are usually pushing sound banking practices to the limit), it's clear which bank will succeed over time. Therefore, turning down clients, which can sometimes be hard to do, is often the only way to be a responsible bank.

Risk taking is a detailed, analytical process and includes extensive risk mitigation.

Shareholders may be surprised to find out that, fundamentally, we are not a *risk-taking* but rather a *risk-mitigating* institution. Risk mitigation is not guessing – it is a thoughtful, detailed analytical process that leads to measured decision making. Participants in our risk meetings can attest that while we are adamant about serving clients, we are also fanatic about understanding and mitigating some of the associated risks. So, in addition to proper client selection, risks are mitigated through simplification, diversification, hedging, syndication, covenants, hard limits, continuous monitoring and fast reaction to problems. We deeply analyze everything so we can shoulder appropriate risk *for and with* our clients. We are their financial partner.

A recent example in the oil and gas sector shows how we balance risk while serving clients in tough times.

From 2014 to 2016, oil prices collapsed from a high of \$108 per barrel to a low of \$26 per barrel. We were carrying approximately 250 loans to smaller oil and gas companies (mostly based in Houston), referred to in the industry as “reserve-based loans,” or RBLs. The proven oil and gas reserves in the ground served as the collateral for these loans, as reviewed by both J.P. Morgan’s petroleum engineers and third-party engineering consultants. We had \$3 billion in outstanding loans under the RBL structure (and more to the oil industry as a whole). While we made these loans conservatively, we knew that low oil prices at the bottom of the cycle put us at great risk of loan losses – maybe even as high as \$500 million. Our view was that we were going to work with these borrowers; i.e., extend the loans and try to help the companies survive this rough patch. (Of course, we put up additional loan loss reserves to account for possible losses.) At one point, surprisingly, some regulators made it clear that they did not want banks to extend these loans because they were too risky. But we thought it was important, even at the risk of losing hundreds of millions of dollars (something that we were positioned to be able to do), to help our clients get through this tough time rather than desert them when they needed us most. And sticking with our clients is exactly what we did. We thought regulators were overreacting – and, indeed, our losses, ultimately, were miniscule. Because of these actions, we are still welcome in Houston.

3. We believe in good regulation – both to help America grow and improve financial stability.

I want to be very clear that we do not advocate for the repeal of Dodd-Frank. We believe that the strength and resilience of the U.S. financial system have benefited from the law. Ten years out from the crisis, however, it is appropriate for policymakers to examine areas of our regulatory framework that are excessive, overlapping, inefficient or duplicative. At the same time, they should identify areas where banks can promote economic growth without impacting the very important progress we have made on safety and soundness. In fact, a stronger economy, by definition, is a safer economy. Our goal should be to achieve a rational, calibrated approach to regulation that strikes the right balance. This should be an ongoing and rigorous process that does not require any significant piece of legislation and should not be politicized.

Here are a few areas where we think recalibration would be good not only for banks, but for consumers and the economy as a whole:

- **Carefully monitor the growing shadow bank system.** While we do not believe that the rise in non-banks and shadow banking has reached the point of systemic risk, the growth in non-bank mortgage lending, student lending, leveraged lending and some consumer lending is accelerating and needs to be assiduously monitored. (We do this monitoring regularly as part of our own business.) Growth in shadow banking has been possible because rules and regulations imposed upon banks are not necessarily imposed upon these non-bank lenders, which exemplifies the risk of not having the new rules properly calibrated. An additional risk is that many of these non-bank lenders will not be able to continue lending in difficult economic times – their borrowers will become stranded. Banks traditionally try to continue lending to their customers in tough times.

- **The country desperately needs mortgage reform – it would add to America's economic growth.** Reducing onerous and unnecessary origination and servicing requirements (there are 3,000 federal and state requirements today) and opening up the securitization markets for safe loans would dramatically improve the cost and availability of mortgages to consumers – particularly the young, the self-employed and those with prior defaults. And these would not be subprime mortgages but mortgages that we should be making. By taking this step, our economists believe that homeownership and economic growth would increase by up to 0.2% a year.

In the early 2000s, bad mortgage laws helped create the Great Recession of 2008. Today, bad mortgage rules are hindering the healthy growth of the U.S. economy. Because there are so many regulators involved in crafting the new rules, coupled with political intervention that isn't always helpful, it is hard to achieve the much-needed mortgage reform. This has become a critical issue and one reason why banks have been moving away from significant parts of the mortgage business. That business, in particular, highlights one of the flaws of our complicated capital allocation regime. The best way to risk manage a bank is to use risk weights that are actually based on risk. However, since most banks are also constrained by standardized capital (a capital measure that does not risk-adjust for the lower risk of having a properly underwritten prime mortgage), owning mortgages becomes hugely unprofitable.

Because of these significant issues, we are intensely reviewing our role in originating, servicing and holding mortgages. The odds are increasing that we will need to materially change our mortgage strategy going forward.

We also need to get the recalibration of other regulatory requirements right, particularly around operational risk capital, the Fed's Comprehensive Capital Analysis and Review (CCAR) stress test and the additional allocation of capital to globally systemically important banks (GSIB). If we don't do so, certain products and services will continue to be pushed outside the banking system (where they are, fundamentally, not regulated), distorting markets and raising the cost of credit for clients.

- **Operational risk capital.** We now hold nearly \$400 billion of operational risk-weighted assets, which means we hold more than \$40 billion of equity for assets that don't exist. This was a new calculation added after the crisis to recognize that banks also bear serious operational risk (stemming from lawsuits, processing errors and other issues). I agree that all banks bear operational risk, yet this is also true for all companies. Most companies, including banks, have earnings to pay for operational risk. And the calculation that gets us to \$400 billion is questionable and so complex that I am not going to explain it here. Finally, most of our operational risk assets stem from Bear Stearns and WaMu subprime mortgage products that we don't even offer anymore. Tying up capital in perpetuity – looking for shadows on the wall – is probably not the best idea for fostering growth in America.

- **Comprehensive Capital Analysis Review.** I deeply believe in stress testing, but I do have issues with CCAR. First, it consists of only a single test (there are many things that can go wrong that should be stress tested) – which is unlikely to prepare anyone (banks or regulators) adequately. There is an arbitrariness to a single test. Moreover, I don't think CCAR accurately represents what a loss would look like in the nine quarters after a Lehman-type event (remember

that in the nine quarters following the actual Lehman collapse, JPMorgan Chase earned \$30 billion). One of the refrains that we hear about CCAR results is they show that most banks at the worst part of the stress cycle can barely cover their required capital. This is fundamentally inaccurate. The CCAR test can give this false impression because it requires banks to do unnatural things (such as continuing all stock buybacks – even when it is completely obvious that banks wouldn't or *couldn't* do this). As a result, we don't rely solely on CCAR, and we stress test hundreds of scenarios a month, preparing ourselves for circumstances far worse than CCAR stress.

While CCAR losses may exceed what banks are likely to experience, they do appropriately include benefits that banks receive from being diversified and from having healthy profit margins. And CCAR is an effective built-in countercyclical buffer because its whole purpose is to ensure adequate capital at the worst point of a major stress event. Capital requirements for GSIBs, however, are completely different.

- **GSIB capital requirements.** My biggest issue is with GSIB capital requirements, and since they may be added to the CCAR stress test, they become even more important. Most of the factors used in GSIB requirements are not risk-adjusted – and many of the calculations have no fundamental underpinning or logical justification. Their methodology irrationally multiplies certain factors over and over, and many of the facts are simply unjustified on any basis. For example, one of the risks is called “substitutability,” which is supposed to measure the risk that we won't be able to replace certain services of a large bank that fails or retrenches during a crisis. The specific factors used to calculate this risk are market share of equity and debt underwriting and market making. But when

Lehman failed, no one had a problem in replacing any of these activities. For another example, American regulators simply doubled thresholds for American banks (versus international competition) and have never adjusted them, as they were supposed to do, for economic growth, for other new regulations like total loss absorbing capacity and liquidity or for the fact that GSIB banks have become a smaller part of the financial system. Now regulators are talking about adding GSIB requirements to CCAR, which is only logical if the GSIB charge itself makes sense in the first place. If GSIB regulation is to become this important, it needs thorough justification.

Later in this letter I discuss some possible adverse consequences to the U.S. financial system because of the interplay between these factors in a downturn. One comment that we continue to hear is that U.S. banks are now doing quite well despite evidence that GSIB requirements are tougher on U.S. banks than on foreign banks. But that outperformance is not ordained from above and may not always be the case. We should calculate data the right way, and U.S. banks, their employees, shareholders and the communities they serve should not be put at a permanent disadvantage.

Proper calibration of financial regulation can enhance the growth and resiliency of the U.S. economy, which actually reduces systemic risk and helps banks safely serve more clients.

4. We believe stock buybacks are an essential part of proper capital allocation but secondary to long-term investing.

I have already noted that stock buybacks, though sometimes misused, are an important tool that businesses must have to reallocate excess capital. To reiterate, this should be done only after proper investments for the future have been considered.

A recent complaint is that companies, partially due to tax reform, have used their excess capital to buy back more stock instead of investing in their business. While this is true, you should keep in mind three things. First, as stock buybacks increased in 2018, so did corporate capital expenditures and research and development (R&D). In fact, contrary to popular belief, capital expenditures as a percentage of GDP are higher today than in the “good old days” of the 1950s and 1960s. Second, companies tend to buy back stock when they don’t see a good use for capital in the next year or two. We believe that as companies adjust to the new higher cash flows, they will begin to reinvest more of that

money in the United States. *The benefit of tax reform is the long-term (multi-year) cumulative effect of capital retained and reinvested in the United States.* And third, the capital that was used to buy back stock did not disappear – it was given to shareholders who then put it to a better and higher use of their own choosing.

Here is one concluding comment on long-term investing: Many investors legitimately demand that companies think long term and explain their strategies and policies. Meanwhile, these same investors, who demand long-term thinking from companies, often invest in funds that are paid a lot of money for how a stock performs in one year. I hope these investors appreciate the disconnect and hope they will consider the pressures for short-term performance they may have helped to create.

5. On the importance of the cloud and artificial intelligence, we are all in.

The power of the cloud is real.

We were a little slow in adopting the cloud, for which I am partially responsible. My early thinking about the cloud was that it was just another term for outsourcing. I held firm to the view, which is somewhat still true, that we can run our own data centers, networks and applications as efficiently as anyone. But here's the critical point: Cloud capabilities are far more extensive, and we are now full speed ahead. Let me cite a couple of examples:

- The cloud gives us the ability to achieve rapid scale and elasticity of computing power *exponentially* beyond our own capacity. This will be especially relevant as we scale up our artificial intelligence efforts.
- The cloud platform is agile and flexible. It offers access to data sets, advanced analytics and machine learning capabilities beyond our own. It increases developers' effectiveness by multiples – you can almost “click and drop” new elements into existing programs as opposed to writing extensive new code. For instance, adding databases and/or machine learning to an application can be done almost instantaneously. And certain tasks, such as testing code and provisioning compute power, are automated.
- The cloud provides a software development experience that is frictionless and allows our engineers to prototype quickly and learn fast, as well as increase the speed of delivering new capabilities to our customers and clients.

It is important to note that the cloud has matured to the point where it can meet the high expectations that are set by large enterprises that have fairly intense demands around security, audit procedures, access to systems, cyber security and business resiliency.

We will be rapidly “refactoring” most of our applications to take full advantage of cloud computing. We then can decide whether it is more advantageous to run our applications

on the external cloud or the internal cloud (the internal cloud will have many of the benefits of the external cloud's scalable and efficient platforms).

One final but key issue: Agile platforms and cloud capabilities not only allow you to do things much faster but also enable you to organize teams differently. You can create smaller teams of five to 20 people who can be continually reimagining, reinventing and rolling out new products and services in a few days instead of months.

The power of artificial intelligence and machine learning is real.

These technologies already are helping us reduce risk and fraud, upgrade customer service, improve underwriting and enhance marketing across the firm. And this is just the beginning. As our management teams get better at understanding the power of AI and machine learning, these tools are rapidly being deployed across virtually everything we do. We can also use artificial intelligence to try to achieve certain desired outcomes, such as making mortgages even more available to minorities. A few examples will suffice:

- In the Corporate & Investment Bank, DeepX leverages machine learning to assist our equities algorithms globally to execute transactions across 1,300 stocks a day, and this total is rising as we roll out DeepX to new countries.
- Across our company, we will be deploying virtual assistants (robots driven by artificial intelligence) to handle tasks such as maintaining internal help desks, tracking down errors and routing inquiries.
- In Consumer Marketing, we are better able to customize insights and offerings for individual customers, based on, for example, their ability to save or invest, their travel preferences or the availability of discounts on brands they like.
- Technological solutions help us do better underwriting, expediting the mortgage or automobile loan approval process, letting

the customer accept the loan in a couple of clicks and then start shopping for a home or car.

- In our Consumer Operations, we are using AI and machine learning techniques for ATM cash management to optimize cash in devices, reduce the cost of reloads and schedule ATM maintenance.
- And our initial results from machine learning fraud applications are expected to drive approximately \$150 million of annual benefits and countless efficiencies. For example, machine learning is helping to deliver a better customer experience while also prioritizing safety at the point of sale, where fraud losses have been reduced significantly, with automated decisions on transactions made in milliseconds. We are now able to approve 1 million additional good customers (who would have been declined for potential fraud) and also decline approximately 1 million additional fraudsters (who would have been approved). Machine learning will

also curtail check fraud losses by analyzing signatures, payee names and check features in real time.

- Over time, AI will also dramatically improve Anti-Money Laundering/Bank Secrecy Act protocols and processes as well as other complex compliance requirements.

We will try to retrain and redeploy our workforce as AI reduces certain types of jobs.

We are evaluating all of our jobs to determine which are most susceptible to being lost through AI. We will plan ahead so we can retrain or deploy our employees both for other roles inside the company and, if necessary, outside the company.

The combined power of virtually unlimited computing strength, AI applied to almost anything and the ability to use vast sets of data and rapidly change applications is extraordinary – we have only begun to take advantage of the opportunities for the company and for our customers.

6. We remain devoted and diligent to protect privacy and stay cyber safe – we will do what it takes.

The threat of cyber security may very well be the biggest threat to the U.S. financial system.

I have written in previous letters about the enormous effort and resources we dedicate to protect ourselves and our clients – we spend nearly \$600 million a year on these efforts and have more than 3,000 employees deployed to this mission in some way. Indirectly, we also spend a lot of time and effort trying to protect our company in different ways as part of the ordinary course of running the business. But the financial system is interconnected, and adversaries are smart and relentless – so we must continue to be vigilant. The good news is that the industry (plus many other industries), along with the full power of the federal government, is increasingly being mobilized to combat this threat.

The issues around privacy are real.

We have spoken frequently in the past about the importance of safeguarding the privacy of our customers. We already do this extensively, and, in fact, we are inventing new products to make it easier for our customers to understand where we send their data (with their permission), as well as how to change or restrict what we do with that data.

New laws in Europe stipulate that consumers should be able to see what data companies have on file about them and to correct or delete this information if they choose. These are the right principles, but they are very complex to execute. It is imperative that the U.S. government thoughtfully design policies to protect its consumers and that these policies be national versus state-specific. Different

state laws around privacy rules would create a virtually impossible legal, compliance and regulatory-monitoring situation.

But maybe the most crucial privacy issue of all relates to protecting our democracy. Our First Amendment rights do not extend to foreign governments, entities or individuals. The openness of the internet means that

trolls, foreign governments and others are aggressively using social media and other platforms to confuse and distort information. They should not be allowed to secretly or dishonestly advertise or even promote ideas on media and social networks. We believe there are ways to address this, and we will be talking more about this issue in the future.

7. We know there are risks on the horizon that will eventually demand our attention.

In spite of all the uncertainty, the U.S. economy continues to grow in 2019, albeit more slowly than in 2018. Employment and wages are going up, inflation is moderate, financial markets are healthy, and consumer and business confidence remains strong, although down from all-time highs. The consumer balance sheet and credit are in rather good shape, and housing, though not particularly strong, is in short supply in many U.S. cities, which should eventually be a tailwind. Before I review some of the serious and possibly increasing risks that we may confront in the years ahead, I do want to review what happened in the fourth quarter of 2018.

The fourth quarter of 2018 might be a harbinger of things to come.

Going into the final months of last year, optimism about the global economy prevailed, and this was reflected in the stock and bond markets. But in the fourth quarter, growth slowed in Germany; Italy repudiated European Union rules; Brexit uncertainty remained; and fear spiked around America's trade issues with China. Among other geopolitical tensions, the U.S. government shutdown began. In addition, more questions arose about interest rate increases in the United States and the effect of the reversal of unprecedented quantitative easing, particularly in this country. These issues, which reduced growth forecasts and increased uncertainty, should legitimately cause stock prices to drop and bond spreads to increase. However, stock markets fell 20%, investment grade bond spreads gapped out by 36% and

certain markets (like initial public offerings and high yield) virtually closed down. Even at the time, these large swings seemed to be an overreaction, but they highlight two critical issues. One, which we never forget, is that investor sentiment can veer widely from optimism to pessimism based on little fundamental change. And second, for the fourth or fifth time in this recovery, there were excessive moves in the market with rapidly increasing volatility accompanied by steep drops in liquidity.

Market reactions do not always accurately reflect the real economy, and, therefore, policymakers and even companies should not overreact to them. But they do reflect market participant views of changing probabilities and possibilities of economic outcomes. Thus, policymakers (and banks), particularly the Fed, must necessarily (because they need to think forward) take an assessment of these issues into account. With this backdrop, I will discuss some of the serious issues on people's minds (with more on liquidity later).

There are legitimate concerns around China's economy (in addition to trade), but they are manageable.

To fully understand China, you have to do a fair assessment of all of its strengths and weaknesses. Over the last 40 years, China has done a highly effective job of getting itself to this point of economic development, but in the next 40 years, the country will have to confront serious issues. The Chinese lack enough food, water and energy; corruption continues to be a problem; state-owned

enterprises are often inefficient; corporate and government debt levels are growing rapidly; financial markets lack depth, transparency and adequate rule of law; and Asia is a very complex part of the world geopolitically speaking. Just as important, not enough people participate in the nation's political system. Chinese leadership is well aware of these issues and talks about many of them quite openly. I say none of this to be negative about China (indeed, I have enormous respect for what the Chinese have accomplished in the economic realm) but just to give a balanced view. And in spite of these difficulties, we believe that China is well on its way to becoming a fully developed nation, though the future will probably entail more uncertainty and moments of slower growth (like the rest of us) than in the past.

Disruption of trade is another risk for China. The United States' trade issues with China are substantial and real. They include the theft or forced transfer of intellectual property; lack of bilateral investment rights, giving ownership or control of investments; onerous non-tariff barriers; unfair subsidies or benefits for state-owned enterprises; and the lack of rapid enforcement of any disagreements. The U.S. position is supported, though in an uncoordinated way, by our Japanese and European allies. We should only expect China to do what is in its own self-interest, but we believe that it should and will agree to some of the United States' trade demands because, ultimately, the changes will create a stronger Chinese economy. We should also point out that over the last 30 years, the Chinese have been on a high-speed path that includes increasing transparency and economic reform, and while the momentum slows down periodically, they have continued relentlessly on that path. We believe the odds are high that a fair trade deal will eventually be worked out – but if not, there could be serious repercussions.

China can deal with many serious situations because, unlike developed democratic nations, it can both macromanage and micromanage its economy and move very fast. Government officials can pull, in a coor-

dated way, fiscal, monetary and industrial policy levers to maintain the growth and employment they want, and they have the control and wherewithal to do it. That being said, the American public should understand that China does not have a straight road to becoming the dominant economic power. The nation simply has too much to overcome in the foreseeable future. If China and the United States can maintain a healthy strategic and economic relationship (and that should be our goal), it could greatly benefit both countries – as well as the rest of the world.

Debt levels are increasing around the world – although this debt is mitigated because much of it is sovereign debt, which is different from corporate and consumer debt.

If countries essentially owe debt to themselves, not to creditors outside their country, they can generally manage their debt (America's total debt to GDP is just about 80%, while Japan's is approaching 200%). Such debt is not necessarily a good thing because it can be politically destabilizing and overcomplicate policymaking; however, it is generally manageable because if a nation owes money to itself, it is essentially reallocating its income across various interest groups within the country. If the country can continue to grow, it can still create more income for its citizens.

America's debt level is rapidly increasing but is not at the danger level. While America does owe in excess of \$6 trillion (essentially 40% of its publicly held debt) to creditors outside the country, U.S. companies and investors hold more than \$25 trillion in total claims on foreigners, including more than \$12 trillion of foreign portfolio holdings, and the U.S. economy is worth more than \$100 trillion. So we earn more on foreign assets than we pay to foreign creditors. This is not a major issue. However, our country's debt level over the next 30 years will start to increase exponentially, and at a certain point, this could cause concern in global capital markets. We have time to address this problem, but we should start to deal with the issue well *before* it becomes a crisis.

People also point to emerging market debt – both corporate and sovereign – as a potential issue, but the emerging markets, both countries and companies, are much bigger and stronger than they were in the past. They have more foreign exchange reserves and generally more effective risk management of currency and interest rate mismatches.

Leveraged lending is increasing, particularly through shadow banks.

Total leveraged lending in the United States is approximately \$2.3 trillion. About 25% of the loans are owned by banks, the majority in more senior positions, and the remaining 75% are owned by shadow banks or non-banks. Deconstructing that number a bit, about \$1.8 trillion is in U.S. institutional leverage term loans – approximately 30% of which are owned by banks. We estimate that approximately \$500 billion of direct loans are owned exclusively by non-banks. While leveraged lending is a growing issue and one that we are monitoring, we don't think this is yet of the size or quality to cause systemic issues in the financial system. This does not mean it won't create some issues. When things get bad, invariably prices drop dramatically, certain types of high-yield debt cannot be refinanced, etc. – but at this level, it is still a manageable issue.

There are growing geopolitical tensions – with less certainty around American global leadership.

Geopolitical tensions are always there – just reading the newspaper in any week in any year since World War II would make anyone pretty worried. But it does appear that geopolitical tensions are growing. Let me mention a few: Russian aggression, Middle East conflicts, Venezuela, North Korea, Iran, Turkey, Brexit and European politics generally.

It's always difficult to understand the effect of geopolitical uncertainty. But it is now heightened due to uncertainty around how the United States intends to exercise global leadership. This uncertainty may very well be the biggest new unknown factor affecting critical geopolitical and economic issues.

The chance of bad policy errors is increasing.

In this risk section and in the next section on public policy, I feel compelled to emphasize an obvious point: Bad public policy is a major risk. It could be central banks and monetary policy, trade snafus or simply deep political gridlock in an increasingly complex world – but bad policymaking is definitely an increasing risk for the global economy.

The confusion and uncertainty around liquidity are causing some legitimate concerns.

Several times in the last few years, including in the fourth quarter of 2018, markets exhibited rapid losses of liquidity, although fortunately, and importantly, the markets recovered in all cases – but that was in the context of a good environment. The ongoing debate around liquidity and short-term losses of liquidity in the market is an important one. We consider it in two ways: traditional liquidity and macro liquidity.

- **Traditional liquidity.** I call it **micro** liquidity here, and it generally refers to the width of the bid-ask spread, as well as the size and speed with which securities can be bought or sold without dramatically affecting their price. There is no question that some micro liquidity is more constrained than in the past due to bank capital, liquidity and Volcker Rule requirements. In addition, high-frequency traders generally create some intraday liquidity (within a day), though even this is unreliable in a downturn. Because they rarely take positions interday (day to day), traders do not create real liquidity, but my view is that they increase the volatility of liquidity over time. There is no question that rules and regulations also cause unwanted and unnecessary distortions in money market vehicles, such as repos and swaps, particularly at quarter-end.

If you look at liquidity – from before the financial crisis to today – in fairly liquid markets like Treasuries, swaps and equities, there is a noticeable difference. In good markets, liquidity is essentially high and is almost at the same level today as it

was before the crisis. But when markets became volatile in the last several years, liquidity dropped much further and faster than it did before the crisis. It is important to remember that this happened in good times. Therefore, it is reasonable to expect that what we have been experiencing is now the *new normal of liquidity* – and that we should be prepared for it to be even worse in truly difficult times.

- **Macro liquidity.** This describes a broader view of financial conditions. For example, is it easy to borrow and lend? Are banks able to increase their lending? Is the cost of borrowing going up? Is the Fed adding or reducing liquidity in the system (essentially by buying or selling Treasuries)? There is no doubt that new regulations, particularly bank liquidity requirements, dramatically reduce the ability of the Fed to increase bank lending today by shoring up bank reserves. In the old days, the central bank could effectively create excess reserves by buying Treasuries. These excess reserves were lendable by the bank. Today, such reserves are often not lendable due to new liquidity rules. So bank lending as a function of deposits is, in effect, permanently reduced. The notion of “money velocity” and in fact the transmission of monetary policy are, therefore, different from the past, and it is hard to calculate the full effect of all these changes. It is extremely difficult for us, and probably even for the Fed, to know when and at what level the removal of cash (liquidity) from the system starts to significantly affect macro or micro liquidity. We will, however, probably know it when we see it.

There may be too much certainty that growth will be slow and inflation subdued.

There is still global growth, and employment and wages continue to go up. However, this has been a very slow recovery, and it is possible that the “normal” increase of inflation late in the cycle, due to wage demands and limited supply, can still happen. We don’t see it today, but I would not rule it out. In addition, 10-year bond spreads have been suppressed in some way by the extreme

quantitative easing around the world. If that ever reverses in a material way, how could it not have an effect on the 10-year bond? Finally, I would not look at the yield curve and its potential inversion as giving the same signals as in the past. There has simply been too much interference in the global markets by central banks and regulators to understand its full effect on the yield curve.

Expect banks to be far more constrained going into the next real downturn.

Today is nothing like 2008. There are fewer leveraged financial assets in the system now than a decade ago. In 2008, huge losses in the mortgage market forced consumers and companies to sell assets acquired by borrowing. Fundamentally, market panic ensued. Now there is far less borrowing against assets, and it is unlikely that there will be a lot of forced selling as a result. However, keep in mind that it is still possible for investors to sell lots of assets if any form of market panic takes place.

When the next real downturn begins, banks will be constrained – both psychologically and by new regulations – from lending freely into the marketplace, as many of us did in 2008 and 2009. New regulations mean that banks will have to maintain more liquidity going into a downturn, be prepared for the impacts of even tougher stress tests and hold more capital because capital requirements are even more procyclical than in the past. Effectively, some new rules will force capital to the sidelines just when it might be needed most by clients and the markets. For example, in the next financial crisis, JPMorgan Chase will simply be unable to take some of the actions we took in 2008, as described in the sidebar on pages 27-28.

The Fed is still quite powerful and retains numerous tools to deal with many of the issues described above.

There is excessive focus on what the Fed says and does in the short term. The Fed appropriately, and by necessity, needs to be data dependent – how could it be otherwise? And, of course, while proper policy requires Fed

officials to constantly think about the future (though it does not require them to make specific forecasts public), they can't know what the future holds with any certainty. But they are deeply knowledgeable, flexible and appropriately willing to change their minds. And, counter to what you often hear today, they retain a large number of tools at their disposal. They can change short-term rates at will and, in fact, can effect change on longer term rates if they want. With a few simple words, they can change the future expectations of the interest rate curve. They can buy or finance an extraordinary amount of assets, and they can revise regulations, if necessary, to improve liquidity or enhance lending. They can often, simply by asking, get banks

to take certain actions that they want. It is a mistake to think that they don't have significant tools at their disposal.

Of course, we hyper-focus on today's problems, and they often overshadow the progress we are making across the globe. We should not overlook the positive signs. In addition to the strong U.S. economy, the world is still growing, trade issues may be properly resolved and Brazil, among others, has turned the corner economically.

If a downturn starts and leads to darker scenarios, we will be prepared, and we also believe the U.S. government will eventually respond adequately.

8. We are prepared for – though we are not predicting – a recession.

The key point here is that a fairly healthy U.S. economy will be confronting a wide variety of issues in 2020 and 2021. It's hard to look at all the issues facing the world and not think that the range of possible outcomes is broader and that the odds of bad outcomes might be increasing. And certain factors, like confidence, which we know is important, can be easily damaged by bad policy, unexpected events or even high market volatility. The next recession may not resemble prior recessions. Next time, the cause may be just the cumulative effect of negative factors – the proverbial last straw on the camel's back.

We are always prepared to deal with the next recession.

We generally do not spend a lot of time guessing about when the next recession will be – we manage our business knowing that there will be cycles.

First and foremost, we will continue to serve our clients. From the prior parts of this letter, you can see that we continued to make responsible loans to our clients during and after the Great Recession when they needed us most – and we will do that again. We will

not stop investing in our future, investing in technology or building new branches. We will continue to make markets for our clients. We will not overreact to the credit cycle.

We will mitigate risk. We may reduce risk by taking on fewer new clients or by syndicating or hedging risk. And we may reduce risk by managing our portfolio of securities and loans unrelated to clients. We will exercise more of our muscle in terms of managing expenses, monitoring headcount and creating more efficiencies. We will have special credit teams, created in advance, to deal with any problematic credits.

Finally, we will be seeking out new ways to grow and compete. Our experience is that recessions do create opportunities for healthy companies to enhance their franchises generally by serving clients where other companies cannot.

III. PUBLIC POLICY

There are many critical issues roiling the United States and other countries around the world today – just to name a few: capitalism versus other economic systems, the role of business in our society, how the United States intends to exercise global leadership, income inequality, equal opportunity, access to healthcare, immigration and diversity. Many people have lost faith in government's ability to solve these and other problems. In fact, almost all institutions – governments, schools, unions, media and businesses – have lost credibility in the eyes of the public. In the meantime, many of these problems have been around for a long time and are not aging well. Politics is increasingly divisive, and a number of policies are not working. This state of affairs is unlikely to get better without thorough diagnosis, thoughtful policy solutions and a commitment to a common purpose.

In this section, I attempt to analyze and offer some views on what has caused this situation and then suggest some solutions. Neither the diagnoses nor the proposed cures are purely my own. These issues have been studied intensively by many people with deep knowledge. And given the space and other constraints of this letter, I may be about to violate the Einstein maxim, which I love: "Everything should be made as simple as possible, but not simpler." One of the main points I am trying to make is that when you step back and take a *comprehensive multi-year view*, **looking at the situation in its *totality*, it is the *cumulative* effect** of many of our policies that has created many of our problems. And whatever the solutions, I think they are unlikely to be achieved by government alone – civil society and business need to be part of the equation. To start, we must understand our problems.

1. The American Dream is alive – but fraying for many.

Before I talk about our problems, I think it's important to put any negatives in context, so first a paean to our nation. America is still the most prosperous nation the world has ever seen. We are blessed with the natural gifts of land; all the food, water and energy we need; the Atlantic and Pacific oceans as natural borders; and wonderful neighbors in Canada and Mexico. And we are blessed with the extraordinary gifts from our Founding Fathers, which are still unequalled: freedom of speech, freedom of religion, freedom of enterprise, and the promise of equality and opportunity. These gifts have led to the most dynamic economy the world has ever seen, nurturing vibrant businesses

large and small, exceptional universities, and a welcoming environment for innovation, science and technology. America was an idea borne on principles, not based upon historical relationships and tribal politics. It has and will continue to be a beacon of hope for the world and a magnet for the world's best and brightest.

Of course, America has always had its flaws. Some of its more recent issues center on income inequality, stagnant wages, lack of equal opportunity, immigration and lack of access to healthcare. I make it a practice when hearing complaints to strive to understand where people might be right or partially right instead of rejecting or accepting their views reflexively.

Middle class incomes have been stagnant for years. Income inequality has gotten worse. Forty percent of American workers earn less than \$15 an hour, and about 5% of full-time American workers earn the minimum wage or less, which is certainly not a living wage. In addition, 40% of Americans don't have \$400 to deal with unexpected expenses, such as medical bills or car repairs. More than 28 million Americans don't have medical insurance at all. And, surprisingly, 25% of those eligible for various types of federal assistance programs don't get any help. No one can claim that the promise of equal opportunity is being offered to *all* Americans through our education systems, nor are those who have run afoul of our justice system getting the second chance that many of them deserve. And we have been debating immigration reform for 30 years. Simply put, the social needs of far too many of our citizens are not being met.

Over the last 10 years, the U.S. economy has grown cumulatively about 20%. While this may sound impressive, it must be put into context: After a sharp downturn, economic growth would have been 40% over 10 years in a normal recovery. Twenty percent more growth would have added \$4 trillion to GDP, which certainly would have driven wages higher and given us the wherewithal to broadly build a better country. Key questions that keep arising – and remain unanswered are: Why have productivity and economic growth been so anemic? And why have income inequality and so many other things gotten worse? Included among the common explanations is that “secular stagnation” is the new normal. I’ve also heard blame placed on institutional greed and “short-termism,” bad corporate governance, job displacement from new technologies, immigration or trade and a lack of new productivity-enhancing technology. Another common refrain is that capitalism and free enterprise have failed. As you’ll see, I think some of these arguments miss the mark.

2. We must have a proper diagnosis of our problems – the issues are real and serious – if we want to have the proper prescription that leads to workable solutions.

Slogans are not policy, and, though simple and sometimes virtuous-sounding, they often lead to policies that fail. Well-intentioned but poorly designed policies generally have large and unintended negative consequences. Policy should always be extremely well-designed.

In my view, too often we don't perform the deep analysis required to fully understand our problems. One of the reasons is that we often have too short term an orientation; i.e., looking at how things have changed year-over-year or even quarter-over-quarter. We frequently fail to look at trends over a multi-year period or over decades – we miss the forest for the trees. It's also important to point out that many economic models that are used to design policy have a hard time

incorporating or accounting for the effect of certain factors that can be pivotal but are too complex or qualitative to model.

I have tried to come up with a list of critical factors that greatly affect the health of an economy over many years (such as education, infrastructure, healthcare, etc.). The list is below, and when you look at how we have performed in these areas, it's rather condemning. Our shortcomings in these areas clearly have impeded the prosperity of the U.S. economy and have failed many of our fellow citizens over the past two decades or so.

Our problems: What's holding back our nation's productivity and economic growth and reducing opportunity



INEFFECTIVE AND OUT-OF-TOUCH EDUCATION SYSTEMS

Many of our high schools, vocational schools and community colleges do not properly prepare today's younger generation for available professional-level jobs, many of which pay a multiple of the minimum wage. We used to be among the best in the world at training our workforce for good jobs, but now we are falling short. This is a huge reason for both inequality and lack of opportunity. Our inner-city high schools are failing their communities and are leaving too many behind. In some inner-city schools, fewer than 60% of students graduate, and of those who do, a significant number are not prepared for employment and are often relegated to a life of poverty. Proper training and retraining would also help in our rapidly changing technological world. Finally, skills training has become increasingly important over time, and the negligence of our education systems to be responsive to employers' current needs has to have reduced GDP growth.



SOARING HEALTHCARE COSTS

These now represent almost 20% of GDP – more than twice the cost per person compared with most developed nations. While we have some of the best healthcare in the world, our outcomes are not twice as good as those of the rest of the world. Some studies say that gains in life expectancy in the last 50 years were a significant contributor to U.S. national wealth (and health), possibly equal to half of GDP growth, as people were healthier and lived longer, which generally improved the quality of the labor force and productivity. This may no longer be true. Obesity costs our country \$1.4 trillion a year because it drives so many illnesses (i.e., heart disease, diabetes, cancer, stroke and depression). Even worse, 70% of today's youth (ages 17-24) are not eligible for military service, essentially due to poor academic skills (basic reading and writing) or health issues (often obesity or diabetes). And out-of-pocket healthcare expenses for the average American have skyrocketed over the last 20 years, causing huge anxiety, particularly for low-income families who have been hit with the highest increases in healthcare costs.



EXCESSIVE REGULATION AND BUREAUCRACY

Excessive regulation for both large and small companies has reduced growth and business formation without making the economic system safer or better. The ease of starting a business in the United States has worsened, and both small business formation and employment growth have dropped to the lowest rates in 30 years. By some estimates, approximately \$2 trillion is spent on federal regulations annually, which is about \$15,000 per household. We need good regulations, and we have to get better at effectively implementing them – accomplishing the desired good outcomes – while minimizing unnecessary costs and bad unintended consequences.



INABILITY TO PLAN AND BUILD INFRASTRUCTURE

It took eight years to get a man to the moon (from idea to completion), but it now can take a decade to simply get the permits to build a bridge or a new solar field. The country that used to have the best infrastructure on the planet by most measures is now not even ranked among the top 20 developed nations, according to the World Economic Forum's Basic Requirement Index, which reflects infrastructure along with other criteria. We are falling behind on airports, bridges, water, highways, aviation and more. One study examined the effect of poor infrastructure on efficiency (for example, poorly constructed highways, congested airports with antiquated air traffic control systems, aging electrical grids and old water pipes) and concluded this could all be costing us more than \$200 billion a year. Philip K. Howard, who does some of the best academic work on America's infrastructure, estimates it would cost \$4 trillion to fix our aging infrastructure – and this is less than it would cost not to fix it. In fact, a recent study by Business Roundtable found that every dollar spent restoring our infrastructure system to good repair and expanding its capacity would produce nearly \$4 in economic benefits. What happened to that "can-do" nation of ours?



PREVIOUSLY UNCOMPETITIVE TAX SYSTEM FOR BUSINESS

Over the last 20 years, as the world reduced its tax rates, America did not. Our previous tax code was increasingly uncompetitive, overly complex and loaded with special-interest provisions that created winners and losers. This was driving down capital investment in the United States and giving an advantage to foreign companies, thereby reducing productivity and causing wages to remain stagnant. The good news is the recent changes in the U.S. tax system include many of the key ingredients to fuel economic expansion: a business tax rate that will make the United States competitive around the world along with provisions to free U.S. companies to bring back profits earned overseas.



INEFFICIENT MORTGAGE MARKETS

The inability to reform mortgage markets has dramatically reduced mortgage availability. In fact, our analysis shows that, conservatively, more than \$1 trillion in additional mortgage loans might have been made over a five-year period had we reformed our mortgage system. J.P. Morgan analysis indicates that the cost of not reforming the mortgage markets could be as high as 0.2% of GDP a year.



CAPRICIOUS AND WASTEFUL LITIGATION SYSTEM

Our litigation system now costs 1.6% of GDP, 1% more than what it costs in the average OECD (Organisation for Economic Co-operation and Development) nation.



DRAMATIC REDUCTION IN LABOR FORCE PARTICIPATION

Wages for low-skilled work are no longer a living wage – the incentives to start work have been declining over time. Add to this the education issues already mentioned above. Two other contributing factors are that many former felons have a hard time getting jobs, and an estimated 2 million Americans are currently addicted to opioids (in 2017, a staggering 48,000 Americans died because of opioid overdoses). Some studies show that addiction is one of the major reasons why many men ages 25-54 are permanently out of work.



FRUSTRATING IMMIGRATION POLICIES AND REFORM

Forty percent of foreign students who receive advanced degrees in science, technology and math (300,000 students annually) have no legal way of staying here, although many would choose to do so. Most students from countries outside the United States pay full freight to attend our universities, but many are forced to take the skills they learned here back home. From my vantage point, that means one of our largest exports is brainpower. We need more thoughtful, merit-based immigration policies. In addition, most Americans would like a permanent solution to DACA (Deferred Action for Childhood Arrivals) and a path to legal status for law-abiding, tax-paying undocumented immigrants – this is tearing the body politic apart. The Congressional Budget Office estimates the failure to pass immigration reform earlier this decade is costing us 0.3% of GDP a year.



STUDENT LENDING (AND DEBT)

Irrational student lending, soaring college costs and the burden of student loans have become a significant issue. The impact of student debt is now affecting mortgage credit and household formation – a \$1,000 increase in student debt reduces subsequent homeownership rates by 1.8%. Recent research shows that the burdens of student debt are now starting to affect the economy.



LACK OF PROPER FEDERAL GOVERNMENT BUDGETING AND PLANNING

This inevitably leads to waste, inefficiency and constraints on multi-year planning. One striking example: It may cost the military at least 20% of its spending power when budgets are not approved on time and continuous spending resolutions are imposed. And we don't do some basic things well, like account for loans and guarantees properly and demand appropriate funding of public pension plans.

It is hard to look at these issues in their *totality* and not conclude that they have a significant negative effect on the great American economic engine. My view is if you add it all up, this dysfunction could easily have been a 1% drag on our growth rate. Before I talk about some ideas to address these issues, I would like to discuss one major debate currently in the echo chamber.

Is capitalism to blame? Is socialism better?

There is no question that capitalism has been the most successful economic system the world has ever seen. It has helped lift billions of people out of poverty, and it has helped enhance the wealth, health and education of people around the world. Capitalism enables competition, innovation and choice.

This is not to say that capitalism does not have flaws, that it isn't leaving people behind and that it shouldn't be improved. It's essential to have a strong social safety net – and all countries should be striving for continuous improvement in regulations as well as social and welfare conditions.

Many countries are called *social democracies*, and they successfully combine market economies with strong social safety nets. This is completely different from traditional socialism. In a *traditional socialist system*, the government controls the means of production and decides what to produce and in what quantities, and, often, how and where the citizens work rather than leaving those decisions in the hands of the private sector.

When governments control companies, economic assets (companies, lenders and so on) over time are used to further political interests – leading to inefficient companies and markets, enormous favoritism and corruption. As Margaret Thatcher said, “The problem with socialism is that eventually you run out of other people’s money.” Socialism inevitably produces stagnation, corruption and often worse – such as authoritarian

government officials who often have an increasing ability to interfere with both the economy and individual lives – which they frequently do to maintain power. This would be as much a disaster for our country as it has been in the other places it’s been tried.

I am not an advocate for unregulated, unvarnished, free-for-all capitalism. (Few people I know are.) But we shouldn't forget that true freedom and free enterprise (capitalism) are, at some point, inexorably linked.

Successful economies will create large, successful companies.

Show me a country without any large, successful companies, and I will show you an unsuccessful country – with too few jobs and not enough opportunity as an outcome. And no country would be better off without its large, successful companies in addition to its mid-sized and small companies. Private enterprise is the true engine of growth in any country. Approximately 150 million people work in the United States: 130 million work in private enterprise and only 20 million people in government. As I pointed out earlier in this letter, large, successful companies generally provide good wages, even at the starting level, as well as insurance for employees and their families, retirement plans, training and other benefits. Companies in a free enterprise system drive innovation through capital investments and R&D; they are huge supporters of communities; and they often are at the forefront of social policy. Are they the reason for all of society's ills? Absolutely not. However, in many ways and without ill intent, many companies were able to avoid – almost literally drive by – many of society's problems. Now they are being called upon to do more – and they should.

3. All these issues are fixable, but that will happen only if we set aside partisan politics and narrow self-interest – our country must come first.

We need to set aside partisan politics.

None of these issues is exclusively owned by Democrats or Republicans. To the contrary, it is clear that partisan politics is stopping collaborative policy from being implemented, particularly at the federal level. This is not some special economic malaise we are in. This is about our society. We are unwilling to compromise. We are unwilling or unable to create good policy based on deep analytics. And our government is unable to reorganize and keep pace in the new world. Plain and simple, this is a collective failure to put the needs of society ahead of our personal, parochial and partisan interests. If we do not fix these problems, America’s moral, economic and military dominance may cease to exist.

In my view, we need a Marshall Plan for America. To do this, Democrats have to acknowledge that many of the things that have been done as a nation – often in the name of good – have sometimes not worked and need to be modified. Throwing money at problems does not always work. Recently, a report showed that the federal government wasted nearly \$1 billion on charter schools due to mismanagement and lack of adequate oversight – this was money intended to help children. Democrats should acknowledge Republicans’ legitimate concerns that sending money to Washington tends to be simply seen as waste, ultimately offering little value to local communities. Republicans need to acknowledge that America should and can afford to provide a proper safety net for our elderly, our sick and our poor, as well as help create an environment that generates more opportunities and more income for more Americans. And if we can demon-

strate that we are spending money wisely, we should spend more – think infrastructure and education funding. And that may very well mean taxing the wealthy more. If that happens, the wealthy should remember that if we improve our society and our economy, then they, in effect, are among the main winners.

Our nation requires strong political leaders to develop good, thoughtful policies, use their political skills to determine what is doable and exercise their leadership skills to lead people toward common-sense solutions.

We need to set aside our narrow self-interest.

We live in an increasingly complex world where companies, governments, unions and special interest groups vie for time, attention and favorable circumstances for their respective institutions. While it is a constitutional right to petition our government, and many organizations legitimately fight for the interests of their constituents, we all may have become too self-interested. I fear that this self-interest is part of what is destroying the glue that holds our society together. We all share a collective responsibility to improve our country.

I would like to give a few examples, which represent the tip of the iceberg (it would be easy to come up with thousands more).

- Governments, both federal and state, fight to keep military bases open that we don’t need and Veterans Affairs hospitals that are broken – making the military more costly and less effective. Our shortcomings are not just about inefficiencies; they border on immoral. In an incredibly depressing story, former Secretary of Defense Bob Gates describes how Congress took years longer than it should have to approve the building of U.S. Army personnel

carriers that we needed in Iraq and Afghanistan to protect our soldiers from improvised explosive devices. While we dallied, many of our soldiers died or received terrible lifelong injuries.

Five states (California, Connecticut, Illinois, New Jersey and New York) fight for unlimited state and local tax deductions because those five states reap 46% of the benefit – even worse, knowing that over 80% of the benefits from these deductions go to people who earn more than \$320,000 a year.

- Businesses are equally guilty here. Just start digging through the tax code – buried in there are an extraordinary number of loopholes, credits and exemptions that aren't about competitiveness or good tax policy. Suffice it to

say, industry gets its share of tax breaks and forms of protection from legitimate competition. I could add hospitals, schools and unions to this list – none of our institutions is blameless.

While leaders obviously fight for their institutions, we all need to be able to advocate for policies that are good for our organizations without being bad for our country. And as a general matter, we, as citizens, should support policies that are good for our country even if they may not be good for us individually. For too long, too many have fought to use regulation and legislation to further their interests without appropriate regard for the needs of the country.

4. Governments must be better and more effective – we cannot succeed without their help. The rest of us could do a better job, too.

The U.S. federal government is becoming less relevant to what is going on in people's lives. People have generally lost faith in the ability of institutions to deliver on their mission and meet societal needs. They are demanding change, and we must recognize that change is needed. We need dramatic reform of our global and federal institutions and how we attack our biggest societal challenges. There are signs of progress, particularly in how local governments are starting to attack pressing problems – the ones that directly affect people's lives, like education, housing and employment. Look at Detroit and see how excellent leadership is fixing a once failing city. We should continue to empower local governments to address the needs of our society, but we should be asking our federal government to do the same.

I have already commented about needing real policies that include thoughtful plans to increase growth and create more opportunity for everyone. Faster growth will raise incomes, generate opportunities and create the wherewithal to fund improvements in our social welfare programs. (On pages 48-49, I describe some possible solutions to the problems previously highlighted on pages 43-44.) These solutions are not my own but are a synthesis of some of the best thoughts that we have seen. Some of these solutions are simple, and some are more complex. And obviously, if they were politically easy to put into practice, that would have been done by now. However, I am convinced that if we could get ideas like these implemented, economic growth and opportunity for all would be greatly enhanced.

Some solutions to how we might drive growth, incomes and opportunity



EDUCATION

We know what to do. High schools and community colleges should work with local businesses to create specific skills training programs, internships and apprenticeships that prepare graduating students to be job-ready – whether they go on to earn a credential, to work or to attend college. With 7 million job openings and 6 million unemployed workers in the United States, there is an opportunity for companies to work with local institutions, including community colleges and local apprenticeship programs. Business must be involved in this process, and it needs to be done locally because that is where the actual jobs are. Germany does an exceptional job at apprenticeships. Germany has one of the strongest education and training systems in the world, with about 1.5 million young people annually participating in apprenticeship programs that are paid opportunities to gain in-demand skills along with an education. The vocational schools and apprenticeship programs work directly with local businesses to ensure students are connected to available jobs upon graduation. Germany's youth unemployment rate is one of the lowest in the world.

Some countries are now implementing mandatory preschool for children at three years of age. This is a wonderful policy. It makes childcare less expensive and has proved to be extraordinarily good for student education short and long term. Parents like it, too. Of course, the benefits may not be seen for many years, but this is precisely the type of long-term thinking in policymaking that we need.



HEALTHCARE

This may be our toughest, most complicated problem, but we know there are some things we can do to make the system work better. Some of the solutions may include aligning incentives better; trying to eliminate the extraordinary amount of money wasted on bureaucracy, administration and fraud; empowering employees to make better choices, with upfront transparency in employer plan pricing and options and the actual cost of medical procedures; developing better corporate wellness programs, focusing particularly on obesity and smoking; creating better tools to shop around for non-emergency care and manage healthcare expenses; and reducing the extraordinary expense for unwanted end-of-life care. Another obvious thing to do is to start teaching wellness, nutrition, health and exercise in K-12 classrooms nationwide.



REGULATORY REFORM

Starting a small business today generally requires multiple licenses, which take precious months to get. But it doesn't end there. Talk with any small business owner and that person will describe the mountains of red tape, inefficient systems and a huge amount of documentation involved to operate the business. We need to reduce the number of licenses that are required to open and run a small business. In addition, we should look at the excessive state and local rules affecting small businesses, consolidating and eliminating unnecessary rules and regulations where possible. And all regulations should have a thorough cost-benefit analysis and be periodically reviewed for current relevancy.



INFRASTRUCTURE INVESTMENT

The 2015 transportation spending bill, Fixing America's Surface Transportation Act (FAST Act), is intended to fund surface transportation programs – including highways – at over \$305 billion through 2020. Its aim is to improve mobility on America's highways; create jobs and support economic growth; decrease bureaucracy in getting projects approved and completed – and we need to finish its implementation. Again, experience from other countries may help. We could learn from Germany and Canada, for example, whose officials endorsed large infrastructure projects and sped through permitting in two to three years by forcing federal, state and local approvers to simultaneously work through a single vetting process. Significantly reducing the time of permitting also dramatically reduces the cost and uncertainty around making major capital investments.



TAX CREDITS AND BENEFITS

The business tax changes in the 2017 tax law made the United States more competitive, benefiting American workers today and strengthening our economy for the long term. In 2018, nominal wages increased 3.3% – the fastest rate of growth since 2008 – and job openings exceeded the number of unemployed workers for the first time since the federal government started tracking these data in 2000. Beyond this important progress, there is still more that policymakers could do to help working Americans. Of the 150 million Americans working today, approximately 21 million earn between \$7.25 an hour (the prevailing federal minimum wage) and \$10.10 an hour. It is hard to live on \$7-\$10 an hour, particularly for families (even if two household members are working). While it would be acceptable to increase minimum wages, this should be done locally

and carefully so it does not increase unemployment. Perhaps a more effective step would be to expand the Earned Income Tax Credit (EITC). Today, the EITC supplements low- to moderate-income working individuals and couples, particularly with children. For example, a single mother with two children earning \$9 an hour (approximately \$20,000 a year) could receive a tax credit of more than \$5,000 at year's end. Last year, the EITC program cost the United States about \$63 billion, and 25 million individuals received the credit. We should convert the EITC to make it more like a negative income payroll tax, which would spread the benefit, reduce fraudulent and improper payments, and get it into more people's hands. Workers without children receive a very small tax credit – this should be dramatically expanded, too.



LITIGATION

While the rule of law and the right of plaintiffs to get their day in court are sacrosanct, there have to be ways to improve this system. One example, which works in many other countries, is to have the loser pay in some circumstances. Clearly, this would have to be done in such a way as to ensure that aggrieved parties are not denied appropriate access to our justice system. But we need a way to reduce frivolous litigation designed principally to extract fees for lawyers. We also need to reduce the time and the cost necessary to achieve justice by adding more judges and creating more specialty courts to deal with complex issues.



IMMIGRATION

There has been support for bipartisan comprehensive legislation that provides substantial money for border security, creates more merit-based immigration, makes DACA permanent and gives a path to legal status or citizenship for law-abiding, hard-working, undocumented immigrants. We know this is no easy feat, but we should pass and enact legislation to resolve immigration.



MORTGAGE LENDING

Things can be done to reform mortgage markets, which would increase mortgage availability – as I mentioned in the previous sidebar on pages 43-44.



LABOR FORCE PARTICIPATION

We have already mentioned two critical solutions that would help improve labor force participation – make work pay more by expanding the EITC and provide graduating students with work skills that will lead to better paying jobs. Remember, jobs bring dignity. That first job is often the first rung on the ladder. People like working, and studies show that once people start working, they continue working. Jobs and living wages lead to better social outcomes – more household formation, more marriages and children, and less crime, as well as better health and overall well-being.

Reducing recidivism of those who have been incarcerated is not only important to citizens with a criminal record and their families – but it can also have profound positive implications for public safety. Last year, we welcomed the Federal Deposit Insurance Corporation's proposed changes to allow banks more flexibility in hiring citizens convicted of a crime. Our responsibility to recruit, hire, retain and train talented workers extends to this population, and we will support re-entry programs and give convicted and/or formerly incarcerated Americans a path to well-paying jobs. Finally, we should all be gratified that the government now seems to be taking the opioid problem very seriously.



STUDENT LENDING

We should have programs to ameliorate the burden of student loans on some former students. We would be well-advised to have more properly designed underwriting standards around the creation of student loans. Direct government lending to students has grown almost 500% over the last 10 years – and it has not all been responsible lending. It would also be helpful for the government to disclose student lending programs as if they were accountable on the same basis as a bank. Addressing these factors would lead to far better, and healthier, student lending.



PROPER BUDGETING AND PLANNING

All levels of government should do proper budgeting and planning – and on a multi-year basis. It is particularly important that most federal programs – think military, infrastructure and education – have good long-term plans and be held accountable to execute them. When the government says it is going to spend money, it should tell the American people what the expected outcome is and report on it. It should account for loans the same way the private sector does, and it should be required to do cost-benefit analysis.

Somehow we need to help reinvent government to make it more efficient and nimble in the new world. While the federal government remains somewhat in a stalemate, we have seen governors and mayors at the state and local levels taking active control and framing effective solutions. They are helping to create a laboratory of what works and are often at the forefront with initiatives that restore confidence in the ability of government to deliver. We also call upon CEOs and other leaders to step up and offer non-parochial solutions.

5. CEOs: Your country needs you!

Despite the fact that CEOs are not generally viewed with high levels of trust, surprisingly, the 2019 Edelman Trust Barometer global report – encompassing a general global population of more than 33,000 respondents – shows that 76% think CEOs should take a stand on challenging issues and that 75% actually trust their employer.

We believe CEOs can and should get involved – particularly when they or their companies can uniquely help design policies that are good for America. At JPMorgan Chase, we are strengthening our public policy teams to take our advocacy and ideas to the next level. We believe the best way to scale programs that we have seen work in cities, states and countries around the globe is to develop actionable public policies that allow more people to benefit from economic growth.

We can use our unique capabilities, data and resources to help inform infrastructure policies, corporate governance policies, affordable housing policies, financial education policies and inclusion policies, as well as small business financing and formation, community and economic development, and others. In addition, while almost all companies can help further job skills, training, and diversity and inclusion efforts, each company can also add value where it has distinct capabilities, like expertise around healthcare, infrastructure or technology.

One final thought: If I were king for a day, I would always have a competitive business tax system and invest in infrastructure and education as a *sine qua non* to maximize the long-term health and growth of our economy and our citizens. I would not trade these issues off – I would figure out a way to properly pay for them.

It's not enough just for companies to meet the letter and the spirit of the law. They can also aggressively work to improve society. They can take positions on public policy that they think are good for the country. And they can decide, with proper policies and regulatory oversight, with whom and how they will do business.

However, this does get complex. What companies cannot do is abridge the law of the land or abrogate the rights of voters and their representatives to set the law of the land. There are circumstances in which JPMorgan Chase is called upon to do things and/or set policies that should have been set by the federal government – in effect, these are decisions that the voter must decide. We work very hard to try to stay on the right side of all these issues.

In any event, things have changed. In the past, boards and advisors to boards advised company CEOs to keep their head down and stay out of the line of fire. Now the opposite may be true. If companies and CEOs do not get involved in public policy issues, making progress on all these problems may be more difficult.

6. America's global role and engagement are indispensable.

One of the biggest uncertainties in the world today is America's role on the world stage. A more secure and more prosperous world is also good for the long-term security and prosperity of the United States. And America's role in building that more secure world has been and will likely continue to be indispensable.

While there are many legitimate complaints about international organizations (the North Atlantic Treaty Organization, the World Trade Organization and the United Nations), the world is better off with these

institutions. America should engage and exercise its power and influence cautiously and judiciously. We should all understand that global laws, standards and norms will be established whether or not our nation participates in setting them. It is certain that we will be happier with the evolution of global standards if we help craft and implement them. We should not abdicate this role. To the contrary, it is critical that America help develop the best global standards in trade, immigration, corporate governance and many other important issues.

IN CLOSING

While I have a deep and abiding faith in the United States of America and its extraordinary resiliency and capabilities, we do not have a divine right to success. Our challenges are significant, and we should not assume they will take care of themselves. Let us all do what we can to strengthen our exceptional union.

I would like to express my deep gratitude and appreciation for the employees of JPMorgan Chase. From this letter, I hope shareholders and all readers gain an appreciation for the tremendous character and capabilities of our people and how they have helped communities around the world. I hope you are as proud of them as I am.



Jamie Dimon
Chairman and Chief Executive Officer

April 4, 2019

Consumer & Community Banking

In 2018, the U.S. economy benefited from continued low unemployment and stable inflation. There have been other economic periods like this since the 1950s, but they have not lasted as long. The U.S. economy is strong. Gross domestic product increased at an annual rate of 2.9%; unemployment in 2018 hit its lowest level since December 1969; and wage growth picked up, passing along some of the strength of the economic expansion to the consumer – many of whom are our customers. The consumer debt burden is at manageable levels, both consumer and small business optimism is at or near an all-time high, and consumer credit remains strong.

While the economy is performing well, it is not working for everyone. Across the firm, we recognize this and want to do our part to remedy that reality. As a company, we want to help everyone make the most of their money and seek opportunities to connect with households we don't already serve.

2018 financial results

Consumer and Community Banking (CCB) had a remarkable 2018. We delivered a 28% return on equity on record net income of \$14.9 billion and \$52.1 billion in revenue, up 12% year-over-year. We grew our customer base to nearly 62 million U.S. households, including 4 million small businesses. Among our consumer households, 25% have a relationship with two or more Chase lines of business. This performance is a direct result of the growth in our business drivers and a sustained focus on investing for the medium and long term.

In CCB, our four-year compound annual growth rate for deposits has been double that of the industry overall since 2014, and in 2018, we grew retail deposit share in 27 of our top 30 markets. Our average deposits of \$670 billion were up 5%, and client investment assets reached \$282 billion, up 3% despite volatility in the market. Since 2014, we have brought in \$215 billion of Consumer

Banking deposits and investment balances. The incremental deposits acquired over this time period alone would be equivalent to the seventh largest retail bank in the country.

Our customers spent more than \$1 trillion on 99 million debit and credit card accounts in 2018, averaging 49 million transactions every day. We also have the largest customer base of active mobile users among U.S. banks at 33 million.

We grew our business while reducing our overhead ratio and making significant investments. These include investing in the 400 branches we are opening in new markets to extend our reach to customers, as well as in other improvements to our customers' experience.

We achieved our 2018 results with continued focus on the same four areas as in years past: customers, profitability, people and controls.

Here are some of the highlights of what we accomplished in each of these areas.

Customers

We are proud that Chase has a relationship with nearly half of all U.S. households. A first step in reaching more customers is making sure we are meeting their needs. Therefore, we are introducing new products and refreshing existing ones with the features and benefits our customers value.

Another step taken this past year was to open branches in new markets, specifically Washington, D.C., Philadelphia and Boston. When we enter these communities, we bring the full force of this great company – hiring, lending and helping customers save for their first home, start a business or retire with financial



#1

#1 in total U.S. credit card sales volume and outstandings



#1

#1 in U.S. retail deposit growth



62M

62 million households



#1

#1 most visited banking portal in the U.S.



15

MOBILE LOGINS

15 mobile logins per active user per month



29%

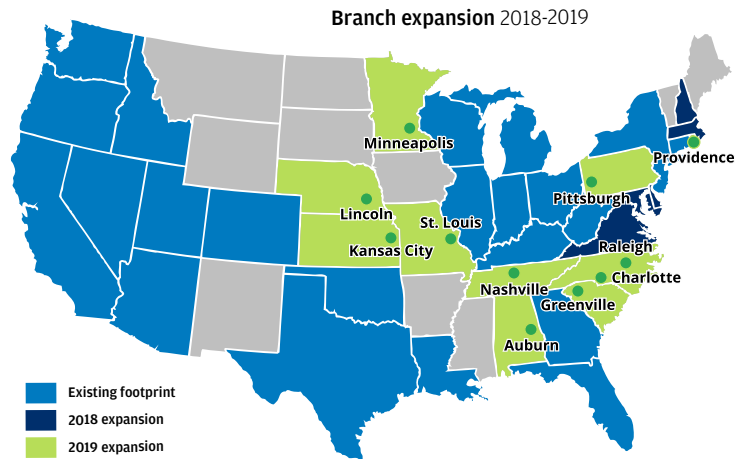
QUICKDEPOSITSM

29% of check deposit transactions through QuickDepositSM

Expanding into new markets

Last year, we announced plans to open up to 400 new retail branches and hire as many as 3,000 employees in new U.S. markets over the next five years. This expansion is part of a \$20 billion investment in our business and local economic growth. We are committed to serving all communities, including those with low- to moderate-income households, with these new branches. We've opened 12 branches in the Greater Washington region, Philadelphia and the Delaware Valley, and Boston – and will continue to grow in these regions.

We plan to add retail branches in nine more U.S. markets this year, opening as many as 90 new branches and hiring 700 employees, offering more customers access to our retail and business banking services and providing jobs to these communities.



security. The reception in each market, by new and existing customers, has been wonderful. As part of the market expansion, we also support each local community directly with help from the JPMorgan Chase Foundation. In Washington, D.C., we committed \$1.6 million in philanthropy. In Boston, we committed \$3 billion for home and small business loans and \$1.1 million to support jobs and skills development.

We are always focused on improving the customer experience. Across all of our products, we have made it quicker and easier to become a Chase customer. Increasingly, that experience is digital, online or mobile. More than 1 million customers opened a checking or savings account digitally in 2018. For existing customers who were adding an account, it took less than three minutes. We have plans to reduce that time even further.

Existing customers enjoyed a steady stream of improvements to their experience with us: the ability to lock and unlock a misplaced card, more options on how to pay credit

card bills, discounts and offers from favorite merchants, and, for those who have multiple relationships with us, a clear understanding of the products they qualify for before applying.

Profitability

We prioritize long-term, profitable growth when making decisions about investing in the future of our consumer franchise. In 2018, we continued our progress to drive down structural expense, reducing our overhead ratio to 53%, down from 56% the prior year. We've also made progress reducing our cost to serve each household while our customer base and total transaction volume continue to grow. We've made investments that have brought down our cost to serve each household by 15% since 2014. These investments allow us to reach more customers at a lower cost and through the channels they prefer. More and more often, that channel is mobile.

Our active mobile customer base grew 11% since 2017, averaging a login rate of 15 times a month. And we have made it easy for customers

who want to speak with someone by phone or in person.

Customers are doing more than 80% of their transactions on their own. This simple experience means customers who use mobile and digital channels are happier with us, tend to do more business with us and are more profitable.

Consumer Banking customers who have relationships with two or more Chase lines of business generate two and a half times more pre-tax income for us. That is because they have deeper relationships and also because they are often servicing their accounts digitally, which is more cost-effective.

For those customers who rely on branches, we are tailoring our physical network to match the service activity of each location. We have expanded into our new market locations using a combination of strategically placed full-service branches, smaller format branches and stand-alone ATMs – which can now support 74% of the transactions that once required a teller.



80+ %
SELF-SERVED

More than 80% of transactions self-served



49M
ACTIVE DIGITAL CUSTOMERS

49 million active digital customers



\$1+T

More than \$1 trillion in credit and debit card sales volume



YOU INVEST
DIGITAL PLATFORM

You Invest digital trading platform launched



1.5M
DIGITAL DEPOSIT ACCOUNTS

1.5 million deposit accounts opened digitally



33M
ACTIVE MOBILE CUSTOMERS

33 million active mobile customers

Looking ahead – 2019

Becoming a customer

As we continue to focus on customers' needs in 2019, we will make it even easier to become a Chase customer and grow with us during a lifetime. Earlier this year, we created a product to meet the needs of the millions of U.S. households outside of the banking system – Chase Secure Banking. For a fee of \$4.95 a month, people receive access to our branches, ATMs and mobile banking to make payments, deposit checks and send money, and they cannot overdraw.

We will also continue to expand to new markets. We expect 93% of the U.S. population to be in our Chase footprint by the end of 2022.

Paying with Chase

Our customers make more than \$2 trillion in payments each year – whether they are shopping with one of our cards, paying a bill or paying another person. No matter the method, we want them to be able to do so with ease and confidence, as well as to realize the value of paying with Chase. In addition to the new customer-friendly features I mentioned earlier, we are upgrading our card chips to be “tap to pay”-enabled.

We announced two new features for our credit card customers coming later this year – My Chase PlanSM and My Chase LoanSM – to provide more ways to borrow using existing Chase credit card lines. When customers need to pay their Chase bills, they can set a fixed amount to pay automatically or pay at our ATMs.

Growing wealth

We want to help everyone make the most of their money, whether they need to build emergency savings to

We are committed to serving all households with these new branches, including ones with low to moderate incomes.

People

We are so proud of our team, 135,000¹ strong. In the same way we focus on making experiences great for our customers, we also strive to do the same for our employees.

We have always believed our company has a role to play in society, leading by example in areas such as diversity. It's important to us that our employees represent the customers we serve. More than 57% of our employees are women, and more than half are minorities. Our employees who work directly with customers in our branches and call centers have higher minority representation than our senior executive positions, and we are working to correct that balance.

But we don't stop with our employees. We are leading initiatives to drive inclusive growth across the country, such as Women on the Move – which helps women overcome barriers they face at work and helps further female

representation – and, most recently, Advancing Black Pathways, our effort to promote greater opportunities for black Americans to participate in economic success.

We are also mindful that the nature of our work is changing as we invest in technology that allows customers to manage their own needs. While we have hired 2,000+ more people in technology and digital roles, we have 7,000 fewer employees working in operational positions since 2014. We are committed to offering other opportunities and training to those employees who might need to find a new role – here at Chase or somewhere else.

Controls

Our customers rely on us to protect their data and their money. We take that responsibility very seriously. Therefore, we deploy many safeguards, checks and balances to make sure we do our work as effectively as possible. This helps us adhere to the many regulations and requirements that govern us. Upgrading and rigorously maintaining these controls is an ongoing discipline; we are proud of the work we do and will continue to improve.

¹ Includes employees and contractors

cover unexpected expenses, save for a home or invest. In January 2019, during National Savings Month, we introduced Auto Save, which allows our customers to set rules for how much to save based on milestones like receiving a paycheck or spending at a certain merchant. And every week, on average, we welcome 5,000 new customers to You Invest, our self-directed digital investing product.

Owning a home

We have made it simpler and faster for customers who want to work with us to buy their home. Our digitally enabled fulfillment process is more convenient than the paper process; it's 20% faster, can be completed online from anywhere and allows customers to monitor their progress through the process. Customer satisfaction is at record highs, but there is still room to simplify and improve.

Owning a car

Of the 62 million households with whom we have a relationship, roughly 1 million of them will buy or lease a car with Chase each year. We think we can do better than that by making the experience easier and adding value to the process – for our customers and for our dealer and manufacturer partners.

Growing businesses

As a firm, JPMorgan Chase can do more to support businesses than just about any other financial services firm. From sole proprietors, family-, female- and minority-owned businesses all the way to the largest global, multinational corporations, we help businesses manage the spectrum of needs, whether making day-to-day payments or financing growth. No matter the business, we are focused on ways to bring unique value to customers who do more business with us.

For our customers who process payments with Chase, we can offer same-day funding if they deposit those sales into a Chase Business Checking account. For a small business owner, same-day access to your sales can make a real difference.

Closing

I have never been more optimistic about our future. We are committed to making our business even better by serving more customers. The key to doing that is moving faster. We have made progress improving upon the pace we became accustomed to, but we still need to do better.

Members of my leadership team and I traveled to China at the end of 2018, and we were impressed by the

speed at which companies function. Those we visited are using machine learning to open accounts in seconds or pay out claims based on smartphone images within hours. Seeing these capabilities only inspired us to move more quickly and push the boundaries of what we think we can accomplish for our customers and our shareholders.



Gordon Smith

Co-President and Chief Operating Officer, JPMorgan Chase & Co., and CEO, Consumer & Community Banking

2018 HIGHLIGHTS AND ACCOMPLISHMENTS

- #1 in overall customer satisfaction among national banks (J.D. Power)
- #1 in primary bank relationships within our Chase footprint
- The most frequently added new bank among small businesses that added another financial institution in the past year (Barlow Research)¹
- Retail deposit volume growth at a rate more than twice the industry average since 2014
- #1 most visited banking portal in the U.S. – chase.com
- #1 U.S. credit card issuer
- #1 U.S. co-brand credit card issuer
- #1 in total U.S. credit and debit payments volume
- Relief provided to customers affected by the California wildfires and the federal government shutdown

¹ 1Q17-4Q18 data, small businesses with revenue \$100,000 to \$25 million

Corporate & Investment Bank

2018 performance and backdrop

The Corporate & Investment Bank (CIB) had a record year in 2018, setting a new benchmark for earnings of \$11.8 billion on \$36.4 billion of revenue, resulting in a return on equity (ROE) of 16%.

We are now 10 years removed from the financial crisis of 2008, when J.P. Morgan was a safe haven for clients in chaotic markets. We remain that safe haven while we drive the industry forward through innovation and technology.

The standout performances of our businesses last year and over the past decade are the result of hard work, continuous investment and a belief that a complete, global offering helps clients meet their evolving financial objectives. As our clients grow in size and complexity, they require a financial partner who can provide the financing solutions they need, wherever they need them and however they want them delivered.

Last year was especially active for mergers and acquisitions (M&A) and equity markets. We advised on more than \$1 trillion in announced M&A¹ in 2018, including significant deals

such as Takeda's \$82 billion acquisition of Shire, IBM's \$34 billion purchase of Red Hat and Walmart's \$16 billion acquisition of Flipkart, India's largest online retailer.

We ranked #1 in wallet share for both debt and equity capital markets and raised more than \$475 billion for clients around the world. We led prominent initial public offerings (IPO), including for AXA Equitable Holdings, the largest U.S. insurance IPO since 2002, and for Siemens Healthineers, the largest healthcare IPO ever in EMEA².

As a result of our worldwide investment banking work for clients, we generated \$7.5 billion in fees and solidified our #1 standing in market share for the 10th consecutive year. In fact, amid heavy competition in a relatively healthy economic environment, our share of global investment banking business stood at 8.7%, the highest of any bank since 2009.

Despite volatile trading markets at the end of the year, we continued to be a leading provider of trading liquidity to institutional investors, reporting full-year Markets revenue of \$19.6 billion, up 6% from 2017. In Equities, we achieved record full-year revenue of

\$6.9 billion, up 21%. Our Cash Equities, Equity Derivatives and Prime Finance businesses each gained market share, and each generated double-digit revenue growth during the year. The investments we have made in people and technology have led to stronger execution capabilities and significant growth in both client balances and volumes. Over the past five years, our Equities business has gained more wallet share than our top three competitors combined.

Even with the fourth quarter's turbulent markets, stronger performances during the year in areas such as Currencies & Emerging Markets and Commodities contributed to \$12.7 billion of Fixed Income Markets revenue in 2018, nearly matching our 2017 result. Once again, we gained share as the industry wallet declined.

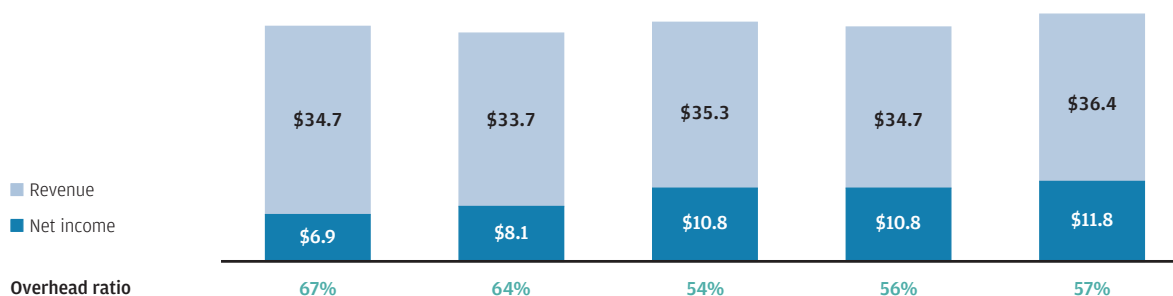
In Treasury Services, we continued to outpace competitors, growing firmwide revenue to approximately \$9 billion. Our performance was helped by higher interest rates and operating deposits, which have grown by 9% since 2016.

Looking ahead, Treasury Services will benefit from our recent decision to integrate its operations with

Strong Returns on Higher Capital³

(\$ in billions)

	2014	2015	2016	2017	2018
CIB ROE	10%	12%	16%	14%	16%
Capital	\$61	\$62	\$64	\$70	\$70



¹ Dealogic as of January 1, 2019

² EMEA = Europe/Middle East/Africa

³ Reported results for 2014 and 2015 have been revised to reflect the adoption in 2018 of the new revenue recognition guidance



#1

#1 in global investment banking fees for the 10th consecutive year



\$1T OF M&A

Advisor on more than \$1 trillion of announced M&A transactions



\$475+ B
OF CAPITAL

More than \$475 billion raised for clients in the capital markets



#1

#1 Global Trading House

Chase Merchant Services, the largest merchant acquirer in the U.S. and Europe. Together, these businesses form the biggest wholesale payments network in the world, processing more than \$6 trillion payments daily. It serves 1.6 million small business customers and more than 80% of Fortune 500 companies. By combining units, we will be able to reduce legacy platform costs, accelerate the expansion of our merchant acquisition business into Latin America and Asia Pacific, and continue to innovate across networks using blockchain technology.

Securities Services continued to grow and transform in 2018 while benefiting from higher interest rates and client balances. The business took on an unprecedented amount of new client business while at the same time streamlining infrastructure and upgrading systems.

In addition to onboarding more than \$1 trillion in assets from BlackRock, there were many other significant successes. New business wins globally have led to a growth in assets under custody of approximately \$2.7 trillion since the start of 2017. Such mandates helped drive revenue up 8% in 2018 to \$4.2 billion, while we maintained industry-leading operating margins and high client satisfaction scores.

Although our overall results are impressive, it's important for us to stay hungry and focused on our clients, anticipate changes and never lapse into complacency. We embrace disruption – even as the market

leader – and continually invest in digital technologies to provide clients with data and insights when and where they want them.

That focus has generated results for our shareholders, too. In addition to earning an industry-leading return on equity, our market share among the CIB's largest competitors grew the most year-over-year, even after outpacing the group between 2014 and 2017, according to data from Coalition.

We know that profitability stems from serving clients well, and the choices we are making today always start with the same two-part question: Is this the right thing to do for our clients and for the long term?

The economic cycle

From an economic perspective, fundamental growth continues to support the longest postwar expansion in history. Corporate earnings and balance sheets are healthy, U.S. unemployment is near record lows and we are not seeing signs of deteriorating credit quality.

That said, I believe we are closer to the end of the expansionary cycle than the beginning. My sense is that the market volatility in the fourth quarter of 2018 was partly due to fear among investors that the downturn was coming sooner than expected. Meanwhile, "flash crashes" are becoming more frequent. These are a function of a number of factors, including thinner liquidity across asset classes, fewer participants in the market and a growing percentage of automated trading volumes.

We expect to see periods of volatility in the future, and we are committed to managing risk in a dynamic way no matter what market conditions we face. That requires us to be disciplined and not overextend ourselves, trusting in our strengths and doing what is right.

Around the world

Investors always assess geopolitical risks, and 2018 provided no shortage of them. For our part, we constantly monitor and stress test our positions. We take a long-term view of client relationships and investments while maintaining discipline on underwriting standards and risk concentrations across clients, countries and products.

Potential opportunities in Asia Pacific, particularly China, remain significant. Last year, we announced major growth plans for China, including the appointment of a new country chief executive officer along with a formal application to Chinese regulators to establish a new, majority-owned securities company.

In Europe, our attention remains on Brexit. Despite the uncertainty of the U.K.'s future relationship with the European Union, J.P. Morgan has been planning for the worst while hoping for the best. Regardless of Brexit's ultimate consequences, J.P. Morgan will be able to serve clients in any scenario. We're fortunate to have branches, offices and talented people across Europe, ensuring seamless client service before, during and after Brexit.



Top Global
Research Firm



\$6T
WHOLESALE PAYMENTS



First to create a
blockchain-based payment
information network



#1 Fixed Income Trading
market share



FIRST
TO OFFER
REAL-TIME PAYMENTS

First to offer real-time
payments in U.S. dollars, euros
and British pounds



FIRST
U.S. BANK
WITH DIGITAL COIN

First U.S. bank with
a digital coin



\$23.2T
ASSETS UNDER CUSTODY

\$23.2 trillion client assets
under custody



#1

Co #1 Equity Trading
market share

Technology

We've learned the hard way that it is incredibly costly to lose a leadership position due to a failure to embrace change. Our firm was a leader in foreign exchange in the late 1990s, but by resisting rather than embracing electronic trading, we lost market share. It took many years and millions of dollars of investment to recapture our leadership – illustrating the crippling effect that short-term thinking can have on a business.

That lesson is one of the many reasons we continue to reinvest such significant sums – now more than \$11.5 billion per year – into technology across the firm.

As electronification of the trading markets continues across asset classes, we are building sophisticated trading platforms, such as Algo Central, enabling clients to use predictive analytics to tailor orders and even change the speed and execution style while the trade is live.

In Securities Services, which safeguards more than \$23 trillion in client assets, we extended our Investment Analytics Platform to more than 200 large investor clients,

giving them clearer insight into their own portfolios and helping them better manage the risks and concentrations associated with their positions.

In wholesale payments, more than 180 international banks have signed on to be part of J.P. Morgan's Interbank Information Network, which uses blockchain technology to instantly transfer global payment information among correspondent banks, allowing funds to reach beneficiaries faster and with fewer steps. We are also the first bank to offer real-time payments in U.S. dollars, euros and British pounds, and the first U.S. bank to create and test a digital coin for instantaneous cross-border payments using blockchain.

In investment banking, we are using technology to empower bankers and strengthen connections with clients. With access to a wealth of information about M&A and the capital markets, bankers can sit side by side with clients, review trends and evaluate timely capital raises or even model what might happen to their stock in an activist situation. Treasurers can view our top-ranked research, evaluate various financial metrics and create custom reports on an easy-to-use

dashboard. This transparency only strengthens relationships and provides even more value to companies that look to us for strategic advice.

There is also a large opportunity to improve efficiencies internally using technology. About 40% of time in global operations is spent on servicing client accounts, including answering queries. As we develop systems to better direct those requests, we will spend less time searching for answers and more time responding to client needs.

With our scale, global footprint and leadership, we have the ability to analyze data and generate insights like no other financial services company in the world. We increasingly see our business as a platform to which clients can connect for whatever financial products and services they need.

Most exciting, perhaps, is the innovative spirit surging through the bank. Last September, we kicked off a competition in which teams of analysts and associates across the CIB were invited to submit their best ideas for making the company faster, smarter and better. In a span of several weeks, the teams submitted 469 ideas, many of which we are already taking for-

ward with funding. The competition showcased the amazing talent emerging within the organization and fueled optimism about our bank's future.

Communities and partnerships

Being part of a firm that has four best-in-class franchises is extraordinary. The talent and resources we can mobilize for a client, a government, an industry or a new market are unmatched. Our work in Detroit is well-known: We have partnered with local officials and organizations, investing \$150 million in the city's economic recovery. This effort goes beyond a financial commitment. Through the JPMorgan Chase Service Corps, teams of our colleagues are working on-site at local nonprofit partners to solve specific challenges.

I'm proud to say that the firm is extending its resources to other cities and communities, such as Greater Paris and Chicago. As a global bank with clients and employees around the world, we believe we can add value by partnering with local governments and organizations to expand access to jobs and skills for young people and adults and help regional businesses grow.

We are also working with colleagues across the bank to support different segments of the economy. The CIB's integration with Chase Merchant Services is aimed at making international payments seamless for both consumers and e-commerce companies. Similarly, being able to offer best-in-class advice and capital markets expertise to 19,000 mid-sized companies on Commercial Banking's roster helped yield \$2.5 billion of North America investment banking revenue during 2018 – a record. Our bankers are planning to gradually extend efforts to mid-sized companies in Europe and Latin America as well. We're also working with the Private Bank to expand our coverage of family offices across the U.S. and around the world.

Conclusion

We have worked hard over many years to earn our place as an industry leader – in market share, financial strength and reputation. As we transform our business for the future, we will build on our legacy of success by taking advantage of strategic growth opportunities while maintaining day-to-day discipline. Our experienced and talented CIB leadership team, bolstered by the next generation of

vibrant, energetic employees, is propelling our company to the forefront of digital banking and is positioning us to serve our clients with the innovative, effective financial strategies they will need in the years to come.



Daniel E. Pinto
Co-President and Chief Operating Officer, JPMorgan Chase & Co., and CEO, Corporate & Investment Bank

2018 HIGHLIGHTS AND ACCOMPLISHMENTS

- The CIB had earnings of \$11.8 billion on \$36.4 billion of revenue, producing a best-in-class ROE of 16%.
- J.P. Morgan ranked #1 in global investment banking fees for the 10th consecutive year, ending 2018 with an 8.7% market share, the highest share of any bank since 2009.
- J.P. Morgan ranked #1 in wallet share for both debt and equity capital markets, raising more than \$475 billion for clients around the world.
- J.P. Morgan advised on 10 of the top 20 M&A transactions in 2018 and generated a full-year record in M&A revenue.
- J.P. Morgan ranked as the #1 Global Research Firm in *Institutional Investor* magazine's annual investor survey. We also ranked #1 in both All-America and All-Europe Fixed Income, #1 in All-America Equity Research, and #2 in All-Europe Equity Research and Latin America Research.
- Overall Markets revenue of \$19.6 billion was up 6%, led by record revenue in Equities trading, which was up 21%.
- Firmwide revenue in Treasury Services grew to nearly \$9 billion in 2018. Our decision to integrate the business with our Merchant Services offering now provides clients with access to the largest wholesale payments network in the world.
- With \$23.2 trillion in assets under custody, our Securities Services business continued to win more client mandates across the globe, helping to drive revenue up 8% in 2018.
- More than 180 international banks have signed on to be part of J.P. Morgan's Interbank Information Network, which uses blockchain technology to instantly transfer global payment information among correspondent banks.

Commercial Banking

In Commercial Banking (CB), we continue to execute our long-term, disciplined strategy, focused on helping our clients succeed and making a positive difference in our communities. Across our business, we have been steadily investing to deliver more value to our clients. I'm excited about what we've accomplished so far and the tremendous opportunity ahead of us. As you consider the future for CB, it's useful to reflect on our progress over the last decade:

- This 10-year perspective provides a through-the-cycle lens, which is the best way to measure the outcome of our efforts, as well as the tremendous potential for CB. At every step along the way, we have been building with patience, selecting the best clients and maintaining our fortress principles.
- During this time, we commenced our Middle Market expansion efforts, focusing on delivering our broad-based capabilities to more clients across the U.S. To date, we have opened 67 new locations, added 650 new bankers and set a

solid foundation for continued organic growth.

- In 2008, we acquired our Commercial Term Lending (CTL) franchise from Washington Mutual. Since then, CTL has become the #1 multi-family lender in the U.S., as we have made significant investments to better serve our clients.

I'm incredibly proud of how our team is executing and the market leadership positions we've established. You can see the outcome of this hard work and discipline in our performance – over the past decade, we've added high-quality loans and deposits, nearly doubled revenue and tripled net income.

While we're pleased with these results, we are not standing still. We see enormous potential for our franchise and are building for the next 10 years and beyond. In this letter, I share highlights from our 2018 performance, the progress we are making on our strategic priorities and the investments underway that will drive continued success for our clients and CB.

Record performance in 2018

In 2018, CB delivered outstanding financial results. We generated record revenue of \$9.1 billion, up 5% year-over-year, and net income grew 20% to a record \$4.2 billion. We have remained highly selective in growing our loan portfolio, and our net charge-offs were just 3 basis points for the year. Our continued credit, expense and capital discipline led to an industry-leading overhead ratio of 37% and a strong return on equity of 20%.

Clients are at the center of everything we do, and we're delivering meaningful advice, solutions and capital to help them succeed. In 2018, we hired more than 150 new bankers and made nearly 30,000 more client calls. Through these efforts, we added over 1,200 new relationships, grew loans by \$7.4 billion across our business and ended the year with \$206 billion in average loan balances.

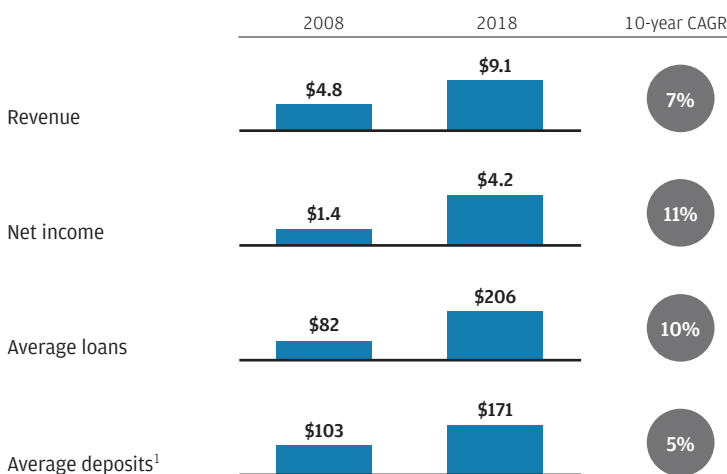
Being able to deliver our leading investment banking capabilities locally separates us from our competitors. Our partnership with the Corporate & Investment Bank (CIB) is outstanding and allows us to deepen our strategic dialogue with clients. Even while investment banking activity is market dependent, we have grown revenue every year since the JPMorgan Chase/Bank One merger in 2004. 2018 was no exception, as we generated a record \$2.5 billion in Investment Banking (IB) revenue, accounting for 39% of CIB's North America investment banking fees.

Growing our client franchise

Across all of our businesses, we have a tremendous opportunity to add more great clients and deepen those relationships over time. Since launching our Middle Market expansion efforts, we are local and active in 39 new metropolitan statistical areas

Ten-Year Retrospective – Consistent Investment and Disciplined Growth

(\$ in billions)



¹ Deposits herein represent average client deposits and other third-party liabilities
CAGR = Compound annual growth rate

and have added close to 2,800 new clients. When we move into a new market, we are truly engaged in our communities and deliver the full power and platform of our entire firm. Client by client, banker by banker, we have organically created a nice-sized bank from scratch, building a \$15 billion loan portfolio and an \$11 billion deposit franchise. The foundational investments we make upfront, essentially our operating infrastructure, are meaningful and are now largely in place. As our presence matures, these newer markets will drive revenue growth, margins and returns for many years to come.

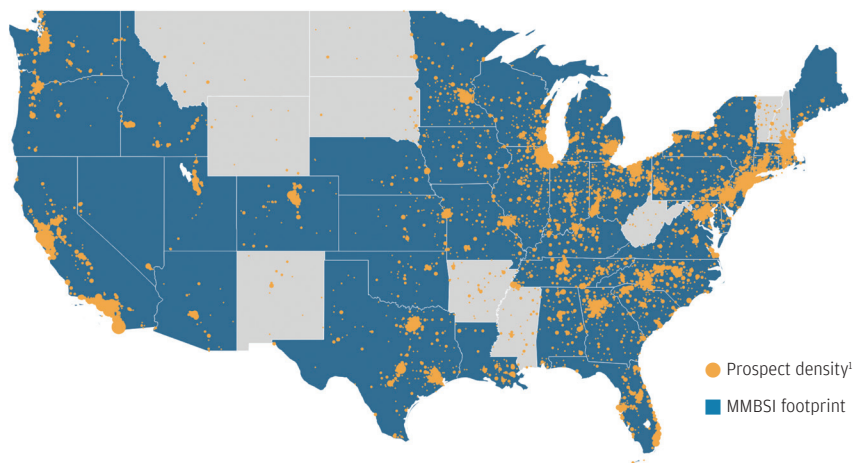
The growth potential for our Middle Market business isn't limited to our expansion markets. Through data-driven analysis, we've identified and prioritized 38,000 prospective clients nationally. Some of our most exciting opportunities are within our legacy markets, such as New York, Chicago, Dallas and Houston, where we have been for over a century.

Overall, we now have banking teams in 116 locations across the U.S. These markets account for roughly 70% of the country's gross domestic product, and our success will continue to be driven by our exceptional teams, our comprehensive capabilities delivered locally and CB's ability to grow with clients over time.

Positioning for long-term success in Commercial Real Estate

Our Commercial Real Estate (CRE) businesses are designed to thrive through the cycle, and growth has been highly selective and disciplined. We are pleased with our performance in 2018, generating loan growth of 4% and \$24 billion in loan originations. As we move into 2019, we will continue to target cycle-resistant seg-

Middle Market Banking and Specialized Industries – Market Opportunity



¹ Size of circle indicates relative number of prospects in a given city
MMBSI = Middle Market Banking and Specialized Industries

ments and asset classes, watch market conditions closely and maintain our strict underwriting criteria. By staying true to these fundamentals, we believe we can thoughtfully continue to grow our CRE loan portfolio.

Enhancing our capabilities to deliver more value

Recognizing that clients are in various stages of development and in different industries, we know they have unique needs and priorities. We also know that expectations are shifting and that we need to continually raise the bar to deliver more value. As such, CB has dedicated, client-focused design teams working to integrate, simplify and create new functionality. These teams are developing exciting new capabilities that will deliver powerful solutions while substantially improving the overall client experience.

We are making significant investments in our digital and payments capabilities, and this work is critical to our value proposition. It will enable our clients to connect with us in the simplest way possible,

whether through application programming interfaces or an open banking solution, and allow clients to accept and collect payments from anywhere in the world, in any currency. Finally, our ability to deliver real-time data and insights will help clients optimize and simplify their operations. The value we deliver through these capabilities allows us to build incredibly close client relationships and is the foundation for gathering and retaining long-term, stable operating deposits.

Similarly, we are transforming how we provide credit to our clients. As an example, in CTL, speed and certainty of execution are critical. To address this, we developed our proprietary loan origination platform, CREOS. Today, we use CREOS to process 100% of our CTL volume and are seeing terrific results with more than 40% of our loans closing in less than 30 days. This platform allows our clients to focus on running their business and lets us deliver a superior client experience rather than compete on pricing, terms and credit.

Making a positive difference in the communities we serve

In CB, we embrace our obligation to be a positive force in our communities and are well-positioned to support the firm's commitment to making a difference. In 2018, we financed the development of more than 20,000 housing units for low-income individuals, and, notably, our Community Development Banking team provided \$188 million in capital to the nation's largest Community Development Financial Institutions. In addition, CB supported local businesses, states and municipalities, school districts, non-profits and higher education institutions with over \$56 billion in capital to help them deliver their critical services. Equally important to serving our communities, last year CB employees volunteered more than 20,000 hours at local organizations.

Looking forward

I hope you can see why I'm incredibly proud of our franchise and excited about the opportunities ahead. CB's performance over the last 10 years has set the standard for us going forward. We have an exceptional team, outstanding capabilities and enormous market opportunities. We believe we are well-prepared for whatever market conditions are ahead, and the investments we are making today will drive success for decades to come.

All of this comes down to our clients. We are grateful for our long-standing relationships and appreciate the trust and confidence they place in JPMorgan Chase. I also want to thank the entire CB team for making our business better every day and their ongoing commitment to serving clients.



Douglas B. Petno
CEO, Commercial Banking

2018 HIGHLIGHTS AND ACCOMPLISHMENTS

Performance highlights

- Delivered record revenue of \$9.1 billion and record earnings of \$4.2 billion
- Generated return on equity of 20% on \$20 billion of allocated capital
- Continued superior credit quality – net charge-off ratio of 0.03%
- Delivered an industry-leading overhead ratio of 37%

Leadership positions

- #1 U.S. multifamily lender¹
- #1 Traditional Middle Market Bookrunner²
- Winner of Greenwich Best Brand Awards in Middle Market Banking – Overall, Loans and Lines of Credit, Cash Management, International Products and Services³

Business segment highlights

- Middle Market Banking – Record gross Investment Banking revenue⁴; added five new offices
- Corporate Client Banking – Record revenue, with strong investment banking growth and record average loans
- Commercial Term Lending – Completed rollout of new CREOS platform across the business, resulting in more than 40% of new loans originated with normalized controllable cycle times of less than 30 days
- Real Estate Banking – Record net income, with revenue up 13% from 2017

- Community Development Banking – Provided over \$1.5 billion in capital for affordable housing properties and supported the firm's *Advancing-Cities* initiative with banking and community engagement expertise
- Investment banking – Record gross revenue of \$2.5 billion⁵; 8% CAGR since 2013
- International banking – Revenue⁶ of \$400 million; 10% CAGR since 2013

Firmwide contribution

- Commercial Banking clients accounted for 39%⁵ of total North America investment banking fees
- Over \$145 billion in assets under management from Commercial Banking clients, generating approximately \$500 million in investment management revenue
- \$513 million in Card Services revenue⁴
- \$4.1 billion in Treasury Services revenue

Progress in key growth areas

- Middle Market expansion – Record revenue of \$649 million; 17% CAGR since 2013

¹ Rank based on S&P Global Market Intelligence as of December 31, 2018

² Refinitiv LPC, FY18

³ Greenwich Associates Commercial Banking Study, 2018

⁴ Investment Banking and Card Services revenue represents gross revenue generated by CB clients

⁵ Represents the percentage and amount of CIB's North America investment banking fees generated by CB clients, excluding fees from fixed income and equity markets, which is included in CB gross IB revenue

⁶ Non-U.S. revenue from U.S. multinational clients

CAGR = Compound annual growth rate

Asset & Wealth Management

In 2018, we marked the 10-year anniversary of the global financial crisis, emanating from the U.S., that shocked financial markets all around the world. Investors with the fortitude to remain steadfast on their long-term investing journey and withstand the tremendous volatility have been highly rewarded. But for many others in the decade since 2008, it has been difficult to endure the severe drawdowns and even more challenging to ever fully re-risk. 2018 didn't enhance confidence in markets either – for the first time in this century, cash was the only major publicly traded U.S. asset class to generate a positive return for investors.

Fiduciaries since 1881

Reflecting over the past decade, I am proud of how our teams have helped clients – from those with a small savings account to the world's largest pension and sovereign wealth funds – navigate this volatile period. As stewards of wealth, we measure success by our ability to drive positive client outcomes over time, and we recognize the responsibility and privilege that come with serving as a fiduciary. Since launching our first investment product in 1881 – one

that is still available today – our J.P. Morgan culture has remained committed each and every day to delivering to clients the strongest risk-adjusted investment returns we can uncover in the markets.

Strong investment performance

2018 marked another impressive year in investment performance versus our competitors, with more than 83% of our mutual fund assets under management (AUM) around the world outperforming the peer median over the 10-year period.

In 2018, we were recognized by Morningstar with five important ratings upgrades, representing almost \$70 billion in client assets. Smart-Retirement was upgraded to Gold, making it the only active target date manager in the industry with a Gold rating. Global Allocation, Small Cap Equity and Growth & Income all were upgraded to Silver. Core Plus Bond was upgraded to Bronze.

Our impressive investment performance attracted \$25 billion of net new asset flows in 2018, marking our 10th consecutive year of net long-term inflows and bringing the total assets entrusted to us to \$2.7 trillion.



SMART RETIREMENT

Upgraded to Gold, ranked top quintile over 10 years



GLOBAL ALLOCATION

Upgraded to Silver, ranked top decile over 5 years



SMALL CAP EQUITY

Upgraded to Silver, ranked top decile over 5, 10 & 15 years



GROWTH & INCOME

Upgraded to Silver, ranked top quintile over 5 & 10 years

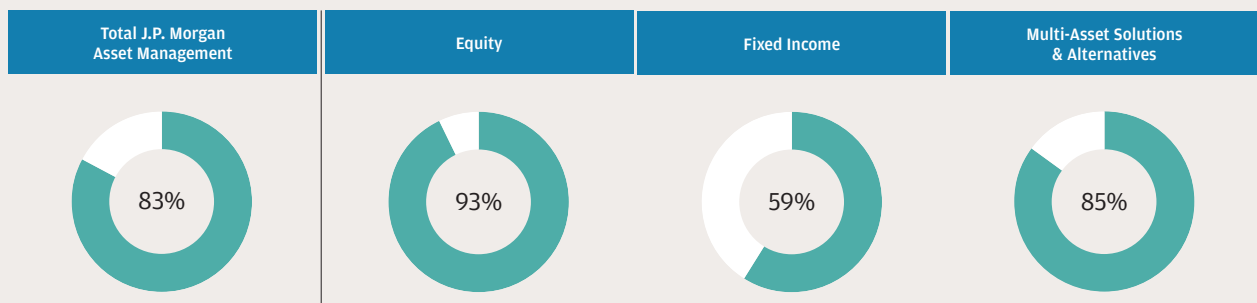


CORE PLUS BOND

Upgraded to Bronze, ranked top quartile over 5 & 10 years

2018 % of J.P. Morgan Asset Management Long-Term Mutual Fund AUM Outperforming Peer Median over 10 years¹

(net of fees)



¹ For footnoted information, refer to slide 16 in the 2019 Asset & Wealth Management Investor Day presentation, which is available at jpmorganchase.com/corporate/investor-relations/event-calendar.htm

AUM = Assets under management

Importantly, our flows are not concentrated in any one asset class, region or channel but come from a well-diversified set of global businesses.

Consistent financial performance

When we focus on client outcomes, our own financial success follows.

Record revenue of \$14.1 billion and record net income of \$2.9 billion enabled us to deliver a **healthy 31% return on equity** for our shareholders. As we continue to invest in the business for the future, our deeply embedded culture of risk management allowed us to do so while holding our net charge-off ratio to a very low 0.01%.

Top talent

Top talent is our single most important asset. We consistently attract, train and cultivate many of the top investment managers and advisors in our industry, proudly retaining

more than 95% of our top talent over the last several years. In the Wealth Management space, we continue to broaden our coverage and are approaching nearly 6,500 advisors, located all around the world and close to where our clients need us most. We will continue to expand our footprint across the U.S. and other high-growth areas such as China, where we can import our firm's expertise, as well as welcome new local talent into the J.P. Morgan family.

Product innovation

To help ensure we continue providing our clients with the solutions they need today and into the future, we are laser focused on innovating new products everywhere we do business. There's nothing we can't achieve when we put the resources of this firm behind an initiative, and these are only a few examples:

- **Beta/ETFs:** Just two years ago, we started building our Beta business. Today, we offer beta capabilities and exchange-traded funds (ETF) ranging from active to strategic beta and passive, with \$43 billion in AUM. In 2018, our U.S. ETF business ranked #4 in industry flows, competing head to head with firms that have long led the rankings and were considered unassailable.
- **You Invest:** Launched in 2018, You Invest has transformed the landscape for our retail clients. The easy-to-navigate user interface and the ability to access investments on the go have attracted a new generation of clients, 89% of whom are first-time investors with Chase. And that's only the beginning – later this year, we'll be rolling out our digital advice platform called You Invest Portfolios.

JPMorgan Chase Total Client Asset Flows: 2014-2018¹

		2014	2015	2016	2017	2018		
ASSET CLASS/PRODUCT	Assets= AUM+AUS	AUM	Fixed Income	■	■	■	■	■
		Equity	■	■	■	■	■	
		Multi-Asset	■	■	■	■	■	
		Alternatives	■	■	■	■	■	
		Liquidity	■	■	■	■	■	
	AUS	Brokerage	■	■	■	■	■	
		Custody	■	■	■	■	■	
		Deposits	■	■	■	■	■	
CHANNEL	Assets	Wealth Management	■	■	■	■	■	
		Retail	■	■	■	■	■	
		Institutional	■	■	■	■	■	
REGION	Assets	U.S.	■	■	■	■	■	
		LatAm	■	■	■	■	■	
		EMEA	■	■	■	■	■	
		Asia	■	■	■	■	■	

■ ≥\$0 ■ <\$0

¹ For footnoted information, refer to slide 17 in the 2019 Asset & Wealth Management Investor Day presentation, which is available at jpmorganchase.com/corporate/investor-relations/event-calendar.htm

AUM = Assets under management

AUS = Assets under supervision

- **Digital everything:** Our ability to connect with clients – however, wherever and whenever they need us – is paramount to our future success. Our goal is to deliver J.P. Morgan’s expertise 24/7, world-wide. One example of a recent application we launched is Digital Portfolio Insights. This cutting-edge tool allows external financial advisors to access J.P. Morgan’s proprietary risk management analytics to generate sophisticated and customized insights. In 2018, these advisors used the tool to help them build better portfolios for over 20,000 of their clients.

Simplify for growth

Our ability to innovate and to sustain our growth requires us to have rigorous discipline around business simplification. Over the past few years, we have merged or closed 229 funds while launching 125 new products; we have closed 21 front office locations in order to open 17 new state-of-the-art facilities; and we have decommissioned nearly 230 legacy system tools

while delivering almost 280 modern technology applications straight to our clients and advisors. Our relentless focus on product and system optimization and continuous emphasis on cutting waste allow us to continuously reinvest in our future.

Fortitude

In this time of rapid change and competition, we are fortunate to be part of the broader JPMorgan Chase organization, where we all constantly challenge one another to use our expertise, scale and invaluable client base to continuously reimagine the future of how we serve our clients.

We have a proud legacy of doing first-class business in a first-class way, and we have extended that promise to institutions, central banks, sovereign wealth funds and individuals. It’s our history and our expertise that give us the fortitude and vision to help our clients thrive in today’s evolving market. No matter the speed or scale of change, our fundamental mission remains the same: We are relentlessly focused on

driving toward the best client outcomes, and we believe that focus is the engine of our continued success. I couldn’t be more proud of what we have delivered for our clients and our shareholders, and I have never been more excited for what is to come.



Mary Callahan Erdoes
CEO, Asset & Wealth Management

2018 HIGHLIGHTS AND ACCOMPLISHMENTS

Business highlights

- 10th consecutive year of net long-term inflows
- Record revenue of \$14.1 billion
- Record net income of \$2.9 billion
- Record average loan balances of \$139 billion
- Record average mortgage balances of \$41.5 billion
- More than 83% of our long-term mutual fund AUM outperformed the peer median over the 10-year period
- Retention rate of over 95% for top talent

Leadership positions

- Best Global Provider of Short-Term Investments/ Money Market Funds (*Global Finance*, March 2019)
- Best Tech Innovation in Data Globally (*The Banker*, August 2018)
- North America Asset Manager of the Year (*Reactions*, November 2018)
- Asset Manager of the Year for Asia (*AsianInvestor*, June 2018)
- Leading Pan-European Fund Management Firm (Thomson Reuters/Extel, June 2018)
- Retirement Leader of the Year (*Fund Action*, June 2018)
- ETF Issuer of the Year (ETF.com, March 2019)
- Best Private Bank for Research & Asset Allocation Globally (*Euromoney*, February 2019)
- Best Private Bank for Ultra-High-Net-Worth Globally (*FT/PWM* magazine, November 2018)

Corporate Responsibility

In an era characterized by deep social divisions and widening economic disparity all over the world, companies like ours have a responsibility to be leaders in finding solutions. This is not simply about being a good corporate citizen; it is a business imperative. The success of our firm is inextricably linked to the success of our communities.

Many of today's challenges stem from the reality that, despite a growing economy, people are working

age our firm's expertise: building job skills, expanding small businesses, revitalizing neighborhoods and promoting financial health.

Over the last five years, we have refined this model in Detroit, where we made a \$150 million commitment to the city's economic recovery. The results have exceeded our expectations. People are moving back. The unemployment rate is down from 20% in 2013 to less than 9% today. For the first time in 17 years, home

These efforts underscore the degree to which our mission to drive inclusive growth has become a fundamental tenet of our culture. Through our market expansion, kicked off in 2018, we are bringing the full force of our firm to advance this mission. We are opening 400 new Chase branches, enabling us to lend to more customers, offer more good jobs and further invest in neighborhoods. The first of these branches are now open in Boston, Philadelphia and Washington, D.C., where we are pairing them with expanded lending and philanthropic commitments, focused in low- and moderate-income areas. And we are actively working to hire locally while raising wages for our entry-level employees.

Opening doors to opportunity transforms lives, lifts entire communities and strengthens the global economy. It is also the best way to repair the societal fractures that increasingly divide us – and that's the right thing to do for our firm and for our shareholders.



A stylized, handwritten signature in black ink, consisting of several overlapping loops and lines.

Peter L. Scher
Head of Corporate Responsibility and
Chairman of the Mid-Atlantic Region

“
Business has an obligation and a vested interest in ensuring our system delivers on its unrivaled potential to create widely shared economic opportunity.
”

harder but are unable to get ahead. The average American family has seen its net worth move backward over a generation. Meanwhile, for every \$100 in white family wealth today, black families hold just about \$5. For far too many people, the system is not working.

Business has an obligation and a vested interest in ensuring our system delivers on its unrivaled potential to create widely shared economic opportunity. That's why JPMorgan Chase is applying the same capabilities and resources that enable us to deliver Return on Investment for our shareholders to generate what we call 'Return on Community.' This means we are making intentional, long-term investments aimed at lifting those who are being left behind, focused where we can lever-

values have risen and mortgage lending is up. While much work remains to be done, there is a sense of optimism once again, particularly among young people who now see a future for themselves in their city.

In 2018, we took a major step to expand the number of people and places we reach by launching *AdvancingCities*, our firm's \$500 million initiative to drive inclusive growth around the world. While many cities are experiencing growing economies, vibrant downtown cores often obscure large pockets of concentrated poverty. At the same time, cities offer the opportunity to drive large-scale innovation and impact. Through *AdvancingCities*, we are combining our business and philanthropic resources to do exactly that.

Generating Return on Community

JPMorgan Chase believes that companies must do even more to help solve today's biggest challenges and create economic opportunity for more people. To do so, they must invest in communities the same way they invest in their own businesses. As announced in early 2018, our firm will deploy \$1.75 billion by 2023 to drive inclusive growth in communities around the world. Generating Return on Community is one of our core objectives because we know that the future of our company depends on the well-being of our communities.

To create and sustain lasting positive change, JPMorgan Chase is investing in four key drivers of opportunity, areas that are aligned with our business expertise: jobs and skills, small business expansion, neighborhood revitalization and financial health. We are putting this model into action through significant, long-term and data-driven investments that leverage our firm's expertise, capital, data, technology and global presence.

AdvancingCities — Expanding opportunity at scale

Our model for impact has yielded real results so we are doubling down on our commitment to drive inclusive growth and expanding the number of people and places we reach. JPMorgan Chase launched *AdvancingCities* — our largest, most comprehensive corporate responsibility initiative to date to invest in solutions that bolster the world's cities and the people within them.

This initiative will allow us to deepen our work in cities in two ways: through targeted commitments in key markets where the conditions exist for large-scale investments and through an annual Challenge that will accelerate collaborative, innovative solutions designed by local leaders and residents to break down barriers to opportunity.

To catalyze sustainable growth, we are combining our firm's philanthropic efforts with our lending and investing expertise to deploy up to \$250 million as low-cost, long-term loan capital. We expect our investment to attract an additional \$1 billion in outside capital.

In 2018, marking our 150th anniversary in France, JPMorgan Chase announced its first *AdvancingCities* commitment — a \$30 million, five-year philanthropic investment to provide underserved residents and local entrepreneurs across Greater Paris access to economic opportunity.

Building branches, strengthening our communities

As we expand our consumer business, we are also increasing our philanthropic commitment to our communities. For example, in 2018, we announced plans to open 70 new branches in the Greater Washington region and hire 700 new employees, the first major branch expansion as part of our firm's \$20 billion, five-year investment in our business and local economic growth. To fuel the economy of this region, we committed \$4 billion in lending for home mortgages and small business and \$500 million to support affordable housing. In addition, roughly 20% of our branches in the region will reside in low- and moderate-income communities. We also doubled our philanthropic investment, committing \$25 million to create economic opportunity for residents at risk of being left behind in today's economy.



One such investment is the \$6 million we committed in 2018 to prepare Greater Washington area students for local, in-demand technology jobs. As an employer, we hear from so many of our clients and employers about their struggle to find workers with the right skills. In 2017, only 3,000 individuals obtained associate degrees and other sub-baccalaureate credentials in digital skills and technology, while there were 15,000 jobs that needed those credentials in the region. Demand for tech workers with less than a four-year degree increased by 42% in the region between 2014 and 2017.

As part of our firm's global New Skills for Youth initiative, our investment will support five school districts in Virginia, Washington, D.C., and Maryland and enable them to partner with local colleges and universities to build career pathways for students that lead to well-paying technology jobs.

Unlocking the power of data for public good

We are harnessing our scale and scope to shed light on the inner workings of today's global economy. The JPMorgan Chase Institute seeks to help decision makers — policymakers, businesses and nonprofit leaders — use timely data and thoughtful analyses to make informed decisions that advance inclusive growth around the world. Drawing on our firm's unique proprietary data, expertise and market access, the Institute develops analyses and insights on the inner workings of the global economy, frames critical problems, and convenes stakeholders and leading thinkers around solutions. Our firm's data informs all of our strategic investments in communities around the world.

In 2018, the Institute shared valuable analyses and insights on:

- Local commerce activity, leveraging 4 billion credit and debit card transactions from nearly 7.7 million customers to provide an unprecedented view of the online U.S. economy, examining how online commerce has grown, who has driven that growth, and how it has impacted brick-and-mortar merchants;
- Families' out-of-pocket healthcare spending trends from 2014 to 2017;
- Growth and evolution of the Online Platform Economy, exploring its scale, key segments, characteristics and how earnings from platforms figure into family income;
- Challenges, opportunities and life cycles of America's small businesses by analyzing revenue and cash flows of 1.3 million small businesses;
- Institutional investor trading behavior in foreign exchange markets around three events that led to the largest one-day moves in the relevant currencies in the last 20 years: Brexit, the 2016 U.S. presidential election and the decision by the Swiss National Bank to remove the Swiss franc floor; and
- Americans' tax refunds by income and other demographic characteristics, as well as the impact of tax refunds on healthcare spending.

2018 HIGHLIGHTS AND ACCOMPLISHMENTS

Awards and recognition

- Ranked Top 10 on *Fortune* magazine's World's Most Admired Companies list
- Named to *Fortune* magazine's Change the World list for the second year in a row
- Named to *The Chronicle of Philanthropy's* Top 20 Corporate Givers list
- Named recipient of the International Medical Corps' Global Citizen Award
- Harvard Business School (in a 2018 case study) profiled the firm's model for impact in Detroit and how it's being applied in other cities
- Named to the *Military Times'* Best for Vets Employers list
- Named an ENERGY STAR® Partner of the Year, recognized by the U.S. Environmental Protection Agency and U.S. Department of Energy
- Named to *Black Enterprise's* 50 Best Companies for Diversity list

Accomplishments

Generating Return on Community through our comprehensive, multimillion-dollar commitments to Detroit, Chicago and the Greater Washington region:

- Detroit: Five years into our \$150 million commitment:
 - 13,573 people participated in workforce programs; 1,632 units of affordable housing were created or preserved; 13,180 people received services to improve their financial health; 2,067 jobs were created or retained; 4,387 small businesses received capital or technical assistance



- Chicago's South and West sides: One year into our \$40 million commitment:
 - 2,857 people participated in workforce programs; 176 units of housing were created or preserved; 5,341 people

received services to improve their financial health; 1,246 jobs were created or retained; and 1,319 small businesses received capital or technical assistance

- Greater Washington region: One year into our \$25 million commitment:
 - 590 units of affordable housing were created or preserved; 312 jobs were created or retained; 722 small businesses received capital or technical assistance
- Through New Skills at Work, over the past five years, we have helped nearly 150,000 people receive skills training for well-paying jobs in growing industries by partnering with about 740 nonprofits, investing \$250 million in job training and career education initiatives in 37 countries, as well as 30 U.S. states and Washington, D.C.



- Through our global commitment to promote financial health:
 - Announced eight financial services innovators as winners of the Financial Solutions Lab (FinLab) 2018 Challenge, focused on improving consumer financial health in the U.S. To date, FinLab has supported more than 30 innovative financial technology (fintech) companies that have raised over \$500 million in capital since joining the program, saving U.S. residents more than \$1 billion.
 - Launched the Financial Inclusion Lab in India, applying insights from the Lab in the U.S. to help scale early-stage fintech startups that are focused on helping India's underserved communities.

- Expanded the Entrepreneurs of Color Fund (EOCF) from Detroit to Chicago, the South Bronx and the Bay Area, providing minority entrepreneurs with access to capital, education and other resources to build and grow their businesses. Through 2018, JPMorgan Chase has committed \$13.6 million through EOCF, resulting in 210 loans totaling \$9.5 million that created or retained 1,200 jobs.

- To date, hosted five Partnerships for Raising Opportunity in Neighborhoods (PRO Neighborhoods) competitions, awarding more than \$98 million to over 70 Community Development Financial Institutions across the U.S. After our \$68 million commitment, the winners of the first three competitions raised an additional \$713 million in outside capital, issued over 21,000 loans to low- and moderate-income customers, and created or preserved more than 3,000 affordable housing units and 11,000 quality jobs.
- In 2018, provided \$3.2 billion for wind and solar projects in the U.S. Since 2003, JPMorgan Chase has committed or arranged more than \$21 billion in financing for wind, solar and geothermal projects in the U.S.
- Awarded our 1,000th mortgage-free home to a U.S. military veteran, reaching all five branches of service in communities across 44 states.

- Engaged our employees to serve our communities:
 - Nearly 59,000 employees volunteered more than 389,000 hours in 2018. This includes 218 employee volunteers from offices in 15 countries who contributed 18,500 hours working on-site with 49 of our nonprofit partners through the JPMorgan Chase Service Corps.
 - Within the first three months of the firm's Board Match program – which doubles the impact of eligible employees' donations to nonprofits on whose boards they serve – 271 employees contributed, resulting in the firm matching more than \$1.3 million to those organizations.



- In 2018, our firm and employees donated more than \$4 million to assist disaster relief efforts around the globe.

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The following pages from JPMorgan Chase & Co.'s 2018 Form 10-K are not included herein: 1-38, 300-311

FIVE-YEAR SUMMARY OF CONSOLIDATED FINANCIAL HIGHLIGHTS (unaudited)

As of or for the year ended December 31, (in millions, except per share, ratio, headcount data and where otherwise noted)					
	2018	2017	2016	2015	2014
Selected income statement data					
Total net revenue	\$ 109,029	\$ 100,705	\$ 96,569	\$ 94,440	\$ 95,994
Total noninterest expense	63,394	59,515	56,672	59,911	62,156
Pre-provision profit	45,635	41,190	39,897	34,529	33,838
Provision for credit losses	4,871	5,290	5,361	3,827	3,139
Income before income tax expense	40,764	35,900	34,536	30,702	30,699
Income tax expense	8,290	11,459	9,803	6,260	8,954
Net income	\$ 32,474	\$ 24,441	\$ 24,733	\$ 24,442	\$ 21,745
Earnings per share data					
Net income: Basic	\$ 9.04	\$ 6.35	\$ 6.24	\$ 6.05	\$ 5.33
Diluted	9.00	6.31	6.19	6.00	5.29
Average shares: Basic	3,396.4	3,551.6	3,658.8	3,741.2	3,808.3
Diluted	3,414.0	3,576.8	3,690.0	3,773.6	3,842.3
Market and per common share data					
Market capitalization	\$ 319,780	\$ 366,301	\$ 307,295	\$ 241,899	\$ 232,472
Common shares at period-end	3,275.8	3,425.3	3,561.2	3,663.5	3,714.8
Book value per share	70.35	67.04	64.06	60.46	56.98
Tangible book value per share ("TBVPS") ^(a)	56.33	53.56	51.44	48.13	44.60
Cash dividends declared per share	2.72	2.12	1.88	1.72	1.58
Selected ratios and metrics					
Return on common equity ("ROE")	13%	10%	10%	11%	10%
Return on tangible common equity ("ROTCE") ^(a)	17	12	13	13	13
Return on assets ("ROA")	1.24	0.96	1.00	0.99	0.89
Overhead ratio	58	59	59	63	65
Loans-to-deposits ratio	67	64	65	65	56
Liquidity coverage ratio ("LCR") (average) ^(b)	113	119	N/A	N/A	N/A
Common equity tier 1 ("CET1") capital ratio ^(c)	12.0	12.2	12.3	11.8	10.2
Tier 1 capital ratio ^(c)	13.7	13.9	14.0	13.5	11.6
Total capital ratio ^(c)	15.5	15.9	15.5	15.1	13.1
Tier 1 leverage ratio ^(c)	8.1	8.3	8.4	8.5	7.6
Supplementary leverage ratio ("SLR") ^(d)	6.4%	6.5%	6.5%	6.5%	N/A
Selected balance sheet data (period-end)					
Trading assets	\$ 413,714	\$ 381,844	\$ 372,130	\$ 343,839	\$ 398,988
Investment securities	261,828	249,958	289,059	290,827	348,004
Loans	984,554	930,697	894,765	837,299	757,336
Core Loans	931,856	863,683	806,152	732,093	628,785
Average core loans	885,221	829,558	769,385	670,757	596,823
Total assets	2,622,532	2,533,600	2,490,972	2,351,698	2,572,274
Deposits	1,470,666	1,443,982	1,375,179	1,279,715	1,363,427
Long-term debt	282,031	284,080	295,245	288,651	276,379
Common stockholders' equity	230,447	229,625	228,122	221,505	211,664
Total stockholders' equity	256,515	255,693	254,190	247,573	231,727
Headcount	256,105	252,539	243,355	234,598	241,359
Credit quality metrics					
Allowance for credit losses	\$ 14,500	\$ 14,672	\$ 14,854	\$ 14,341	\$ 14,807
Allowance for loan losses to total retained loans	1.39%	1.47%	1.55%	1.63%	1.90%
Allowance for loan losses to retained loans excluding purchased credit-impaired loans ^(e)	1.23	1.27	1.34	1.37	1.55
Nonperforming assets	\$ 5,190	\$ 6,426	\$ 7,535	\$ 7,034	\$ 7,967
Net charge-offs	4,856	5,387	4,692	4,086	4,759
Net charge-off rate	0.52%	0.60%	0.54%	0.52%	0.65%

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

- TBVPS and ROTCE are non-GAAP financial measures. For a further discussion of these measures, refer to Explanation and Reconciliation of the Firm's Use of Non-GAAP Financial Measures and Key Performance Measures on pages 57-59.
- For the years ended December 31, 2018 and 2017, the percentage represents the Firm's reported average LCR for the three months ended December 31, 2018 and 2017, per the U.S. LCR public disclosure requirements which became effective April 1, 2017. Refer to Liquidity Risk Management on pages 95-100 for additional information on the Firm's LCR.
- Ratios presented are calculated under the Basel III Transitional capital rules and for the capital ratios represent the lower of the Standardized or Advanced approach. As of December 31, 2018, the Firm's capital ratios were equivalent whether calculated on a transitional or fully phased-in basis. Refer to Capital Risk Management on pages 85-94 for additional information on Basel III.
- Effective January 1, 2018, the SLR was fully phased-in under Basel III. The SLR is defined as Tier 1 capital divided by the Firm's total leverage exposure. Ratios prior to 2018 were calculated under the Basel III Transitional rules, per the SLR public disclosure requirements which became effective January 1, 2015.
- Excluded the impact of residential real estate purchased credit-impaired ("PCI") loans, a non-GAAP financial measure. For further discussion of these measures, refer to Explanation and Reconciliation of the Firm's Use of Non-GAAP Financial Measures and Key Performance Measures on pages 57-59, and the Allowance for credit losses on pages 120-122.
- On December 22, 2017, the Tax Cuts and Jobs Act ("TCJA") was signed into law. The Firm's results for the year ended December 31, 2017 included a \$2.4 billion decrease to net income as a result of the enactment of the TCJA. For additional information related to the impact of the TCJA, refer to Note 24.
- Excluding net charge-offs of \$467 million related to the student loan portfolio sale, the net charge-off rate for the year ended December 31, 2017 would have been 0.55%.

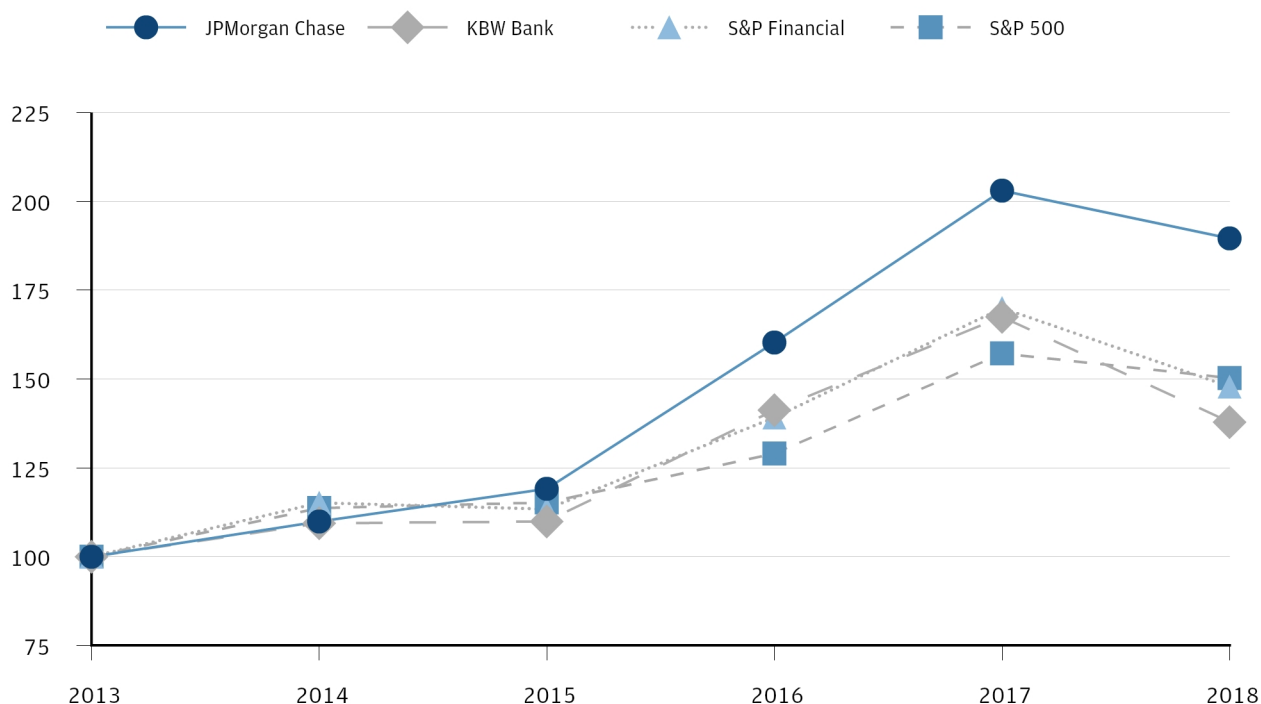
FIVE-YEAR STOCK PERFORMANCE

The following table and graph compare the five-year cumulative total return for JPMorgan Chase & Co. (“JPMorgan Chase” or the “Firm”) common stock with the cumulative return of the S&P 500 Index, the KBW Bank Index and the S&P Financial Index. The S&P 500 Index is a commonly referenced equity benchmark in the United States of America (“U.S.”), consisting of leading companies from different economic sectors. The KBW Bank Index seeks to reflect the performance of banks and thrifts that are publicly traded in the U.S. and is composed of leading national money center and regional banks and thrifts. The S&P Financial Index is an index of financial companies, all of which are components of the S&P 500. The Firm is a component of all three industry indices.

The following table and graph assume simultaneous investments of \$100 on December 31, 2013, in JPMorgan Chase common stock and in each of the above indices. The comparison assumes that all dividends are reinvested.

December 31, (in dollars)	2013	2014	2015	2016	2017	2018
JPMorgan Chase	\$ 100.00	\$ 109.88	\$ 119.07	\$ 160.23	\$ 203.07	\$ 189.57
KBW Bank Index	100.00	109.36	109.90	141.23	167.49	137.82
S&P Financial Index	100.00	115.18	113.38	139.17	169.98	147.82
S&P 500 Index	100.00	113.68	115.24	129.02	157.17	150.27

December 31,
(in dollars)



Management’s discussion and analysis

The following is Management’s discussion and analysis of the financial condition and results of operations (“MD&A”) of JPMorgan Chase for the year ended December 31, 2018. The MD&A is included in both JPMorgan Chase’s Annual Report for the year ended December 31, 2018 (“Annual Report”) and its Annual Report on Form 10-K for the year ended December 31, 2018 (“2018 Form 10-K”) filed with the Securities and Exchange Commission (“SEC”). Refer to the Glossary of terms and acronyms on pages 293-299 for definitions of terms and acronyms used throughout the Annual Report and the 2018 Form 10-K.

The MD&A contains statements that are forward-looking within the meaning of the Private Securities Litigation Reform Act of 1995. These statements are based on the current beliefs and expectations of JPMorgan Chase’s management and are subject to significant risks and uncertainties. For a discussion of certain of those risks and uncertainties and the factors that could cause JPMorgan Chase’s actual results to differ materially because of those risks and uncertainties, refer to Forward-looking Statements on page 147) and Part I, Item 1A: Risk factors in the 2018 Form 10-K.

INTRODUCTION

JPMorgan Chase & Co. (NYSE: JPM), a financial holding company incorporated under Delaware law in 1968, is a leading global financial services firm and one of the largest banking institutions in the United States of America (“U.S.”), with operations worldwide; JPMorgan Chase had \$2.6 trillion in assets and \$256.5 billion in stockholders’ equity as of December 31, 2018. The Firm is a leader in investment banking, financial services for consumers and small businesses, commercial banking, financial transaction processing and asset management. Under the J.P. Morgan and Chase brands, the Firm serves millions of customers in the U.S. and globally many of the world’s most prominent corporate, institutional and government clients.

JPMorgan Chase’s principal bank subsidiaries are JPMorgan Chase Bank, National Association (“JPMorgan Chase Bank, N.A.”), a national banking association with U.S. branches in 27 states and the District of Columbia as of December 31, 2018, and Chase Bank USA, National Association (“Chase Bank USA, N.A.”), a national banking association that is the Firm’s principal credit card-issuing bank. In January 2019, the OCC approved an application of merger which was filed by JPMorgan Chase Bank, N.A. and Chase Bank USA, N.A. in December 2018 and which contemplates that Chase Bank USA, N.A. will merge with and into JPMorgan Chase Bank, N.A., with JPMorgan Chase Bank, N.A. as the surviving bank. For additional information refer to Supervision and Regulation on pages 1-6 in the 2018 Form 10-K. JPMorgan Chase’s principal nonbank subsidiary is J.P. Morgan Securities LLC (“J.P. Morgan Securities”), a U.S. broker-dealer. The bank and non-bank subsidiaries of JPMorgan Chase operate nationally as well as through overseas branches and subsidiaries, representative offices and subsidiary foreign banks. The Firm’s principal operating subsidiary in the U.K. is J.P. Morgan Securities plc, a subsidiary of JPMorgan Chase Bank, N.A.

For management reporting purposes, the Firm’s activities are organized into four major reportable business segments, as well as a Corporate segment. The Firm’s consumer business is the Consumer & Community Banking (“CCB”) segment. The Firm’s wholesale business segments are Corporate & Investment Bank (“CIB”), Commercial Banking (“CB”), and Asset & Wealth Management (“AWM”). For a description of the Firm’s business segments, and the products and services they provide to their respective client bases, refer to Business Segment Results on pages 60-78, and Note 31.

EXECUTIVE OVERVIEW

This executive overview of the MD&A highlights selected information and does not contain all of the information that is important to readers of this 2018 Form 10-K. For a complete description of the trends and uncertainties, as well as the risks and critical accounting estimates affecting the Firm and its various lines of business, this 2018 Form 10-K should be read in its entirety.

Effective January 1, 2018, the Firm adopted several new accounting standards, of which the most significant to the Firm was the guidance related to revenue recognition, and recognition and measurement of financial assets. The revenue recognition guidance requires gross presentation of certain costs that were previously offset against revenue. This change was adopted retrospectively and, accordingly, prior period amounts were revised, resulting in both total net revenue and total noninterest expense increasing with no impact to net income. The adoption of the recognition and measurement guidance resulted in \$505 million of fair value gains in the first quarter of 2018, recorded in total net revenue, on certain equity investments that were previously held at cost. For additional information, refer to Note 1.

Financial performance of JPMorgan Chase

Year ended December 31, (in millions, except per share data and ratios)	2018	2017	Change
Selected income statement data			
Total net revenue	\$109,029	\$100,705	8%
Total noninterest expense	63,394	59,515	7
Pre-provision profit	45,635	41,190	11
Provision for credit losses	4,871	5,290	(8)
Net income	32,474	24,441	33
Diluted earnings per share	9.00	6.31	43
Selected ratios and metrics			
Return on common equity	13%	10%	
Return on tangible common equity	17	12	
Book value per share	\$ 70.35	\$ 67.04	5
Tangible book value per share	56.33	53.56	5
Capital ratios^(a)			
CET1	12.0%	12.2%	
Tier 1 capital	13.7	13.9	
Total capital	15.5	15.9	

(a) Ratios presented are calculated under the Basel III Transitional rules. As of December 31, 2018, the Firm's capital ratios were equivalent whether calculated on a transitional or fully phased-in basis. Refer to Capital Risk Management on pages 85-94 for additional information on Basel III.

Comparisons noted in the sections below are for the full year of 2018 versus the full year of 2017, unless otherwise specified.

Firmwide overview

JPMorgan Chase reported strong results for 2018, with record net income and EPS of \$32.5 billion and \$9.00 per share, respectively, on net revenue of \$109.0 billion. Excluding the impact of the Tax Cuts & Jobs Acts ("TCJA"), net income and EPS were still records for a full year. The Firm reported ROE of 13% and ROTCE of 17%. For additional information related to the impact of the TCJA, refer to the Consolidated Results of Operations on pages 48-51 and Note 24.

- Net income increased 33%, reflecting higher net revenue and the impact of the lower U.S. federal statutory income tax rate as a result of the TCJA, partially offset by an increase in noninterest expense.
- Total net revenue increased 8%. Net interest income was \$55.1 billion, up 10%, driven by the impact of higher rates, loan growth and Card margin expansion, partially offset by lower CIB Markets net interest income. Noninterest revenue was \$54.0 billion, up 7%, largely driven by higher CIB Markets noninterest revenue and auto lease income, partially offset by markdowns on certain legacy private equity investments and the impact of higher funding spreads on derivatives.
- Noninterest expense was \$63.4 billion, up 7%, predominantly driven by investments in the business, including technology, marketing, higher compensation expense on increased headcount, and real estate, as well as higher revenue-related costs, including auto lease depreciation and volume-related transaction costs.
- The provision for credit losses was \$4.9 billion, down from \$5.3 billion in the prior year, reflecting a decrease in the consumer provision driven by a lower addition to the credit card allowance for credit losses and lower net charge-offs. The lower net charge-offs were primarily driven by recoveries from loan sales in the residential real estate portfolio, predominantly offset by higher net charge-offs in the credit card portfolio, as anticipated. The prior year also included a net \$218 million write-down recorded in connection with the sale of the student loan portfolio. The decrease in the consumer provision was partially offset by an increase in the wholesale provision, reflecting additions to the allowance for loan losses from select client downgrades.
- The total allowance for credit losses was \$14.5 billion at December 31, 2018, and the Firm had a loan loss coverage ratio, excluding the PCI portfolio, of 1.23%, compared with 1.27% in the prior year. The Firm's nonperforming assets totaled \$5.2 billion at December 31, 2018, a decrease from \$6.4 billion in the prior year, reflecting improved credit performance in the consumer portfolio, and reductions in the wholesale portfolio including repayments and loan sales.
- Firmwide average core loans and core loans excluding CIB both increased 7%.

Selected capital-related metrics

- The Firm's Basel III Fully Phased-In CET1 capital was \$183.5 billion, and the Standardized and Advanced CET1 ratios were 12.0% and 12.9%, respectively.
- The Firm's Fully Phased-In supplementary leverage ratio ("SLR") was 6.4%.
- The Firm continued to grow tangible book value per share ("TBVPS"), ending 2018 at \$56.33, up 5%.

ROTCE and TBVPS are each non-GAAP financial measures. Core loans and each of the Fully Phased-In capital and certain leverage measures are all considered key performance measures. For a further discussion of each of these measures, refer to Explanation and Reconciliation of the Firm's Use of Non-GAAP Financial Measures and Key Performance Measures on pages 57-59, and Capital Risk Management on pages 85-94.

Management's discussion and analysis

Lines of business highlights

Selected business metrics for each of the Firm's four lines of business are presented below for the full year of 2018.

CCB ROE 28%	<ul style="list-style-type: none"> Revenue of \$52.1 billion, up 12%; record net income of \$14.9 billion, up 58% Average core loans up 6%; average deposits of \$670 billion, up 5% Client investment assets of \$282 billion, up 3% Credit card sales volume up 11% and merchant processing volume up 15%
CIB ROE 16%	<ul style="list-style-type: none"> Record revenue of \$36.4 billion, up 5%; record net income of \$11.8 billion, up 9% Maintained #1 ranking for Global Investment Banking fees with 8.7% wallet share Record Equity Markets revenue of \$6.9 billion, up 21% Investment Banking revenue up 2%; Treasury Services revenue up 13%; and Securities Services revenue up 8%
CB ROE 20%	<ul style="list-style-type: none"> Record revenue of \$9.1 billion, up 5%; record net income of \$4.2 billion, up 20% Average loan balances of \$205.5 billion, up 4% Strong credit quality with net charge-offs of 3 bps
AWM ROE 31%	<ul style="list-style-type: none"> Record revenue of \$14.1 billion, up 2%; record net income of \$2.9 billion, up 22% Average loan balances of \$139 billion, up 12% Assets under management ("AUM") of \$2.0 trillion, down 2%

For a detailed discussion of results by line of business, refer to the Business Segment Results on pages 60-61.

Credit provided and capital raised

JPMorgan Chase continues to support consumers, businesses and communities around the globe. The Firm provided credit and raised capital for wholesale and consumer clients during 2018, consisting of:

\$2.5 trillion	Total credit provided and capital raised
\$227 billion	Credit for consumers
\$24 billion	Credit for U.S. small businesses
\$937 billion	Credit for corporations
\$1.3 trillion	Capital raised for corporate clients and non-U.S. government entities
\$57 billion	Credit and capital raised for U.S. governments and nonprofit entities ^(a)

(a) Includes states, municipalities, hospitals and universities.

2019 outlook

These current expectations are forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Such forward-looking statements are based on the current beliefs and expectations of JPMorgan Chase's management and are subject to significant risks and uncertainties. For a further discussion of certain of those risks and uncertainties and the other factors that could cause JPMorgan Chase's actual results to differ materially because of those risks and uncertainties, refer to Forward-Looking Statements on page 147 and the Risk Factors section on pages 7-28. There is no assurance that actual results in 2019 will be in line with the outlook set forth below, and the Firm does not undertake to update any forward-looking statements.

JPMorgan Chase's outlook for 2019 should be viewed against the backdrop of the global and U.S. economies, financial markets activity, the geopolitical environment, the competitive environment, client and customer activity levels, and regulatory and legislative developments in the U.S. and other countries where the Firm does business. Each of these factors will affect the performance of the Firm and its lines of business. The Firm expects that it will continue to make appropriate adjustments to its businesses and operations in response to ongoing developments in the legal, regulatory, business and economic environments in which it operates.

Firmwide

- Management expects full-year 2019 net interest income, on a managed basis, to be in excess of \$58 billion, reflecting the annualized impact of 2018 interest rate increases, as well as expected loan and deposit growth.
- The Firm takes a disciplined approach to managing its expenses, while investing for growth and innovation. As a result, management expects Firmwide adjusted expense for the full-year 2019 to be less than \$66 billion.
- The Firm continues to experience charge-off rates at very low levels, reflecting favorable credit trends across the consumer and wholesale portfolios. Management expects full-year 2019 net charge-offs to be less than \$5.5 billion, higher than 2018, driven by growth.

First-quarter 2019

- Management expects the first-quarter 2019 net interest income, on a managed basis, to be approximately flat compared with the fourth-quarter of 2018.
- Firmwide adjusted expense for the first-quarter 2019 is expected to be up mid-single digits compared with the first quarter of 2018.
- Markets revenue for the first-quarter 2019 is expected to be lower when compared with the prior-year quarter by high-teens percentage points on a reported basis, and by low double-digit percentage points excluding the impact of the recognition and measurement accounting standard in the first quarter of 2018, depending on market conditions.

Management's discussion and analysis

Business Developments

Expected departure of the U.K. from the EU

In 2016, the U.K. voted to withdraw from the European Union ("EU"), and in March 2017, the U.K. invoked Article 50 of the Lisbon Treaty, which commenced withdrawal negotiations with the EU. As a result, the U.K. is scheduled to depart from the EU on March 29, 2019. Negotiations regarding the terms of the U.K.'s withdrawal continue between the U.K. and the EU, although the situation remains highly uncertain.

The Firm has a long-standing presence in the U.K., which currently serves as the regional headquarters of the Firm's operations in over 30 countries across Europe, the Middle East, and Africa ("EMEA"). In the region, the Firm serves clients and customers across its business segments. The Firm has approximately 16,000 employees in the U.K., of which approximately two-thirds are in London, with operational and technology support centers in locations such as Bournemouth, Glasgow and Edinburgh.

The Firm has been preparing for and continues to make significant progress in its readiness for the U.K.'s expected withdrawal from the EU, which is commonly referred to as "Brexit." JPMorgan Chase established a Firmwide Brexit Implementation program in 2017. The program covers strategic implementation across all impacted businesses and functions. The program's objective is to deliver the Firm's capabilities on "day one" of the U.K.'s withdrawal across all impacted legal entities. The program includes an ongoing assessment of implementation risks including political, legal and regulatory risks and plans for addressing and mitigating those risks. The Firm is also monitoring the expected macroeconomic developments associated with a no-deal scenario and has undertaken stress testing covering credit and market risk to assess potential impacts.

Significant uncertainty remains around the U.K.'s expected departure from the EU, including the possibility that the U.K. departs without any agreement being reached on how U.K. financial services firms will conduct business within the EU (i.e., "a no-deal scenario").

The Firm is planning for a U.K. withdrawal in the event that an agreement is reached, as well as for a no-deal scenario. Significant uncertainties exist under either potential outcome. For example, in planning for the U.K. withdrawal from the EU under a no-deal scenario, the Firm is focused on the following key areas to ensure continuation of service to its EU clients: regulatory and legal entity readiness; client readiness; and business and operational readiness.

Regulatory and legal entity readiness

The Firm intends to leverage its existing EU legal entities, in Germany, Luxembourg and Ireland to conduct broader financial service activities. These legal entities are in advanced stages of readiness, including governance,

infrastructure, capital, local regulatory licenses and branch authorizations, as needed. The Firm anticipates that its EU legal entities will be ready to service its EU clients in March 2019, if required. There are some dependencies on final authorizations from the European Central Bank and jurisdictional National Competent Authorities to carry out new activity in the EU legal entities.

Client readiness

Where required, agreements with the Firm's EU clients are being re-documented from current U.K. legal entities to existing EU legal entities to ensure continuation of service. This process involves establishing new agreements such as ISDA master agreements between clients and the relevant EU legal entity. There is a risk that not all clients will have the appropriate legal and operational arrangements in place upon the U.K.'s withdrawal from the EU. The Firm continues to actively engage with its clients to ensure preparedness and, to the extent possible, minimize operational disruption.

Business and operational readiness

The Firm is expecting to add several hundred employee positions in its various EU locations, including individuals who the Firm expects to relocate from the U.K. The Firm is preparing to be operational in the EU across all in-scope businesses and functions, including the build-out of technology, processes and controls, and the necessary resourcing in the EU locations across first, second and third line of defense functions.

The Firm and its EU legal entities' access to market infrastructures such as trading venues, central counterparties ("CCPs") and central settlement systems ("CSDs") will need to be adjusted to comply with the evolving regulatory framework. Some uncertainty remains with respect to the readiness of the overall market ecosystem and connectivity between participants. The Firm continues to monitor the regulatory landscape and is preparing to take mitigating action, as needed, specifically in areas such as "contract continuity" that would allow U.K. entities to continue servicing trade lifecycle events.

In the event that the U.K.'s withdrawal from the EU is delayed through a transition deal or another mechanism, the Firm would have the required operational capabilities to conduct business from its EU legal entities, but the timing of any changes would be re-assessed to ensure that a strategic approach is taken. The Firm continues to closely monitor all negotiations and legislative developments and has developed an implementation plan that allows for flexibility given the continued uncertainty.

LIBOR transition

The Financial Stability Board (“FSB”) and the Financial Stability Oversight Council (“FSOC”) have observed that the secular decline in interbank short-term funding poses structural risks for unsecured benchmark interest rates such as Interbank Offered Rates (“IBORs”), and therefore regulators and market participants in various jurisdictions have been working to identify alternative reference rates that are compliant with the International Organization of Securities Commission’s standards for transaction-based benchmarks. In the U.S., the Alternative Reference Rates Committee (the “ARRC”), a group of market and official sector participants, identified the Secured Overnight Financing Rate (“SOFR”) as its recommended alternative benchmark rate. Other alternative reference rates have been recommended in other jurisdictions.

IBORs are referenced in approximately \$370 trillion of wholesale and consumer transactions globally spanning a broad range of financial products and contracts. Without advance transition planning for alternative benchmarks, sudden cessation of those broadly referenced rates could cause significant disruptions to gross flows of floating-rate payments and receipts. An abrupt cessation could also impair the normal functioning of a variety of markets, including commercial and consumer lending.

JPMorgan Chase established a Firmwide LIBOR Transition program in early 2018. The Firmwide CFO and the CEO of the CIB oversee the program as senior sponsors. When assessing risks associated with IBOR transition, the program considers three possible scenarios: disorderly transition, measured/regulated transition, and IBOR in continuity. These risks will continue to be monitored, along with any new risks that emerge as the program progresses. Plans to mitigate the risks associated with IBOR transition have been identified, with some already in the early stages of implementation. Model risk, for example, will be mitigated by the identification and migration of swap curves based on IBORs to new alternative reference rates.

Market participants are working closely with public sector representation as part of National Working Groups (“NWGs”) towards the common goal of facilitating an orderly transition from IBORs. Current NWG efforts include the development of cash and derivative markets referencing alternative reference rates, as well as the development of industry consensus for fallback language that would determine the rates to use in various IBOR-indexed contracts when a particular IBOR ceases to be produced. The Firm is encouraging its clients to actively participate in industry consultations on fallback language in order to ensure the broadest possible industry engagement in and understanding of IBOR transition. The Firm continues to monitor the transition by clients from the current IBOR-referencing products to products referencing the new alternative reference rates.

NWGs are also working with accounting standard setters to manage the accounting implications of amending existing contracts to add fallback language and to change reference rates. Current efforts include the identification of potential accounting impacts and potential alternatives to mitigate those impacts through interpretation of existing accounting rules, or through transition relief from FASB and IASB standard setting.

The Firm continues to develop and implement plans to appropriately mitigate the risks associated with IBOR discontinuation as identified alternative reference rates develop, and liquidity in the markets referencing them increases. The Firm will continue to engage with regulators as the transition progresses.

Management's discussion and analysis

CONSOLIDATED RESULTS OF OPERATIONS

This section provides a comparative discussion of JPMorgan Chase's Consolidated Results of Operations on a reported basis for the three-year period ended December 31, 2018, unless otherwise specified. Factors that relate primarily to a single business segment are discussed in more detail within that business segment. For a discussion of the Critical Accounting Estimates Used by the Firm that affect the Consolidated Results of Operations, refer to pages 141-143.

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

Revenue

Year ended December 31, (in millions)	2018	2017	2016
Investment banking fees	\$ 7,550	\$ 7,412	\$ 6,572
Principal transactions	12,059	11,347	11,566
Lending- and deposit-related fees	6,052	5,933	5,774
Asset management, administration and commissions	17,118	16,287	15,364
Investment securities gains/ (losses)	(395)	(66)	141
Mortgage fees and related income	1,254	1,616	2,491
Card income	4,989	4,433	4,779
Other income ^(a)	5,343	3,646	3,799
Noninterest revenue	53,970	50,608	50,486
Net interest income	55,059	50,097	46,083
Total net revenue	\$ 109,029	\$ 100,705	\$ 96,569

(a) Included operating lease income of \$4.5 billion, \$3.6 billion and \$2.7 billion for the years ended December 31, 2018, 2017 and 2016, respectively.

2018 compared with 2017

Investment banking fees increased from a strong prior year, with overall share gains, reflecting:

- higher advisory fees driven by a higher number of large completed transactions, and
- higher equity underwriting fees driven by a higher share of fees, reflecting strong performance across products predominantly offset by
- lower debt underwriting fees primarily driven by declines in industry-wide fee levels.

For additional information, refer to CIB segment results on pages 66-70 and Note 6.

Principal transactions revenue increased primarily reflecting higher revenue in CIB driven by:

- Equity Markets with strength across products, primarily in derivatives and prime brokerage, reflecting strong client activity, and
- Fixed Income Markets reflecting strong performance in Currencies & Emerging Markets, and higher revenue in Commodities compared to a challenging prior year, largely offset by lower revenue in Credit,

- the results also reflect a loss in Credit Adjustments & Other, largely driven by higher funding spreads on derivatives.

The increase in CIB was partially offset by private equity losses reflecting markdowns on certain legacy private equity investments compared with gains in the prior year in Corporate.

For additional information, refer to CIB and Corporate segment results on pages 66-70 and pages 77-78, respectively, and Note 6.

Asset management, administration and commissions revenue increased reflecting:

- higher asset management fees in AWM and CCB driven by higher average market levels and the cumulative impact of net inflows. For AWM, these were partially offset by fee compression and lower performance fees
- higher brokerage commissions driven by higher volumes in CIB and AWM, and higher asset-based fees in CIB.

For additional information, refer to AWM, CCB and CIB segment results on pages 74-76, pages 62-65 and pages 66-70, respectively, and Note 6.

For information on lending- and deposit-related fees, refer to the segment results for CCB on pages 62-65, CIB on pages 66-70, and CB on pages 71-73 and Note 6; on securities gains, refer to the Corporate segment discussion on pages 77-78.

Investment securities losses increased due to sales related to repositioning the investment securities portfolio.

Mortgage fees and related income decreased driven by:

- lower net production revenue reflecting lower production margins and volumes, as well as the impact of a loan sale, partially offset by
- higher net mortgage servicing revenue reflecting higher MSR risk management results, predominantly offset by lower servicing revenue on a lower level of third-party loans serviced.

For further information, refer to CCB segment results on pages 62-65, Note 6 and 15.

Card income increased driven by:

- lower new account origination costs, and higher merchant processing fees on higher volumes, largely offset by
- lower net interchange income reflecting higher rewards costs and partner payments, largely offset by higher card sales volumes. The rewards costs included an adjustment to the credit card rewards liability of approximately \$330 million, recorded in the second quarter of 2018, driven by an increase in redemption rate assumptions.

For further information, refer to CCB segment results on pages 62-65 and Note 6.

Other income increased reflecting:

- higher operating lease income from growth in auto operating lease volume in CCB
- fair value gains of \$505 million recognized in the first quarter of 2018 related to the adoption of the new recognition and measurement accounting guidance for certain equity investments previously held at cost
- the absence of the impact related to the enactment of the TCJA, which reduced the value of certain of CIB's tax-oriented investments by \$520 million in the prior year

partially offset by

- lower investment valuations in AWM, and
- the absence of a legal benefit of \$645 million that was recorded in the prior year in Corporate related to a settlement with the FDIC receivership for Washington Mutual and with Deutsche Bank as trustee of certain Washington Mutual trusts.

For further information, refer to Note 6.

Net interest income increased driven by the impact of higher rates, loan growth across the businesses, and Card margin expansion, partially offset by lower CIB Markets net interest income. The Firm's average interest-earning assets were \$2.2 trillion, up \$49 billion from the prior year, and the net interest yield on these assets, on an FTE basis, was 2.50%, an increase of 14 basis points from the prior year. The net interest yield excluding CIB Markets was 3.25%, an increase of 40 basis points. Net interest yield excluding CIB markets is a non-GAAP financial measure. For a further discussion of this measure, refer to Explanation and Reconciliation of the Firm's Use of Non-GAAP Financial Measures and Key Performance Measures on pages 57-59.

2017 compared with 2016

Investment banking fees increased reflecting higher debt and equity underwriting fees in CIB. The increase in debt underwriting fees was driven by a higher share of fees and an overall increase in industry-wide fees; and the increase in equity underwriting fees was driven by growth in industry-wide issuance, including a strong initial public offering ("IPO") market.

Principal transactions revenue decreased compared with a strong prior year in CIB, primarily reflecting:

- lower Fixed Income-related revenue driven by sustained low volatility and tighter credit spreads

partially offset by

- higher Equity-related revenue primarily in Prime Services, and
- higher Lending-related revenue reflecting lower fair value losses on hedges of accrual loans.

Asset management, administration and commissions revenue increased as a result of higher asset management fees in AWM and CCB, and higher asset-based fees in CIB, both driven by higher market levels

Mortgage fees and related income decreased driven by lower MSR risk management results, lower net production revenue on lower margins and volumes, and lower servicing revenue on lower average third-party loans serviced.

Card income decreased predominantly driven by higher credit card new account origination costs, largely offset by higher card-related fees, primarily annual fees.

Other income decreased primarily due to:

- lower other income in CIB largely driven by a \$520 million impact related to the enactment of the TCJA, which reduced the value of certain of CIB's tax-oriented investments, and
- the absence in the current year of gains from
 - the sale of Visa Europe interests in CCB,
 - the redemption of guaranteed capital debt securities ("trust preferred securities"), and
 - the disposal of an asset in AWM

partially offset by

- higher operating lease income reflecting growth in auto operating lease volume in CCB, and
- a legal benefit of \$645 million recorded in the second quarter of 2017 in Corporate related to a settlement with the FDIC receivership for Washington Mutual and with Deutsche Bank as trustee of certain Washington Mutual trusts.

Net interest income increased primarily driven by the net impact of higher rates and loan growth across the businesses, partially offset by declines in Markets net interest income in CIB. The Firm's average interest-earning assets were \$2.2 trillion, up \$79 billion from the prior year, and the net interest yield on these assets, on a fully taxable equivalent ("FTE") basis, was 2.36%, an increase of 11 basis points from the prior year. The net interest yield excluding CIB Markets was 2.85%, an increase of 26 basis points from the prior year.

Management's discussion and analysis

Provision for credit losses

Year ended December 31, (in millions)	2018	2017	2016
Consumer, excluding credit card	\$ (63)	\$ 620	\$ 467
Credit card	4,818	4,973	4,042
Total consumer	4,755	5,593	4,509
Wholesale	116	(303)	852
Total provision for credit losses	\$ 4,871	\$ 5,290	\$ 5,361

2018 compared with 2017

The **provision for credit losses** decreased as a result of a decline in the consumer provision, partially offset by an increase in the wholesale provision

- the decrease in the **consumer, excluding credit card** portfolio in CCB was due to
 - lower net charge-offs in the residential real estate portfolio, largely driven by recoveries from loan sales, and
 - lower net charge-offs in the auto portfolio
 partially offset by
 - a \$250 million reduction in the allowance for loan losses in the residential real estate portfolio – PCI, reflecting continued improvement in home prices and lower delinquencies; the reduction was \$75 million lower than the prior year for the residential real estate portfolio – non credit-impaired
- the prior year also included a net \$218 million write-down recorded in connection with the sale of the student loan portfolio, and
- the decrease in the **credit card** portfolio was due to
 - a \$300 million addition to the allowance for loan losses, reflecting loan growth and higher loss rates, as anticipated; the addition was \$550 million lower than the prior year,
 largely offset by
 - higher net charge-offs due to seasoning of more recent vintages, as anticipated, and

- in **wholesale**, the current period expense of \$116 million reflected additions to the allowance for loan losses from select client downgrades, largely offset by
 - other net portfolio activity, including a reduction in the allowance for loan losses related to a single name in the Oil & Gas portfolio in the first quarter of 2018, compared to a net benefit of \$303 million in the prior year. The prior year benefit reflected a reduction in the allowance for loan losses on credit quality improvements in the Oil & Gas, Natural Gas Pipelines, and Metals and Mining portfolios.

For a more detailed discussion of the credit portfolio and the allowance for credit losses, refer to the segment discussions of CCB on pages 62-65, CIB on pages 66-70, CB on pages 71-73, the Allowance for Credit Losses on pages 120-122 and Note 13.

2017 compared with 2016

The **provision for credit losses** decreased as a result of:

- a net \$422 million reduction in the wholesale allowance for credit losses, reflecting credit quality improvements in the Oil & Gas, Natural Gas Pipelines, and Metals & Mining portfolios, compared with an addition of \$511 million in the prior year driven by downgrades in the same portfolios
- predominantly offset by
- a higher consumer provision driven by
 - \$450 million of higher net charge-offs, primarily in the credit card portfolio due to growth in newer vintages which, as anticipated, have higher loss rates than the more seasoned portion of the portfolio, partially offset by a decrease in net charge-offs in the residential real estate portfolio reflecting continued improvement in home prices and delinquencies,
 - a \$416 million higher addition to the allowance for credit losses related to the credit card portfolio driven by higher loss rates and loan growth, and a lower reduction in the allowance for the residential real estate portfolio predominantly driven by continued improvement in home prices and delinquencies, and
 - a net \$218 million write-down recorded in connection with the sale of the student loan portfolio.

Noninterest expense

Year ended December 31, (in millions)	2018	2017	2016
Compensation expense	\$33,117	\$31,208	\$30,203
Noncompensation expense:			
Occupancy	3,952	3,723	3,638
Technology, communications and equipment	8,802	7,715	6,853
Professional and outside services	8,502	7,890	7,526
Marketing	3,290	2,900	2,897
Other ^{(a)(b)}	5,731	6,079	5,555
Total noncompensation expense	30,277	28,307	26,469
Total noninterest expense	\$63,394	\$59,515	\$56,672

(a) Included Firmwide legal expense/(benefit) of \$72 million, \$(35) million and \$(317) million for the years ended December 31, 2018, 2017 and 2016, respectively.

(b) Included FDIC-related expense of \$1.2 billion, \$1.5 billion and \$1.3 billion for the years ended December 31, 2018, 2017 and 2016, respectively.

2018 compared with 2017

Compensation expense increased driven by investments in headcount across the businesses, including bankers and advisors, as well as technology and other support staff, and higher revenue-related compensation expense largely in CIB.

Noncompensation expense increased as a result of:

- higher depreciation expense due to growth in auto operating lease volume in CCB
- higher outside services expense primarily due to higher volume-related transaction costs in CIB and higher external fees on revenue growth in AWM
- higher investments in technology in the businesses and marketing in CCB
- a loss of \$174 million on the liquidation of a legal entity, recorded in other expense in Corporate, in the second quarter of 2018, and
- higher legal expense, with a net benefit in the prior year partially offset by
- lower FDIC-related expense as a result of the elimination of the surcharge at the end of the third quarter of 2018, and
- the absence of an impairment in CB on certain leased equipment

For additional information on the liquidation of a legal entity, refer to Note 23.

2017 compared with 2016

Compensation expense increased predominantly driven by investments in headcount in most businesses, including bankers and business-related support staff, and higher performance-based compensation expense, predominantly in AWM.

Noncompensation expense increased as a result of:

- higher depreciation expense from growth in auto operating lease volume in CCB
- contributions to the Firm's Foundation
- a lower legal net benefit compared to the prior year
- higher FDIC-related expense, and
- an impairment in CB on certain leased equipment, the majority of which was sold subsequent to year-end partially offset by
- the absence in the current year of two items totaling \$175 million in CCB related to liabilities from a merchant in bankruptcy and mortgage servicing reserves

For a discussion of legal expense, refer to Note 29.

Income tax expense

Year ended December 31, (in millions, except rate)	2018	2017	2016
Income before income tax expense	\$40,764	\$35,900	\$34,536
Income tax expense	8,290	11,459	9,803
Effective tax rate	20.3%	31.9%	28.4%

2018 compared with 2017

The **effective tax rate** decreased in 2018 driven by

- the impact of the TCJA, including the reduction in the U.S. federal statutory income tax rate, a \$302 million net tax benefit resulting from changes in the prior year estimates related to the remeasurement of certain deferred taxes and the deemed repatriation tax on non-U.S. earnings, and the absence of the initial \$1.9 billion impact from the TCJA's enactment in December 2017

the reduction in the effective tax rate was partially offset by

- the impact of higher pre-tax income, and the change in mix of income and expense subject to U.S. federal, state and local taxes. For further information, refer to Note 24.

2017 compared with 2016

The **effective tax rate** increased in 2017 driven by:

- a \$1.9 billion increase to income tax expense representing the initial impact of the enactment of the TCJA. The increase was driven by the deemed repatriation of the Firm's unremitted non-U.S. earnings and adjustments to the value of certain tax-oriented investments, partially offset by a benefit from the revaluation of the Firm's net deferred tax liability. The incremental expense resulted in a 5.4 percentage point increase in the Firm's effective tax rate

partially offset by

- benefits resulting from the vesting of employee share-based awards related to the appreciation of the Firm's stock price upon vesting above their original grant price, and the release of a valuation allowance.

Management's discussion and analysis

CONSOLIDATED BALANCE SHEETS AND CASH FLOWS ANALYSIS

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

Consolidated balance sheets analysis

The following is a discussion of the significant changes between December 31, 2018 and 2017.

Selected Consolidated balance sheets data

December 31, (in millions)	2018	2017	Change
Assets			
Cash and due from banks	\$ 22,324	\$ 25,898	(14)%
Deposits with banks	256,469	405,406	(37)
Federal funds sold and securities purchased under resale agreements	321,588	198,422	62
Securities borrowed	111,995	105,112	7
Trading assets	413,714	381,844	8
Investment securities	261,828	249,958	5
Loans	984,554	930,697	6
Allowance for loan losses	(13,445)	(13,604)	(1)
Loans, net of allowance for loan losses	971,109	917,093	6
Accrued interest and accounts receivable	73,200	67,729	8
Premises and equipment	14,934	14,159	5
Goodwill, MSRs and other intangible assets	54,349	54,392	—
Other assets	121,022	113,587	7
Total assets	\$ 2,622,532	\$ 2,533,600	4 %

Cash and due from banks and deposits with banks

decreased primarily as a result of a shift in the deployment of excess cash in Treasury and Chief Investment Office ("CIO") from deposits with Federal Reserve Banks to other short-term instruments (as noted below), based on market opportunities. Deposits with banks reflect the Firm's placements of its excess cash with various central banks, including the Federal Reserve Banks.

Federal funds sold and securities purchased under resale agreements increased primarily due to a shift in the deployment of excess cash in Treasury and CIO from deposits with banks to securities purchased under resale agreements, and higher client-driven market-making activities in CIB. For additional information on the Firm's Liquidity Risk Management, refer to pages 95–100.

Securities borrowed increased driven by higher demand for securities to cover short positions related to client-driven market-making activities in CIB.

Trading assets increased as a result of a shift in the deployment of excess cash in Treasury and CIO from deposits with banks into short-term instruments as well as client-driven market-making activities in CIB. For additional information, refer to Derivative contracts on pages 117–118, and Notes 2 and 5.

Investment securities increased primarily due to purchases of U.S. Treasury Bills, reflecting a shift in the deployment of excess cash in Treasury and CIO from deposits with banks. The increase was partially offset by net sales, paydowns and maturities largely of obligations of U.S. states and municipalities, commercial MBS and non-U.S. government debt securities. For additional information on investment

securities, refer to Corporate segment results on pages 77–78, Investment Portfolio Risk Management on page 123 and Notes 2 and 10.

Loans increased reflecting:

- higher loans across the wholesale businesses, primarily driven by commercial and industrial and financial institution clients in CIB and Wealth Management clients globally in AWM, and
- higher consumer loans driven by retention of originated high-quality prime mortgages in CCB and AWM, and growth in credit card loans. These were predominantly offset by mortgage paydowns and loan sales, lower home equity loans, run-off of PCI loans, and lower auto loans.

The **allowance for loan losses** decreased driven by:

- a reduction in the consumer allowance due to a \$250 million reduction in the CCB allowance for loan losses in the residential real estate PCI portfolio, reflecting continued improvement in home prices and lower delinquencies, as well as a \$187 million reduction in the allowance for write-offs of PCI loans partially due to loan sales. These reductions were largely offset by a \$300 million addition to the allowance in the credit card portfolio, due to loan growth and higher loss rates, as anticipated.

For a more detailed discussion of loans and the allowance for loan losses, refer to Credit and Investment Risk Management on pages 102–123, and Notes 2, 3, 12 and 13.

Accrued interest and accounts receivable increased primarily reflecting higher client receivables related to client-driven activities in CIB.

Other assets increased reflecting higher auto operating lease assets from growth in business volume in CCB and higher alternative energy investments in CIB.

For information on Goodwill and MSRs, refer to Note 15.

Selected Consolidated balance sheets data

December 31, (in millions)	2018	2017	Change
Liabilities			
Deposits	\$ 1,470,666	\$ 1,443,982	2
Federal funds purchased and securities loaned or sold under repurchase agreements	182,320	158,916	15
Short-term borrowings	69,276	51,802	34
Trading liabilities	144,773	123,663	17
Accounts payable and other liabilities	196,710	189,383	4
Beneficial interests issued by consolidated variable interest entities ("VIEs")	20,241	26,081	(22)
Long-term debt	282,031	284,080	(1)
Total liabilities	2,366,017	2,277,907	4
Stockholders' equity	256,515	255,693	–
Total liabilities and stockholders' equity	\$ 2,622,532	\$ 2,533,600	4%

Deposits increased in CIB and CCB, largely offset by decreases in AWM and CB.

- The increase in CIB was predominantly driven by growth in operating deposits related to client activity in CIB's Treasury Services business, and in CCB reflecting the continuation of growth from new accounts.
- The decrease in AWM was driven by balance migration predominantly into the Firm's higher-yielding investment-related products. The decrease in CB was driven by a reduction in non-operating deposits.

For more information, refer to the Liquidity Risk Management discussion on pages 95-100; and Notes 2 and 17.

Federal funds purchased and securities loaned or sold under repurchase agreements increased reflecting higher client-driven market-making activities and higher secured financing of trading assets-debt and equity instruments in CIB.

Short-term borrowings increased reflecting short-term advances from Federal Home Loan Banks ("FHLBs") and the net issuance of commercial paper in Treasury and CIO primarily for short-term liquidity management. For additional information, refer to Liquidity Risk Management on pages 95-100.

Trading liabilities increased predominantly as a result of client-driven market-making activities in CIB, which resulted in higher levels of short positions in equity instruments in Equity Markets, including prime brokerage. For additional information, refer to Derivative contracts on pages 117-118, and Notes 2 and 5.

Accounts payable and other liabilities increased partly as a result of higher client payables related to prime brokerage activities in CIB.

Beneficial interests issued by consolidated VIEs decreased due to net maturities of credit card securitizations. For further information on Firm-sponsored VIEs and loan securitization trusts, refer to Off-Balance Sheet Arrangements on pages 55-56 and Note 14 and 27.

Long-term debt decreased primarily driven by lower FHLB advances, predominantly offset by net issuance of structured notes in CIB, as well as net issuance of senior debt in Treasury and CIO. For additional information on the Firm's long-term debt activities, refer to Liquidity Risk Management on pages 95-100 and Note 19.

For information on changes in stockholders' equity, refer to page 153, and on the Firm's capital actions, refer to Capital actions on pages 91-92.

Management's discussion and analysis

Consolidated cash flows analysis

The following is a discussion of cash flow activities during the years ended December 31, 2018, 2017 and 2016.

(in millions)	Year ended December 31,		
	2018	2017	2016
Net cash provided by/(used in)			
Operating activities	\$ 14,187	\$ (10,827)	\$ 21,884
Investing activities	(197,993)	28,249	(89,202)
Financing activities	34,158	14,642	98,271
Effect of exchange rate changes on cash	(2,863)	8,086	(1,482)
Net increase/(decrease) in cash and due from banks	\$(152,511)	\$ 40,150	\$ 29,471

Operating activities

JPMorgan Chase's operating assets and liabilities primarily support the Firm's lending and capital markets activities. These assets and liabilities can vary significantly in the normal course of business due to the amount and timing of cash flows, which are affected by client-driven and risk management activities and market conditions. The Firm believes cash flows from operations, available cash and other liquidity sources, and its capacity to generate cash through secured and unsecured sources are sufficient to meet its operating liquidity needs.

- In 2018, cash provided primarily reflected net income excluding noncash adjustments, increased trading liabilities and accounts payable and other liabilities, partially offset by an increase in trading assets, net originations of loans held-for-sale, and higher securities borrowed and other assets.
- In 2017, cash used primarily reflected a decrease in trading liabilities and accounts payable and other liabilities, and an increase in accrued interest and accounts receivable, partially offset by net income excluding noncash adjustments and a decrease in trading assets.
- In 2016, cash provided primarily reflected net income excluding noncash adjustments, partially offset by an increase in trading assets.

Investing activities

The Firm's investing activities predominantly include originating held-for-investment loans and investing in the securities portfolio and other short-term instruments.

- In 2018, cash used reflected an increase in securities purchased under resale agreements, higher net originations of loans and net purchases of investment securities.
- In 2017, cash provided reflected net proceeds from paydowns, maturities, sales and purchases of investment securities and a decrease in securities purchased under resale agreements, partially offset by net originations of loans.
- In 2016, cash used reflected net originations of loans, and an increase in securities purchased under resale agreements.

Financing activities

The Firm's financing activities include acquiring customer deposits and issuing long-term debt, as well as preferred and common stock.

- In 2018, cash provided reflected higher deposits, short-term borrowings, and securities loaned or sold under repurchase agreements.
- In 2017, cash provided reflected higher deposits and short-term borrowings, partially offset by a net decrease in long-term borrowings.
- In 2016, cash provided reflected higher deposits, net proceeds from long-term borrowings, and an increase in securities loaned or sold under repurchase agreements.
- For all periods, cash was used for repurchases of common stock and cash dividends on common and preferred stock.

* * *

For a further discussion of the activities affecting the Firm's cash flows, refer to Consolidated Balance Sheets Analysis on pages 52-53, Capital Risk Management on pages 85-94, and Liquidity Risk Management on pages 95-100.

OFF-BALANCE SHEET ARRANGEMENTS AND CONTRACTUAL CASH OBLIGATIONS

In the normal course of business, the Firm enters into various off-balance sheet arrangements and contractual obligations that may require future cash payments. Certain obligations are recognized on-balance sheet, while others are off-balance sheet under accounting principles generally accepted in the U.S. (“U.S. GAAP”).

Special-purpose entities

The Firm is involved with several types of off-balance sheet arrangements, including through nonconsolidated special-purpose entities (“SPEs”), which are a type of VIE, and through lending-related financial instruments (e.g., commitments and guarantees).

The Firm holds capital, as deemed appropriate, against all SPE-related transactions and related exposures, such as derivative contracts and lending-related commitments and guarantees.

The Firm has no commitments to issue its own stock to support any SPE transaction, and its policies require that transactions with SPEs be conducted at arm’s length and reflect market pricing. Consistent with this policy, no JPMorgan Chase employee is permitted to invest in SPEs with which the Firm is involved where such investment would violate the Firm’s Code of Conduct.

The table below provides an index of where in this 2018 Form 10-K a discussion of the Firm’s various off-balance sheet arrangements can be found. In addition, refer to Note 1 for information about the Firm’s consolidation policies.

Type of off-balance sheet arrangement	Location of disclosure	Page references
Special-purpose entities: variable interests and other obligations, including contingent obligations, arising from variable interests in nonconsolidated VIEs	Refer to Note 14	244-251
Off-balance sheet lending-related financial instruments, guarantees, and other commitments	Refer to Note 27	271-276

Management's discussion and analysis

Contractual cash obligations

The accompanying table summarizes, by remaining maturity, JPMorgan Chase's significant contractual cash obligations at December 31, 2018. The contractual cash obligations included in the table below reflect the minimum contractual obligation under legally enforceable contracts with terms that are both fixed and determinable. Excluded from the below table are certain liabilities with variable cash flows and/or no obligation to return a stated amount of principal at maturity.

The carrying amount of on-balance sheet obligations on the Consolidated balance sheets may differ from the minimum contractual amount of the obligations reported below. For a discussion of mortgage repurchase liabilities and other obligations, refer to Note 27.

Contractual cash obligations

By remaining maturity at December 31, (in millions)	2018					2017
	2019	2020-2021	2022-2023	After 2023	Total	Total
On-balance sheet obligations						
Deposits ^(a)	\$ 1,447,407	\$ 8,958	\$ 6,227	\$ 5,439	\$ 1,468,031	\$ 1,437,464
Federal funds purchased and securities loaned or sold under repurchase agreements	181,491	458	—	371	182,320	158,916
Short-term borrowings ^(a)	62,393	—	—	—	62,393	42,664
Beneficial interests issued by consolidated VIEs	13,502	5,075	1,400	281	20,258	26,036
Long-term debt ^(a)	26,889	75,816	37,171	118,782	258,658	260,895
Other ^{(b)(c)}	5,592	1,687	1,669	2,846	11,794	13,613
Total on-balance sheet obligations	1,737,274	91,994	46,467	127,719	2,003,454	1,939,588
Off-balance sheet obligations						
Unsettled resale and securities borrowed agreements ^(d)	102,008	—	—	—	102,008	76,859
Contractual interest payments ^(e)	10,960	11,501	8,295	27,496	58,252	54,103
Operating leases ^(f)	1,561	2,840	2,111	4,480	10,992	9,877
Equity investment commitments ^{(c)(g)}	262	2	—	7	271	117
Contractual purchases and capital expenditures ^(c)	1,948	1,048	543	60	3,599	3,743
Obligations under co-brand programs	356	728	566	287	1,937	1,434
Total off-balance sheet obligations	117,095	16,119	11,515	32,330	177,059	146,133
Total contractual cash obligations	\$ 1,854,369	\$ 108,113	\$ 57,982	\$ 160,049	\$ 2,180,513	\$ 2,085,721

(a) Excludes structured notes on which the Firm is not obligated to return a stated amount of principal at the maturity of the notes, but is obligated to return an amount based on the performance of the structured notes.

(b) Primarily includes dividends declared on preferred and common stock, deferred annuity contracts, pension and other postretirement employee benefit obligations, insurance liabilities and income taxes payable associated with the deemed repatriation under the TCJA.

(c) The prior period amounts have been revised to conform with the current period presentation.

(d) For further information, refer to unsettled resale and securities borrowed agreements in Note 27.

(e) Includes accrued interest and future contractual interest obligations. Excludes interest related to structured notes for which the Firm's payment obligation is based on the performance of certain benchmarks.

(f) Includes noncancelable operating leases for premises and equipment used primarily for banking purposes. Excludes the benefit of noncancelable sublease rentals of \$825 million and \$1.0 billion at December 31, 2018 and 2017, respectively. Refer to Note 28 for more information on lease commitments.

(g) Included unfunded commitments of \$40 million at both December 31, 2018 and 2017, to third-party private equity funds, and \$231 million and \$77 million of unfunded commitments at December 31, 2018 and 2017, respectively, to other equity investments.

EXPLANATION AND RECONCILIATION OF THE FIRM'S USE OF NON-GAAP FINANCIAL MEASURES AND KEY PERFORMANCE MEASURES

Non-GAAP financial measures

The Firm prepares its Consolidated Financial Statements in accordance with U.S. GAAP; these financial statements appear on pages 150-154. That presentation, which is referred to as "reported" basis, provides the reader with an understanding of the Firm's results that can be tracked consistently from year-to-year and enables a comparison of the Firm's performance with other companies' U.S. GAAP financial statements.

In addition to analyzing the Firm's results on a reported basis, management reviews Firmwide results, including the overhead ratio, on a "managed" basis; these Firmwide managed basis results are non-GAAP financial measures. The Firm also reviews the results of the lines of business on a managed basis. The Firm's definition of managed basis starts, in each case, with the reported U.S. GAAP results and includes certain reclassifications to present total net revenue for the Firm (and each of the reportable business segments) on an FTE basis. Accordingly, revenue from investments that receive tax credits and tax-exempt securities is presented in the managed results on a basis comparable to taxable investments and securities. These

financial measures allow management to assess the comparability of revenue from year-to-year arising from both taxable and tax-exempt sources. The corresponding income tax impact related to tax-exempt items is recorded within income tax expense. These adjustments have no impact on net income as reported by the Firm as a whole or by the lines of business.

Management also uses certain non-GAAP financial measures at the Firm and business-segment level, because these other non-GAAP financial measures provide information to investors about the underlying operational performance and trends of the Firm or of the particular business segment, as the case may be, and, therefore, facilitate a comparison of the Firm or the business segment with the performance of its relevant competitors. For additional information on these non-GAAP measures, refer to Business Segment Results on pages 60-78. Non-GAAP financial measures used by the Firm may not be comparable to similarly named non-GAAP financial measures used by other companies.

The following summary table provides a reconciliation from the Firm's reported U.S. GAAP results to managed basis.

Year ended December 31, (in millions, except ratios)	2018			2017			2016		
	Reported Results	Fully taxable-equivalent adjustments ^(a)	Managed basis	Reported Results	Fully taxable-equivalent adjustments ^(a)	Managed basis	Reported Results	Fully taxable-equivalent adjustments ^(a)	Managed basis
Other income	\$ 5,343	\$ 1,877 ^(b)	\$ 7,220	\$ 3,646	\$ 2,704	\$ 6,350	\$ 3,799	\$ 2,265	\$ 6,064
Total noninterest revenue	53,970	1,877	55,847	50,608	2,704	53,312	50,486	2,265	52,751
Net interest income	55,059	628 ^(b)	55,687	50,097	1,313	51,410	46,083	1,209	47,292
Total net revenue	109,029	2,505	111,534	100,705	4,017	104,722	96,569	3,474	100,043
Pre-provision profit	45,635	2,505	48,140	41,190	4,017	45,207	39,897	3,474	43,371
Income before income tax expense	40,764	2,505	43,269	35,900	4,017	39,917	34,536	3,474	38,010
Income tax expense	8,290	2,505 ^(b)	10,795	11,459	4,017	15,476	9,803	3,474	13,277
Overhead ratio	58%	NM	57%	59%	NM	57%	59%	NM	57%

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

(a) Predominantly recognized in CIB and CB business segments and Corporate.

(b) The decrease in fully taxable-equivalent adjustments for the year ended December 31, 2018, reflects the impact of the TCJA.

Management's discussion and analysis

Net interest income and net yield excluding CIB's Markets businesses

In addition to reviewing net interest income and the net interest yield on a managed basis, management also reviews these metrics excluding CIB's Markets businesses, as shown below; these metrics, which exclude CIB's Markets businesses, are non-GAAP financial measures. Management reviews these metrics to assess the performance of the Firm's lending, investing (including asset-liability management) and deposit-raising activities. The resulting metrics that exclude CIB's Markets businesses are referred to as non-markets-related net interest income and net yield. CIB's Markets businesses are Fixed Income Markets and Equity Markets. Management believes that disclosure of non-markets-related net interest income and net yield provides investors and analysts with other measures by which to analyze the non-markets-related business trends of the Firm and provides a comparable measure to other financial institutions that are primarily focused on lending, investing and deposit-raising activities.

Year ended December 31, (in millions, except rates)	2018	2017	2016
Net interest income – managed basis^{(a)(b)}	\$ 55,687	\$ 51,410	\$ 47,292
Less: CIB Markets net interest income ^(c)	3,087	4,630	6,334
Net interest income excluding CIB Markets^(a)	\$ 52,600	\$ 46,780	\$ 40,958
Average interest-earning assets	\$2,229,188	\$2,180,592	\$2,101,604
Less: Average CIB Markets interest-earning assets ^(c)	609,635	540,835	520,307
Average interest-earning assets excluding CIB Markets	\$1,619,553	\$1,639,757	\$1,581,297
Net interest yield on average interest-earning assets – managed basis	2.50%	2.36%	2.25%
Net interest yield on average CIB Markets interest-earning assets ^(c)	0.51	0.86	1.22
Net interest yield on average interest-earning assets excluding CIB Markets	3.25%	2.85%	2.59%

- (a) Interest includes the effect of related hedges. Taxable-equivalent amounts are used where applicable.
- (b) For a reconciliation of net interest income on a reported and managed basis, refer to reconciliation from the Firm's reported U.S. GAAP results to managed basis on page 57.
- (c) For further information on CIB's Markets businesses, refer to page 69.

Calculation of certain U.S. GAAP and non-GAAP financial measures

Certain U.S. GAAP and non-GAAP financial measures are calculated as follows:

Book value per share ("BVPS")

Common stockholders' equity at period-end /
Common shares at period-end

Overhead ratio

Total noninterest expense / Total net revenue

Return on assets ("ROA")

Reported net income / Total average assets

Return on common equity ("ROE")

Net income* / Average common stockholders' equity

Return on tangible common equity ("ROTCE")

Net income* / Average tangible common equity

Tangible book value per share ("TBVPS")

Tangible common equity at period-end / Common shares at period-end

* Represents net income applicable to common equity

The Firm also reviews adjusted expense, which is noninterest expense excluding Firmwide legal expense and is therefore a non-GAAP financial measure. Additionally, certain credit metrics and ratios disclosed by the Firm exclude PCI loans, and are therefore non-GAAP measures. Management believes these measures help investors understand the effect of these items on reported results and provide an alternate presentation of the Firm's performance. For additional information on credit metrics and ratios excluding PCI loans, refer to Credit and Investment Risk Management on pages 102-123.

Tangible common equity, ROTCE and TBVPS

Tangible common equity (“TCE”), ROTCE and TBVPS are each non-GAAP financial measures. TCE represents the Firm’s common stockholders’ equity (i.e., total stockholders’ equity less preferred stock) less goodwill and identifiable intangible assets (other than MSRs), net of related deferred tax liabilities. ROTCE measures the Firm’s net income applicable to common equity as a percentage of average TCE. TBVPS represents the Firm’s TCE at period-end divided by common shares at period-end. TCE, ROTCE and TBVPS are utilized by the Firm, as well as investors and analysts, in assessing the Firm’s use of equity.

The following summary table provides a reconciliation from the Firm’s common stockholders’ equity to TCE.

(in millions, except per share and ratio data)	Period-end		Average		
	Dec 31, 2018	Dec 31, 2017	Year ended December 31,		
			2018	2017	2016
Common stockholders’ equity	\$ 230,447	\$ 229,625	\$ 229,222	\$ 230,350	\$ 224,631
Less: Goodwill	47,471	47,507	47,491	47,317	47,310
Less: Other intangible assets	748	855	807	832	922
Add: Certain deferred tax liabilities ^{(a)(b)}	2,280	2,204	2,231	3,116	3,212
Tangible common equity	\$ 184,508	\$ 183,467	\$ 183,155	\$ 185,317	\$ 179,611
Return on tangible common equity	NA	NA	17%	12%	13%
Tangible book value per share	\$ 56.33	\$ 53.56	NA	NA	NA

(a) Represents deferred tax liabilities related to tax-deductible goodwill and to identifiable intangibles created in nontaxable transactions, which are netted against goodwill and other intangibles when calculating TCE.

(b) Amounts presented for December 31, 2017 and later periods include the effect from revaluation of the Firm’s net deferred tax liability as a result of the TCJA.

Key performance measures

The Firm considers the following to be key regulatory capital measures:

- Capital, risk-weighted assets (“RWA”), and capital and leverage ratios presented under Basel III Standardized and Advanced Fully Phased-In rules, and
- SLR calculated under Basel III Advanced Fully Phased-In rules.

The Firm, as well as banking regulators, investors and analysts, use these measures to assess the Firm’s regulatory capital position and to compare the Firm’s regulatory capital to that of other financial services companies.

For additional information on these measures, refer to Capital Risk Management on pages 85-94.

Core loans is also considered a key performance measure. Core loans represents loans considered central to the Firm’s ongoing businesses, and excludes loans classified as trading assets, runoff portfolios, discontinued portfolios and portfolios the Firm has an intent to exit. Core loans is a measure utilized by the Firm and its investors and analysts in assessing actual growth in the loan portfolio.

Management’s discussion and analysis

BUSINESS SEGMENT RESULTS

The Firm is managed on a line of business basis. There are four major reportable business segments - Consumer & Community Banking, Corporate & Investment Bank, Commercial Banking and Asset & Wealth Management. In addition, there is a Corporate segment.

The business segments are determined based on the products and services provided, or the type of customer served, and they reflect the manner in which financial information is currently evaluated by the Firm’s Operating Committee. Segment results are presented on a managed basis. For a definition of managed basis, refer to Explanation and Reconciliation of the Firm’s use of Non-GAAP Financial Measures and Key Performance Measures, on pages 57-59.

JPMorgan Chase						
Consumer Businesses			Wholesale Businesses			
Consumer & Community Banking			Corporate & Investment Bank		Commercial Banking	Asset & Wealth Management
Consumer & Business Banking	Home Lending	Card, Merchant Services & Auto	Banking	Markets & Investor Services	Middle Market Banking	Asset Management
<ul style="list-style-type: none"> Consumer Banking/ Chase Wealth Management Business Banking 	<ul style="list-style-type: none"> Home Lending Production Home Lending Servicing Real Estate Portfolios 	<ul style="list-style-type: none"> Card Services - Credit Card Merchant Services Auto 	<ul style="list-style-type: none"> Investment Banking Treasury Services Lending 	<ul style="list-style-type: none"> Fixed Income Markets Equity Markets Securities Services Credit Adjustments & Other 	<ul style="list-style-type: none"> Corporate Client Banking Commercial Term Lending Real Estate Banking 	<ul style="list-style-type: none"> Wealth Management

Description of business segment reporting methodology

Results of the business segments are intended to present each segment as if it were essentially a stand-alone business. The management reporting process that derives business segment results includes the allocation of certain income and expense items described in more detail below. The Firm also assesses the level of capital required for each line of business on at least an annual basis. The Firm periodically assesses the assumptions, methodologies and reporting classifications used for segment reporting, and further refinements may be implemented in future periods.

Revenue sharing

When business segments join efforts to sell products and services to the Firm’s clients, the participating business segments may agree to share revenue from those transactions. Revenue is recognized in the segment responsible for the related product or service on a gross basis, with an allocation to the other segment(s) involved in the transaction. The segment results reflect these revenue-sharing agreements.

Funds transfer pricing

Funds transfer pricing is the process by which the Firm allocates interest income and expense to each business segment and transfers the primary interest rate risk and liquidity risk exposures to Treasury and CIO within Corporate. The funds transfer pricing process considers the interest rate risk, liquidity risk and regulatory requirements of a business segment as if it were operating independently. This process is overseen by senior management and reviewed by the Firm’s Treasurer Committee.

Debt expense and preferred stock dividend allocation

As part of the funds transfer pricing process, almost all of the cost of the credit spread component of outstanding unsecured long-term debt and preferred stock dividends is allocated to the reportable business segments, while the balance of the cost is retained in Corporate. The methodology to allocate the cost of unsecured long-term debt and preferred stock dividends to the business segments is aligned with the Firm's process to allocate capital. The allocated cost of unsecured long-term debt is included in a business segment's net interest income, and net income is reduced by preferred stock dividends to arrive at a business segment's net income applicable to common equity.

Business segment capital allocation

The amount of capital assigned to each business is referred to as equity. On at least an annual basis, the assumptions and methodologies used in capital allocation are assessed and as a result, the capital allocated to lines of business may change. For additional information on business segment capital allocation, refer to Line of business equity on page 91.

Expense allocation

Where business segments use services provided by corporate support units, or another business segment, the costs of those services are allocated to the respective business segments. The expense is generally allocated based on the actual cost and use of services provided. In contrast, certain other costs related to corporate support units, or to certain technology and operations, are not allocated to the business segments and are retained in Corporate. Expense retained in Corporate generally includes parent company costs that would not be incurred if the segments were stand-alone businesses; adjustments to align corporate support units; and other items not aligned with a particular business segment.

Segment Results - Managed Basis

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

Net income in 2018 for each of the business segments reflects the favorable impact of the reduction in the U.S. federal statutory income tax rate as a result of the TCJA.

The following tables summarize the Firm's results by segment for the periods indicated.

Year ended December 31, (in millions, except ratios)	Consumer & Community Banking			Corporate & Investment Bank			Commercial Banking		
	2018	2017	2016	2018	2017	2016	2018	2017	2016
Total net revenue	\$ 52,079	\$ 46,485	\$ 44,915	\$ 36,448	\$ 34,657	\$ 35,340	\$ 9,059	\$ 8,605	\$ 7,453
Total noninterest expense	27,835	26,062	24,905	20,918	19,407	19,116	3,386	3,327	2,934
Pre-provision profit/(loss)	24,244	20,423	20,010	15,530	15,250	16,224	5,673	5,278	4,519
Provision for credit losses	4,753	5,572	4,494	(60)	(45)	563	129	(276)	282
Net income/(loss)	14,852	9,395	9,714	11,773	10,813	10,815	4,237	3,539	2,657
Return on equity ("ROE")	28%	17%	18%	16%	14%	16%	20%	17%	16%

Year ended December 31, (in millions, except ratios)	Asset & Wealth Management			Corporate			Total		
	2018	2017	2016	2018	2017	2016	2018	2017	2016
Total net revenue	\$ 14,076	\$ 13,835	\$ 12,822	\$ (128)	\$ 1,140	\$ (487)	\$ 111,534	\$ 104,722	\$ 100,043
Total noninterest expense	10,353	10,218	9,255	902	501	462	63,394	59,515	56,672
Pre-provision profit/(loss)	3,723	3,617	3,567	(1,030)	639	(949)	48,140	45,207	43,371
Provision for credit losses	53	39	26	(4)	—	(4)	4,871	5,290	5,361
Net income/(loss)	2,853	2,337	2,251	(1,241)	(1,643)	(704)	32,474	24,441	24,733
Return on equity ("ROE")	31%	25%	24%	NM	NM	NM	13%	10%	10%

The following sections provide a comparative discussion of the Firm's results by segment as of or for the years ended December 31, 2018, 2017 and 2016.

CONSUMER & COMMUNITY BANKING

Consumer & Community Banking offers services to consumers and businesses through bank branches, ATMs, digital (including online and mobile) and telephone banking. CCB is organized into Consumer & Business Banking (including Consumer Banking/Chase Wealth Management and Business Banking), Home Lending (including Home Lending Production, Home Lending Servicing and Real Estate Portfolios) and Card, Merchant Services & Auto. Consumer & Business Banking offers deposit and investment products and services to consumers, and lending, deposit, and cash management and payment solutions to small businesses. Home Lending includes mortgage origination and servicing activities, as well as portfolios consisting of residential mortgages and home equity loans. Card, Merchant Services & Auto issues credit cards to consumers and small businesses, offers payment processing services to merchants, and originates and services auto loans and leases.

Selected income statement data

Year ended December 31, (in millions, except ratios)	2018	2017	2016
Revenue			
Lending- and deposit-related fees	\$ 3,624	\$ 3,431	\$ 3,231
Asset management, administration and commissions	2,402	2,212	2,093
Mortgage fees and related income	1,252	1,613	2,490
Card income	4,554	4,024	4,364
All other income	4,428	3,430	3,077
Noninterest revenue	16,260	14,710	15,255
Net interest income	35,819	31,775	29,660
Total net revenue	52,079	46,485	44,915
Provision for credit losses	4,753	5,572	4,494
Noninterest expense			
Compensation expense ^(a)	10,534	10,133	9,697
Noncompensation expense ^{(a)(b)}	17,301	15,929	15,208
Total noninterest expense	27,835	26,062	24,905
Income before income tax expense	19,491	14,851	15,516
Income tax expense	4,639	5,456	5,802
Net income	\$ 14,852	\$ 9,395	\$ 9,714
Revenue by line of business			
Consumer & Business Banking	\$ 24,805	\$ 21,104	\$ 18,659
Home Lending	5,484	5,955	7,361
Card, Merchant Services & Auto	21,790	19,426	18,895
Mortgage fees and related income details:			
Net production revenue	268	636	853
Net mortgage servicing revenue ^(c)	984	977	1,637
Mortgage fees and related income	\$ 1,252	\$ 1,613	\$ 2,490
Financial ratios			
Return on equity	28%	17%	18%
Overhead ratio	53	56	55

Note: In the discussion and the tables which follow, CCB presents certain financial measures which exclude the impact of PCI loans; these are non-GAAP financial measures.

- (a) Effective in the first quarter of 2018, certain operations staff were transferred from CCB to CB. The prior period amounts have been revised to conform with the current period presentation. For a further discussion of this transfer, refer to CB segment results on page 71.
- (b) Included operating lease depreciation expense of \$3.4 billion, \$2.7 billion and \$1.9 billion for the years ended December 31, 2018, 2017 and 2016, respectively.
- (c) Included MSR risk management results of \$(111) million, \$(242) million and \$217 million for the years ended December 31, 2018, 2017 and 2016, respectively.

2018 compared with 2017

Net income was \$14.9 billion, an increase of 58%.

Net revenue was \$52.1 billion, an increase of 12%.

Net interest income was \$35.8 billion, up 13%, driven by:

- higher deposit margins and growth in deposit balances in CBB, as well as margin expansion and higher loan balances in Card,

partially offset by

- higher rates driving loan spread compression in Home Lending and Auto.

Noninterest revenue was \$16.3 billion, up 11%, driven by:

- higher auto lease volume,
- higher card income due to
 - lower new account origination costs, and higher merchant processing fees on higher volumes,

largely offset by

- lower net interchange income reflecting higher rewards costs and partner payments, largely offset by higher card sales volumes. The rewards costs included an adjustment to the credit card rewards liability of approximately \$330 million in the second quarter of 2018, driven by an increase in redemption rate assumptions
- higher deposit-related fees, as well as higher asset management fees reflecting an increase in client investment assets,

partially offset by

- lower net production revenue reflecting lower mortgage production margins and volumes, as well as the impact of a loan sale.

Refer to Note 15 for further information regarding changes in value of the MSR asset and related hedges, and mortgage fees and related income.

Noninterest expense was \$27.8 billion, up 7%, driven by:

- investments in technology and marketing, and
- higher auto lease depreciation.

The provision for credit losses was \$4.8 billion, a decrease of 15%, reflecting:

- a decrease in the consumer, excluding credit card portfolio due to
 - lower net charge-offs in the residential real estate portfolio, largely driven by recoveries from loan sales, and
 - lower net charge-offs in the auto portfolio

partially offset by

- a \$250 million reduction in the allowance for loan losses in the residential real estate portfolio – PCI, reflecting continued improvement in home prices and lower delinquencies; the reduction was \$75 million lower than the prior year for the residential real estate portfolio – non credit-impaired
- the prior year included a net \$218 million write-down recorded in connection with the sale of the student loan portfolio, and
- a decrease in the credit card portfolio due to
 - a \$300 million addition to the allowance for loan losses, reflecting loan growth and higher loss rates, as anticipated; the addition was \$550 million lower than the prior year,

largely offset by

- higher net charge-offs due to seasoning of more recent vintages, as anticipated.

2017 compared with 2016

Net income was \$9.4 billion, a decrease of 3%.

Net revenue was \$46.5 billion, an increase of 3%.

Net interest income was \$31.8 billion, up 7%, driven by:

- growth in deposit balances and higher deposit margins in CBB, as well as higher loan balances in Card,

partially offset by

- loan spread compression from higher rates, including the impact of higher funding costs in Home Lending and Auto, and
- the impact of the sale of the student loan portfolio.

Noninterest revenue was \$14.7 billion, down 4%, driven by:

- higher new account origination costs in Card,
- lower MSR risk management results,
- the absence in the current year of a gain on the sale of Visa Europe interests,
- lower net production revenue reflecting lower mortgage production margins and volumes, and
- lower mortgage servicing revenue as a result of a lower level of third-party loans serviced

largely offset by

- higher auto lease volume and
- higher card- and deposit-related fees.

Noninterest expense was \$26.1 billion, up 5%, driven by:

- higher auto lease depreciation, and
- continued business growth

partially offset by

- two items totaling \$175 million included in the prior year related to liabilities from a merchant bankruptcy and mortgage servicing reserves.

The provision for credit losses was \$5.6 billion, an increase of 24%, reflecting:

- \$445 million of higher net charge-offs, primarily in the credit card portfolio due to growth in newer vintages which, as anticipated, have higher loss rates than the more seasoned portion of the portfolio, partially offset by a decrease in net charge-offs in the residential real estate portfolio reflecting continued improvement in home prices and delinquencies,
- a \$415 million higher addition to the allowance for credit losses related to the credit card portfolio driven by higher loss rates and loan growth, and a lower reduction in the allowance for the residential real estate portfolio predominantly driven by continued improvement in home prices and delinquencies, and
- a net \$218 million impact in connection with the sale of the student loan portfolio.

The sale of the student loan portfolio during 2017 did not have a material impact on the Firm's Consolidated Financial Statements.

Management's discussion and analysis

Selected metrics

As of or for the year ended December 31, (in millions, except headcount)	2018	2017	2016
Selected balance sheet data (period-end)			
Total assets	\$ 557,441	\$ 552,601	\$ 535,310
Loans:			
Consumer & Business Banking	26,612	25,789	24,307
Home equity	36,013	42,751	50,296
Residential mortgage	203,859	197,339	181,196
Home Lending	239,872	240,090	231,492
Card	156,632	149,511	141,816
Auto	63,573	66,242	65,814
Student	—	—	7,057
Total loans	486,689	481,632	470,486
Core loans	434,466	415,167	382,608
Deposits	678,854	659,885	618,337
Equity	51,000	51,000	51,000
Selected balance sheet data (average)			
Total assets	\$ 547,368	\$ 532,756	\$ 516,354
Loans:			
Consumer & Business Banking	26,197	24,875	23,431
Home equity	39,133	46,398	54,545
Residential mortgage	202,624	190,242	177,010
Home Lending	241,757	236,640	231,555
Card	145,652	140,024	131,165
Auto	64,675	65,395	63,573
Student	—	2,880	7,623
Total loans	478,281	469,814	457,347
Core loans	419,066	393,598	361,316
Deposits	670,388	640,219	586,637
Equity	51,000	51,000	51,000
Headcount^{(a)(b)}	129,518	133,721	132,384

(a) Effective in the first quarter of 2018, certain operations staff were transferred from CCB to CB. The prior period amounts have been revised to conform with the current period presentation. For a further discussion of this transfer, refer to CB segment results on page 71.

(b) During the third quarter of 2018, approximately 1,200 employees transferred from CCB to CIB as part of the reorganization of the Commercial Card business.

Selected metrics

As of or for the year ended December 31, (in millions, except ratio data)	2018	2017	2016
Credit data and quality statistics			
Nonaccrual loans ^{(a)(b)}	\$ 3,339	\$ 4,084	\$ 4,708
Net charge-offs/(recoveries) ^(c)			
Consumer & Business Banking	236	257	257
Home equity	(7)	63	184
Residential mortgage	(287)	(16)	14
Home Lending	(294)	47	198
Card	4,518	4,123	3,442
Auto	243	331	285
Student	—	498 ^(g)	162
Total net charge-offs/ (recoveries)	\$ 4,703	\$ 5,256^(g)	\$ 4,344
Net charge-off/(recovery) rate ^(c)			
Consumer & Business Banking	0.90%	1.03%	1.10%
Home equity ^(d)	(0.02)	0.18	0.45
Residential mortgage ^(d)	(0.16)	(0.01)	0.01
Home Lending ^(d)	(0.14)	0.02	0.10
Card	3.10	2.95	2.63
Auto	0.38	0.51	0.45
Student	—	NM	2.13
Total net charge-offs/ (recovery) rate^(d)	1.04	1.21^(g)	1.04
30+ day delinquency rate			
Home Lending ^{(e)(f)}	0.77%	1.19%	1.23%
Card	1.83	1.80	1.61
Auto	0.93	0.89	1.19
Student	—	—	1.60 ^(h)
90+ day delinquency rate - Card	0.92	0.92	0.81
Allowance for loan losses			
Consumer & Business Banking	\$ 796	\$ 796	\$ 753
Home Lending, excluding PCI loans	1,003	1,003	1,328
Home Lending – PCI loans ^(c)	1,788	2,225	2,311
Card	5,184	4,884	4,034
Auto	464	464	474
Student	—	—	249
Total allowance for loan losses^(c)	\$ 9,235	\$ 9,372	\$ 9,149

(a) Excludes PCI loans. The Firm is recognizing interest income on each pool of PCI loans as each of the pools is performing.

(b) At December 31, 2018, 2017 and 2016, nonaccrual loans excluded mortgage loans 90 or more days past due and insured by U.S. government agencies of \$2.6 billion, \$4.3 billion and \$5.0 billion, respectively. At December 31, 2016, nonaccrual loans also excluded student loans insured by U.S. government agencies under the Federal Family Education Loan Program ("FFELP") of \$263 million. These amounts have been excluded based upon the government guarantee.

(c) Net charge-offs/(recoveries) and the net charge-off/(recovery) rates for the years ended December 31, 2018, 2017 and 2016, excluded \$187 million, \$86 million and \$156 million, respectively, of write-offs in the PCI portfolio. These write-offs decreased the allowance for loan losses for PCI loans. For further

information on PCI write-offs, refer to Summary of changes in the allowance for credit losses on page 121.

- (d) Excludes the impact of PCI loans. For the years ended December 31, 2018, 2017 and 2016, the net charge-off/(recovery) rates including the impact of PCI loans were as follows: (1) home equity of (0.02)%, 0.14% and 0.34%, respectively; (2) residential mortgage of (0.14)%, (0.01)% and 0.01%, respectively; (3) Home Lending of (0.12)%, 0.02% and 0.09%, respectively; and (4) total CCB of 0.98%, 1.12% and 0.95%, respectively.
- (e) At December 31, 2018, 2017 and 2016, excluded mortgage loans insured by U.S. government agencies of \$4.1 billion, \$6.2 billion and \$7.0 billion, respectively, that are 30 or more days past due. These amounts have been excluded based upon the government guarantee.
- (f) Excludes PCI loans. The 30+ day delinquency rate for PCI loans was 9.16%, 10.13% and 9.82% at December 31, 2018, 2017 and 2016, respectively.
- (g) Excluding net charge-offs of \$467 million related to the student loan portfolio transfer, the total net charge-off rates for the full year 2017 would have been 1.10%.
- (h) Excluded student loans insured by U.S. government agencies under FFELP of \$468 million at December 31, 2016 that are 30 or more days past due. This amount has been excluded based upon the government guarantee.

Selected metrics

As of or for the year ended December 31,			
(in billions, except ratios and where otherwise noted)	2018	2017	2016
Business Metrics			
CCB households (in millions) ^(a)	61.7	61.1	60.5
Number of branches	5,036	5,130	5,258
Active digital customers (in thousands) ^(b)	49,254	46,694	43,836
Active mobile customers (in thousands) ^(c)	33,260	30,056	26,536
Debit and credit card sales volume	\$ 1,016.9	\$ 916.9	\$ 821.6
Consumer & Business Banking			
Average deposits	\$ 656.5	\$ 625.6	\$ 570.8
Deposit margin	2.38%	1.98%	1.81%
Business banking origination volume	\$ 6.7	\$ 7.3	\$ 7.3
Client investment assets	282.5	273.3	234.5
Home Lending			
Mortgage origination volume by channel			
Retail	\$ 38.3	\$ 40.3	\$ 44.3
Correspondent	41.1	57.3	59.3
Total mortgage origination volume ^(d)	\$ 79.4	\$ 97.6	\$ 103.6
Total loans serviced (period-end)	\$ 789.8	\$ 816.1	\$ 846.6
Third-party mortgage loans serviced (period-end)	519.6	553.5	591.5
MSR carrying value (period-end)	6.1	6.0	6.1
Ratio of MSR carrying value (period-end) to third-party mortgage loans serviced (period-end)	1.17%	1.08%	1.03%
MSR revenue multiple ^(e)	3.34x	3.09x	2.94x
Card, excluding Commercial Card			
Credit card sales volume	\$ 692.4	\$ 622.2	\$ 545.4
New accounts opened (in millions)	7.8	8.4	10.4
Card Services			
Net revenue rate	11.27%	10.57%	11.29%
Merchant Services			
Merchant processing volume	\$ 1,366.1	\$ 1,191.7	\$ 1,063.4
Auto			
Loan and lease origination volume	\$ 31.8	\$ 33.3	\$ 35.4
Average Auto operating lease assets	18.8	15.2	11.0

(a) The prior period amounts have been revised to conform with the current period presentation.

(b) Users of all web and/or mobile platforms who have logged in within the past 90 days.

(c) Users of all mobile platforms who have logged in within the past 90 days.

(d) Firmwide mortgage origination volume was \$86.9 billion, \$107.6 billion and \$117.4 billion for the years ended December 31, 2018, 2017 and 2016, respectively.

(e) Represents the ratio of MSR carrying value (period-end) to third-party mortgage loans serviced (period-end) divided by the ratio of loan servicing-related revenue to third-party mortgage loans serviced (average).

CORPORATE & INVESTMENT BANK

The Corporate & Investment Bank, which consists of Banking and Markets & Investor Services, offers a broad suite of investment banking, market-making, prime brokerage, and treasury and securities products and services to a global client base of corporations, investors, financial institutions, government and municipal entities. Banking offers a full range of investment banking products and services in all major capital markets, including advising on corporate strategy and structure, capital-raising in equity and debt markets, as well as loan origination and syndication. Banking also includes Treasury Services, which provides transaction services, consisting of cash management and liquidity solutions. Markets & Investor Services is a global market-maker in cash securities and derivative instruments, and also offers sophisticated risk management solutions, prime brokerage, and research. Markets & Investor Services also includes Securities Services, a leading global custodian which provides custody, fund accounting and administration, and securities lending products principally for asset managers, insurance companies and public and private investment funds.

Effective January 1, 2018, the Firm adopted several new accounting standards; the guidance which had the most significant impact on the CIB segment results was revenue recognition, and recognition and measurement of financial assets. The revenue recognition guidance was applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

Selected income statement data

Year ended December 31, (in millions)	2018	2017	2016
Revenue			
Investment banking fees	\$ 7,473	\$ 7,356	\$ 6,548
Principal transactions	12,271	10,873	11,089
Lending- and deposit-related fees	1,497	1,531	1,581
Asset management, administration and commissions	4,488	4,207	4,062
All other income	1,239	572	1,169
Noninterest revenue	26,968	24,539	24,449
Net interest income	9,480	10,118	10,891
Total net revenue^{(a)(b)}	36,448	34,657	35,340
Provision for credit losses	(60)	(45)	563
Noninterest expense			
Compensation expense	10,215	9,531	9,540
Noncompensation expense	10,703	9,876	9,576
Total noninterest expense	20,918	19,407	19,116
Income before income tax expense	15,590	15,295	15,661
Income tax expense	3,817	4,482	4,846
Net income^(a)	\$ 11,773	\$ 10,813	\$ 10,815

- (a) The full year 2017 results reflect the impact of the enactment of the TCJA including a decrease to net revenue of \$259 million and a benefit to net income of \$141 million. For additional information related to the impact of the TCJA, refer to Note 24.
- (b) Included tax-equivalent adjustments, predominantly due to income tax credits related to alternative energy investments; income tax credits and amortization of the cost of investments in affordable housing projects; and tax-exempt income from municipal bonds of \$1.7 billion, \$2.4 billion and \$2.0 billion for the years ended December 31, 2018, 2017 and 2016, respectively.

Selected income statement data

Year ended December 31, (in millions, except ratios)	2018	2017	2016
Financial ratios			
Return on equity	16%	14%	16%
Overhead ratio	57	56	54
Compensation expense as percentage of total net revenue	28	28	27
Revenue by business			
Investment Banking	\$ 6,987	\$ 6,852	\$ 6,074
Treasury Services	4,697	4,172	3,643
Lending	1,298	1,429	1,208
Total Banking	12,982	12,453	10,925
Fixed Income Markets	12,706	12,812	15,259
Equity Markets	6,888	5,703	5,740
Securities Services	4,245	3,917	3,591
Credit Adjustments & Other ^(a)	(373)	(228)	(175)
Total Markets & Investor Services	23,466	22,204	24,415
Total net revenue	\$36,448	\$34,657	\$ 35,340

- (a) Consists primarily of credit valuation adjustments ("CVA") managed centrally within CIB and funding valuation adjustments ("FVA") on derivatives. Results are primarily reported in principal transactions revenue. Results are presented net of associated hedging activities and net of CVA and FVA amounts allocated to Fixed Income Markets and Equity Markets. For additional information, refer to Notes 2, 3 and 23.

2018 compared with 2017

Net income was \$11.8 billion, up 9%.

Net revenue was \$36.4 billion, up 5%.

Banking revenue was \$13.0 billion, up 4%. Investment Banking revenue was \$7.0 billion, up 2% compared to a strong prior year, predominantly driven by higher advisory and equity underwriting fees, predominantly offset by lower debt underwriting fees. The Firm maintained its #1 ranking for Global Investment Banking fees with overall share gains, according to Dealogic. Advisory fees were \$2.5 billion, up 17%, driven by a higher number of large completed transactions. Equity underwriting fees were \$1.7 billion, up 15% driven by a higher share of fees reflecting strong performance across products. Debt underwriting fees were \$3.3 billion, down 12%, compared to a strong prior year, primarily driven by declines in industry-wide fee levels. Treasury Services revenue was \$4.7 billion, up 13%, driven by the impact of higher interest rates and growth in operating deposits as well as higher fees on increased payments volume. Lending revenue was \$1.3 billion, down

9%, driven by lower net interest income primarily reflecting a change in the portfolio mix and overall spread compression, and higher gains in the prior year on securities received from restructurings.

Markets & Investor Services revenue was \$23.5 billion, up 6%. The results included a reduction of approximately \$620 million in tax-equivalent adjustments as a result of the TCJA, and approximately \$500 million of fair value gains in the first quarter of 2018 related to the adoption of the new recognition and measurement accounting guidance for certain equity investments previously held at cost. Prior year results included a reduction of \$259 million resulting from the enactment of the TCJA. Fixed Income Markets revenue was \$12.7 billion, down 1%. Excluding the impact of the TCJA and fair value gains mentioned above, Fixed Income Markets revenue was down 2%. Rates and Credit revenue declined reflecting challenging market conditions in the fourth quarter of 2018 while lower revenue in Fixed Income Financing was driven by compressed margins. This decline was predominantly offset by strong performance including higher client activity in Currencies & Emerging Markets, and higher Commodities revenue compared to a challenging prior year. Equity Markets revenue was \$6.9 billion, up 21%, or up 18% excluding the fair value loss of \$143 million on a margin loan to a single client in the prior year, driven by strength across derivatives, prime brokerage and cash equities, reflecting strong client activity. Securities Services revenue was \$4.2 billion, up 8%, driven by fee growth, higher interest rates and operating deposit growth partially offset by the impact of a business exit. Credit Adjustments & Other was a loss of \$373 million, largely driven by higher funding spreads on derivatives.

The provision for credit losses was a benefit of \$60 million, driven by a reduction in the allowance for credit losses in the first quarter of 2018 related to a single name in the Oil & Gas portfolio, predominantly offset by other net portfolio activity, which includes additions to the allowance for credit losses from select client downgrades. The prior year was a benefit of \$45 million primarily driven by a net reduction in the allowance for credit losses in the Oil & Gas and Metals & Mining portfolios partially offset by a net increase in the allowance for credit losses for a single client.

Noninterest expense was \$20.9 billion, up 8%, predominantly driven by investments in technology and bankers, higher performance-related compensation expense, volume-related transaction costs, and legal expense.

2017 compared with 2016

Net income was \$10.8 billion, flat compared with the prior year, reflecting lower net revenue and higher noninterest expense, offset by a lower provision for credit losses, and a tax benefit resulting from the vesting of employee share-based awards. The current year included a \$141 million benefit to net income as a result of the enactment of the TCJA.

Net revenue was \$34.7 billion, down 2%.

Banking revenue was \$12.5 billion, up 14% compared with the prior year. Investment banking revenue was \$6.9 billion, up 13% from the prior year, driven by higher debt and equity underwriting fees. The Firm maintained its #1 ranking for Global Investment Banking fees, according to Dealogic. Debt underwriting fees were \$3.7 billion, up 16% driven by a higher share of fees and an overall increase in industry-wide fees; the Firm maintained its #1 ranking globally in fees across high-grade, high-yield, and loan products. Equity underwriting fees were \$1.5 billion, up 21% driven by growth in industry-wide issuance including a strong IPO market; the Firm ranked #2 in equity underwriting fees globally. Advisory fees were \$2.2 billion, up 2%; the Firm maintained its #2 ranking for M&A. Treasury Services revenue was \$4.2 billion, up 15%, driven by the impact of higher interest rates and growth in operating deposits. Lending revenue was \$1.4 billion, up 18% from the prior year, reflecting lower fair value losses on hedges of accrual loans.

Markets & Investor Services revenue was \$22.2 billion, down 9% from the prior year. Fixed Income Markets revenue was \$12.8 billion, down 16%, as lower revenue across products was driven by sustained low volatility, tighter credit spreads, and the impact from the TCJA on tax-oriented investments of \$259 million, against a strong prior year. Equity Markets revenue was \$5.7 billion, down 1% from the prior year, and included a fair value loss of \$143 million on a margin loan to a single client. Excluding the fair value loss, Equity Markets revenue was higher driven by higher revenue in Prime Services and cash equities, partially offset by lower revenue in derivatives. Securities Services revenue was \$3.9 billion, up 9%, driven by the impact of higher interest rates and deposit growth, as well as higher asset-based fees driven by higher market levels. Credit Adjustments & Other was a loss of \$228 million, driven by valuation adjustments.

The provision for credit losses was a benefit of \$45 million, which included a net reduction in the allowance for credit losses driven by the Oil & Gas and Metals & Mining portfolios partially offset by a net increase in the allowance for credit losses for a single client. The prior year was an expense of \$563 million, which included an addition to the allowance for credit losses driven by the Oil & Gas and Metals & Mining portfolios.

Noninterest expense was \$19.4 billion, up 2% compared with the prior year.

Management's discussion and analysis

Selected metrics

As of or for the year ended December 31, (in millions, except headcount)	2018	2017	2016
Selected balance sheet data (period-end)			
Assets	\$ 903,051	\$ 826,384	\$ 803,511
Loans:			
Loans retained ^(a)	129,389	108,765	111,872
Loans held-for-sale and loans at fair value	13,050	4,321	3,781
Total loans	142,439	113,086	115,653
Core loans	142,122	112,754	115,243
Equity	70,000	70,000	64,000
Selected balance sheet data (average)			
Assets	\$ 922,758	\$ 857,060	\$ 815,321
Trading assets-debt and equity instruments	349,169	342,124	300,606
Trading assets-derivative receivables	60,552	56,466	63,387
Loans:			
Loans retained ^(a)	114,417	108,368	111,082
Loans held-for-sale and loans at fair value	6,412	4,995	3,812
Total loans	120,829	113,363	114,894
Core loans	120,560	113,006	114,455
Equity	70,000	70,000	64,000
Headcount^(b)	54,480	51,181	48,748

(a) Loans retained includes credit portfolio loans, loans held by consolidated Firm-administered multi-seller conduits, trade finance loans, other held-for-investment loans and overdrafts.

(b) During the third quarter of 2018 approximately 1,200 employees transferred from CCB to CIB as part of the reorganization of the Commercial Card business.

Selected metrics

As of or for the year ended December 31, (in millions, except ratios)	2018	2017	2016
Credit data and quality statistics			
Net charge-offs/ (recoveries)	\$ 93	\$ 71	\$ 168
Nonperforming assets:			
Nonaccrual loans:			
Nonaccrual loans retained ^(a)	443	812	467
Nonaccrual loans held- for-sale and loans at fair value	220	–	109
Total nonaccrual loans	663	812	576
Derivative receivables	60	130	223
Assets acquired in loan satisfactions	57	85	79
Total nonperforming assets	780	1,027	878
Allowance for credit losses:			
Allowance for loan losses	1,199	1,379	1,420
Allowance for lending- related commitments	754	727	801
Total allowance for credit losses	1,953	2,106	2,221
Net charge-off/(recovery) rate ^(b)	0.08%	0.07%	0.15%
Allowance for loan losses to period-end loans retained	0.93	1.27	1.27
Allowance for loan losses to period-end loans retained, excluding trade finance and conduits ^(c)	1.24	1.92	1.86
Allowance for loan losses to nonaccrual loans retained ^(a)	271	170	304
Nonaccrual loans to total period-end loans	0.47	0.72	0.50

(a) Allowance for loan losses of \$174 million, \$316 million and \$113 million were held against these nonaccrual loans at December 31, 2018, 2017 and 2016, respectively.

(b) Loans held-for-sale and loans at fair value were excluded when calculating the net charge-off/(recovery) rate.

(c) Management uses allowance for loan losses to period-end loans retained, excluding trade finance and conduits, a non-GAAP financial measure, to provide a more meaningful assessment of CIB's allowance coverage ratio.

Investment banking fees

(in millions)	Year ended December 31,		
	2018	2017	2016
Advisory	\$ 2,509	\$ 2,150	\$ 2,110
Equity underwriting	1,684	1,468	1,213
Debt underwriting ^(a)	3,280	3,738	3,225
Total investment banking fees	\$ 7,473	\$ 7,356	\$ 6,548

(a) Includes loan syndications.

League table results - wallet share

Year ended December 31,	2018		2017		2016	
	Rank	Share	Rank	Share	Rank	Share
<i>Based on fees^(a)</i>						
Long-term debt^(b)						
Global	#1	7.3%	#1	7.8%	#1	6.8%
U.S.	1	11.2	2	11.1	1	11.1
Equity and equity-related						
Global ^(c)	1	9.1	2	7.1	1	7.4
U.S.	1	12.3	1	11.6	1	13.4
M&A^(d)						
Global	2	8.9	2	8.4	2	8.3
U.S.	2	9.1	2	9.1	2	9.8
Loan syndications						
Global	1	9.5	1	9.3	1	9.3
U.S.	1	12.1	1	11.0	2	11.9
Global investment banking fees ^(e)	#1	8.7%	#1	8.1%	#1	7.9%

(a) Source: Dealogic as of January 1, 2019. Reflects the ranking of revenue wallet and market share.

(b) Long-term debt rankings include investment-grade, high-yield, supranationals, sovereigns, agencies, covered bonds, asset-backed securities ("ABS") and mortgage-backed securities ("MBS"); and exclude money market, short-term debt, and U.S. municipal securities.

(c) Global equity and equity-related ranking includes rights offerings and Chinese A-Shares.

(d) Global M&A reflects the removal of any withdrawn transactions. U.S. M&A revenue wallet represents wallet from client parents based in the U.S.

(e) Global investment banking fees exclude money market, short-term debt and shelf deals.

Markets revenue

The following table summarizes select income statement data for the Markets businesses. Markets includes both Fixed Income Markets and Equity Markets. Markets revenue comprises principal transactions, fees, commissions and other income, as well as net interest income. The Firm assesses its Markets business performance on a total revenue basis, as offsets may occur across revenue line items. For example, securities that generate net interest income may be risk-managed by derivatives that are recorded in principal transactions revenue. For a description of the composition of these income statement line items, refer to Notes 6 and 7.

Principal transactions reflects revenue on financial instruments and commodities transactions that arise from client-driven market making activity. Principal transactions revenue includes amounts recognized upon executing new transactions with market participants, as well as "inventory-related revenue", which is revenue recognized from gains and losses on derivatives and other instruments that the

Firm has been holding in anticipation of, or in response to, client demand, and changes in the fair value of instruments used by the Firm to actively manage the risk exposure arising from such inventory. Principal transactions revenue recognized upon executing new transactions with market participants is driven by many factors including the level of client activity, the bid-offer spread (which is the difference between the price at which a market participant is willing to sell an instrument to the Firm and the price at which another market participant is willing to buy it from the Firm, and vice versa), market liquidity and volatility. These factors are interrelated and sensitive to the same factors that drive inventory-related revenue, which include general market conditions, such as interest rates, foreign exchange rates, credit spreads, and equity and commodity prices, as well as other macroeconomic conditions.

For the periods presented below, the predominant source of principal transactions revenue was the amount recognized upon executing new transactions.

Year ended December 31, (in millions, except where otherwise noted)	2018			2017			2016		
	Fixed Income Markets	Equity Markets	Total Markets	Fixed Income Markets	Equity Markets	Total Markets	Fixed Income Markets	Equity Markets	Total Markets
Principal transactions	\$ 7,560	\$ 5,566	\$ 13,126	\$ 7,393	\$ 3,855	\$ 11,248	\$ 8,347	\$ 3,130	\$ 11,477
Lending- and deposit-related fees	197	6	203	191	6	197	220	2	222
Asset management, administration and commissions	410	1,794	2,204	390	1,635	2,025	388	1,551	1,939
All other income	952	22	974	436	(21)	415	1,014	13	1,027
Noninterest revenue	9,119	7,388	16,507	8,410	5,475	13,885	9,969	4,696	14,665
Net interest income ^(a)	3,587	(500)	3,087	4,402	228	4,630	5,290	1,044	6,334
Total net revenue	\$ 12,706	\$ 6,888	\$ 19,594	\$ 12,812	\$ 5,703	\$ 18,515	\$ 15,259	\$ 5,740	\$ 20,999
Loss days^(b)	5			4			0		

(a) Declines in Markets net interest income in 2018 and 2017 were driven by higher funding costs.

(b) Loss days represent the number of days for which Markets posted losses. The loss days determined under this measure differ from the disclosure of daily market risk-related gains and losses for the Firm in the value-at-risk ("VaR") back-testing discussion on pages 126-128.

Management's discussion and analysis

Selected metrics

As of or for the year ended December 31, (in millions, except where otherwise noted)	2018	2017	2016
Assets under custody ("AUC") by asset class (period-end) (in billions):			
Fixed Income	\$ 12,440	\$ 13,043	\$ 12,166
Equity	8,078	7,863	6,428
Other ^(a)	2,699	2,563	1,926
Total AUC	\$ 23,217	\$ 23,469	\$ 20,520
Client deposits and other third party liabilities (average) ^(b)	\$ 434,422	\$ 408,911	\$ 376,287

(a) Consists of mutual funds, unit investment trusts, currencies, annuities, insurance contracts, options and other contracts.

(b) Client deposits and other third party liabilities pertain to the Treasury Services and Securities Services businesses.

International metrics

Year ended December 31, (in millions, except where otherwise noted)	2018	2017	2016
Total net revenue^(a)			
Europe/Middle East/Africa	\$ 12,102	\$ 11,328	\$ 10,786
Asia/Pacific	5,219	4,525	4,915
Latin America/Caribbean	1,394	1,125	1,225
Total international net revenue	18,715	16,978	16,926
North America	17,733	17,679	18,414
Total net revenue	\$ 36,448	\$ 34,657	\$ 35,340
Loans retained (period-end)^(a)			
Europe/Middle East/Africa	\$ 26,524	\$ 25,931	\$ 26,696
Asia/Pacific	16,778	15,248	14,508
Latin America/Caribbean	5,060	6,546	7,607
Total international loans	48,362	47,725	48,811
North America	81,027	61,040	63,061
Total loans retained	\$ 129,389	\$ 108,765	\$ 111,872
Client deposits and other third-party liabilities (average)^{(a)(b)}			
Europe/Middle East/Africa	\$ 162,846	\$ 154,582	\$ 135,979
Asia/Pacific	82,867	76,744	68,110
Latin America/Caribbean	26,668	25,419	22,914
Total international	\$ 272,381	\$ 256,745	\$ 227,003
North America	162,041	152,166	149,284
Total client deposits and other third-party liabilities	\$ 434,422	\$ 408,911	\$ 376,287
AUC (period-end)^(a) (in billions)			
North America	\$ 14,359	\$ 13,971	\$ 12,290
All other regions	8,858	9,498	8,230
Total AUC	\$ 23,217	\$ 23,469	\$ 20,520

(a) Total net revenue is based predominantly on the domicile of the client or location of the trading desk, as applicable. Loans outstanding (excluding loans held-for-sale and loans at fair value), client deposits and other third-party liabilities, and AUC are based predominantly on the domicile of the client.

(b) Client deposits and other third party liabilities pertain to the Treasury Services and Securities Services businesses.

COMMERCIAL BANKING

Commercial Banking delivers extensive industry knowledge, local expertise and dedicated service to U.S. and U.S. multinational clients, including corporations, municipalities, financial institutions and nonprofit entities with annual revenue generally ranging from \$20 million to \$2 billion. In addition, CB provides financing to real estate investors and owners. Partnering with the Firm's other businesses, CB provides comprehensive financial solutions, including lending, treasury services, investment banking and asset management to meet its clients' domestic and international financial needs.

Selected income statement data

Year ended December 31, (in millions)	2018	2017	2016
Revenue			
Lending- and deposit-related fees	\$ 870	\$ 919	\$ 917
Asset management, administration and commissions	73	68	69
All other income ^(a)	1,400	1,535	1,334
Noninterest revenue	2,343	2,522	2,320
Net interest income	6,716	6,083	5,133
Total net revenue^(b)	9,059	8,605	7,453
Provision for credit losses	129	(276)	282
Noninterest expense			
Compensation expense ^(c)	1,694	1,534	1,396
Noncompensation expense ^(c)	1,692	1,793	1,538
Total noninterest expense	3,386	3,327	2,934
Income before income tax expense	5,544	5,554	4,237
Income tax expense	1,307	2,015	1,580
Net income	\$ 4,237	\$ 3,539	\$ 2,657

- (a) Includes revenue from investment banking products and commercial card transactions.
- (b) Total net revenue included tax-equivalent adjustments from income tax credits related to equity investments in designated community development entities that provide loans to qualified businesses in low-income communities, as well as tax-exempt income related to municipal financing activities of \$444 million, \$699 million and \$505 million for the years ended December 31, 2018, 2017 and 2016, respectively. The decrease in taxable-equivalent adjustments reflects the impact of TCJA.
- (c) Effective in the first quarter of 2018, certain Operations and Compliance staff were transferred from CCB and Corporate, respectively, to CB. As a result, expense for this staff is now reflected in CB's compensation expense with a corresponding adjustment for expense allocations reflected in noncompensation expense. CB's, Corporate's and CCB's previously reported headcount, compensation expense and noncompensation expense have been revised to reflect this transfer.

2018 compared with 2017

Net income was \$4.2 billion, an increase of 20%.

Net revenue was \$9.1 billion, an increase of 5%. Net interest income was \$6.7 billion, an increase of 10%, reflecting higher deposit margins and loan growth, partially offset by lower loan spreads. Noninterest revenue was \$2.3 billion, a decrease of 7%, reflecting lower Community Development Banking revenue, which was also impacted by the absence of the TCJA benefit in the prior year, and lower deposit fees, partially offset by higher investment banking revenue.

Noninterest expense was \$3.4 billion, an increase of 2%, with continued investments in banker coverage and technology in the current year predominantly offset by the absence of an impairment on certain leased equipment in the prior year.

The provision for credit losses was an expense of \$129 million, driven by select client downgrades. The prior year provision for credit losses was a benefit of \$276 million.

2017 compared with 2016

Net income was \$3.5 billion, an increase of 33%, driven by higher net revenue and a lower provision for credit losses, partially offset by higher noninterest expense.

Net revenue was \$8.6 billion, an increase of 15%. Net interest income was \$6.1 billion, an increase of 19%, driven by higher deposit spreads and loan growth. Noninterest revenue was \$2.5 billion, an increase of 9%, predominantly driven by higher Community Development Banking revenue, including a \$115 million benefit for the impact of the TCJA on certain investments, and higher investment banking revenue.

Noninterest expense was \$3.3 billion, an increase of 13% driven by hiring of bankers and business-related support staff, investments in technology, and an impairment of approximately \$130 million on certain leased equipment, the majority of which was sold subsequent to year-end.

The provision for credit losses was a benefit of \$276 million, driven by net reductions in the allowance for credit losses, including in the Oil & Gas, Natural Gas Pipelines and Metals & Mining portfolios. The prior year provision for credit losses was \$282 million driven by downgrades in the Oil & Gas portfolio and select client downgrades in other industries.

Management's discussion and analysis

CB product revenue consists of the following:

Lending includes a variety of financing alternatives, which are primarily provided on a secured basis; collateral includes receivables, inventory, equipment, real estate or other assets. Products include term loans, revolving lines of credit, bridge financing, asset-based structures, leases, and standby letters of credit.

Treasury services includes revenue from a broad range of products and services that enable CB clients to manage payments and receipts, as well as invest and manage funds.

Investment banking includes revenue from a range of products providing CB clients with sophisticated capital-raising alternatives, as well as balance sheet and risk management tools through advisory, equity underwriting, and loan syndications. Revenue from Fixed Income and Equity Markets products used by CB clients is also included.

Other product revenue primarily includes tax-equivalent adjustments generated from Community Development Banking activities and certain income derived from principal transactions.

CB is divided into four primary client segments: Middle Market Banking, Corporate Client Banking, Commercial Term Lending, and Real Estate Banking.

Middle Market Banking covers corporate, municipal and nonprofit clients, with annual revenue generally ranging between \$20 million and \$500 million.

Corporate Client Banking covers clients with annual revenue generally ranging between \$500 million and \$2 billion and focuses on clients that have broader investment banking needs.

Commercial Term Lending primarily provides term financing to real estate investors/owners for multifamily properties as well as office, retail and industrial properties.

Real Estate Banking provides full-service banking to investors and developers of institutional-grade real estate investment properties.

Other primarily includes lending and investment-related activities within the Community Development Banking business.

Selected income statement data (continued)

Year ended December 31, (in millions, except ratios)	2018	2017	2016
Revenue by product			
Lending	\$ 4,049	\$ 4,094	\$ 3,795
Treasury services	4,074	3,444	2,797
Investment banking ^(a)	852	805	785
Other	84	262	76
Total Commercial Banking net revenue	\$ 9,059	\$ 8,605	\$ 7,453
Investment banking revenue, gross ^(b)	\$ 2,491	\$ 2,385	\$ 2,331
Revenue by client segment			
Middle Market Banking	\$ 3,708	\$ 3,341	\$ 2,848
Corporate Client Banking	2,984	2,727	2,429
Commercial Term Lending	1,366	1,454	1,408
Real Estate Banking	681	604	456
Other	320	479	312
Total Commercial Banking net revenue	\$ 9,059	\$ 8,605	\$ 7,453
Financial ratios			
Return on equity	20%	17%	16%
Overhead ratio	37	39	39

(a) Includes total Firm revenue from investment banking products sold to CB clients, net of revenue sharing with the CIB.

(b) Represents total Firm revenue from investment banking products sold to CB clients. As a result of the adoption of the revenue recognition guidance, prior period amounts have been revised to conform with the current period presentation. For additional information, refer to Note 1.

Selected metrics

As of or for the year ended December 31, (in millions, except headcount)	2018	2017	2016
Selected balance sheet data (period-end)			
Total assets	\$ 220,229	\$ 221,228	\$ 214,341
Loans:			
Loans retained	204,219	202,400	188,261
Loans held-for-sale and loans at fair value	1,978	1,286	734
Total loans	\$ 206,197	\$ 203,686	\$ 188,995
Core loans	206,039	203,469	188,673
Equity	20,000	20,000	16,000
Period-end loans by client segment			
Middle Market Banking	\$ 56,656	\$ 56,965	\$ 53,929
Corporate Client Banking	48,343	46,963	43,027
Commercial Term Lending	76,720	74,901	71,249
Real Estate Banking	17,563	17,796	14,722
Other	6,915	7,061	6,068
Total Commercial Banking loans	\$ 206,197	\$ 203,686	\$ 188,995
Selected balance sheet data (average)			
Total assets	\$ 218,259	\$ 217,047	\$ 207,532
Loans:			
Loans retained	204,243	197,203	178,670
Loans held-for-sale and loans at fair value	1,258	909	723
Total loans	\$ 205,501	\$ 198,112	\$ 179,393
Core loans	205,320	197,846	178,875
Client deposits and other third-party liabilities	170,901	177,018	174,396
Equity	20,000	20,000	16,000
Average loans by client segment			
Middle Market Banking	\$ 57,092	\$ 55,474	\$ 52,242
Corporate Client Banking	47,780	46,037	41,756
Commercial Term Lending	75,694	73,428	66,700
Real Estate Banking	17,808	16,525	13,063
Other	7,127	6,648	5,632
Total Commercial Banking loans	\$ 205,501	\$ 198,112	\$ 179,393
Headcount^(a)	11,042	10,061	9,352

(a) Effective in the first quarter of 2018, certain Operations and Compliance staff were transferred from CCB and Corporate, respectively, to CB. The prior period amounts have been revised to conform with the current period presentation. For a further discussion of this transfer, refer to page 71, Selected income statement data, footnote (c).

Selected metrics

As of or for the year ended December 31, (in millions, except ratios)	2018	2017	2016
Credit data and quality statistics			
Net charge-offs/(recoveries)	\$ 53	\$ 39	\$ 163
Nonperforming assets			
Nonaccrual loans:			
Nonaccrual loans retained ^(a)	511	617	1,149
Nonaccrual loans held-for-sale and loans at fair value	—	—	—
Total nonaccrual loans	511	617	1,149
Assets acquired in loan satisfactions	2	3	1
Total nonperforming assets	513	620	1,150
Allowance for credit losses:			
Allowance for loan losses	2,682	2,558	2,925
Allowance for lending-related commitments	254	300	248
Total allowance for credit losses	2,936	2,858	3,173
Net charge-off/(recovery) rate ^(b)	0.03%	0.02%	0.09%
Allowance for loan losses to period-end loans retained	1.31	1.26	1.55
Allowance for loan losses to nonaccrual loans retained ^(a)	525	415	255
Nonaccrual loans to period-end total loans	0.25	0.30	0.61

(a) Allowance for loan losses of \$92 million, \$92 million and \$155 million was held against nonaccrual loans retained at December 31, 2018, 2017 and 2016, respectively.

(b) Loans held-for-sale and loans at fair value were excluded when calculating the net charge-off/(recovery) rate.

ASSET & WEALTH MANAGEMENT

Asset & Wealth Management, with client assets of \$2.7 trillion, is a global leader in investment and wealth management. AWM clients include institutions, high-net-worth individuals and retail investors in many major markets throughout the world. AWM offers investment management across most major asset classes including equities, fixed income, alternatives and money market funds. AWM also offers multi-asset investment management, providing solutions for a broad range of clients' investment needs. For Wealth Management clients, AWM also provides retirement products and services, brokerage and banking services including trusts and estates, loans, mortgages and deposits. The majority of AWM's client assets are in actively managed portfolios.

Effective January 1, 2018, the Firm adopted several new accounting standards; the guidance which had the most significant impact on the AWM segment results was revenue recognition. The revenue recognition guidance was applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

Selected income statement data

Year ended December 31, (in millions, except ratios and headcount)	2018	2017	2016
Revenue			
Asset management, administration and commissions	\$10,171	\$ 9,856	\$ 9,187
All other income	368	600	602
Noninterest revenue	10,539	10,456	9,789
Net interest income	3,537	3,379	3,033
Total net revenue	14,076	13,835	12,822
Provision for credit losses	53	39	26
Noninterest expense			
Compensation expense	5,495	5,317	5,063
Noncompensation expense	4,858	4,901	4,192
Total noninterest expense	10,353	10,218	9,255
Income before income tax expense	3,670	3,578	3,541
Income tax expense	817	1,241	1,290
Net income	\$ 2,853	\$ 2,337	\$ 2,251
Revenue by line of business			
Asset Management	\$ 7,163	\$ 7,257	\$ 6,747
Wealth Management	6,913	6,578	6,075
Total net revenue	\$14,076	\$13,835	\$12,822
Financial ratios			
Return on common equity	31%	25%	24%
Overhead ratio	74	74	72
Pre-tax margin ratio:			
Asset Management	26	22	27
Wealth Management	26	30	28
Asset & Wealth Management	26	26	28
Headcount	23,920	22,975	21,082
Number of Wealth Management client advisors	2,865	2,605	2,504

2018 compared with 2017

Net income was \$2.9 billion, an increase of 22%.

Net revenue was \$14.1 billion, an increase of 2%. Net interest income was \$3.5 billion, up 5%, driven by deposit margin expansion and loan growth. Noninterest revenue was \$10.5 billion, up 1%, driven by higher management fees on higher average market levels and the cumulative impact of net inflows, predominantly offset by fee compression, lower investment valuations and lower performance fees.

Revenue from Asset Management was \$7.2 billion, down 1%, driven by lower investment valuations, fee compression and lower performance fees, predominantly offset by higher management fees on higher average market levels and the cumulative impact of net inflows.

Revenue from Wealth Management was \$6.9 billion, up 5%, reflecting higher management fees on the cumulative impact of net inflows and higher average market levels as well as higher net interest income from deposit margin expansion and continued loan growth, partially offset by fee compression.

Noninterest expense was \$10.4 billion, an increase of 1%, driven by investments in advisors and technology and higher external fees on revenue growth, largely offset by lower legal expense.

2017 compared with 2016

Net income was \$2.3 billion, an increase of 4% compared with the prior year, reflecting higher revenue and a tax benefit resulting from the vesting of employee share-based awards, offset by higher noninterest expense.

Net revenue was \$13.8 billion, an increase of 8%. Net interest income was \$3.4 billion, up 11%, driven by higher deposit spreads. Noninterest revenue was \$10.5 billion, up 7%, driven by higher market levels, partially offset by the absence of a gain in the prior year on the disposal of an asset.

Revenue from Asset Management was \$7.3 billion, up 8% from the prior year, driven by higher market levels, partially offset by the absence of a gain in prior year on the disposal of an asset.

Revenue from Wealth Management was \$6.6 billion, up 8% from the prior year, reflecting higher net interest income from higher deposit spreads.

Noninterest expense was \$10.2 billion, an increase of 10%, predominantly driven by higher legal expense and compensation expense on higher revenue and headcount.

AWM's lines of business consist of the following:

Asset Management provides comprehensive global investment services, including asset management, pension analytics, asset-liability management and active risk-budgeting strategies.

Wealth Management offers investment advice and wealth management, including investment management, capital markets and risk management, tax and estate planning, banking, lending and specialty-wealth advisory services.

AWM's client segments consist of the following:

Private Banking clients include high- and ultra-high-net-worth individuals, families, money managers, business owners and small corporations worldwide.

Institutional clients include both corporate and public institutions, endowments, foundations, nonprofit organizations and governments worldwide.

Retail clients include financial intermediaries and individual investors.

Asset Management has two high-level measures of its overall fund performance.

• **Percentage of mutual fund assets under management in funds rated 4- or 5-star:** Mutual fund rating services rank funds based on their risk-adjusted performance over various periods. A 5-star rating is the best rating and represents the top 10% of industry-wide ranked funds. A 4-star rating represents the next 22.5% of industry-wide ranked funds. A 3-star rating represents the next 35% of industry-wide ranked funds. A 2-star rating represents the next 22.5% of industry-wide ranked funds. A 1-star rating is the worst rating and represents the bottom 10% of industry-wide ranked funds. The "overall Morningstar rating" is derived from a weighted average of the performance associated with a fund's three-, five- and ten-year (if applicable) Morningstar Rating metrics. For U.S. domiciled funds, separate star ratings are given at the individual share class level. The Nomura "star rating" is based on three-year risk-adjusted performance only. Funds with fewer than three years of history are not rated and hence excluded from this analysis. All ratings, the assigned peer categories and the asset values used to derive this analysis are sourced from these fund rating providers mentioned in footnote (a). The data providers re-denominate the asset values into U.S. dollars. This % of AUM is based on star ratings at the share class level for U.S. domiciled funds, and at a "primary share class" level to represent the star rating of all other funds except for Japan where Nomura provides ratings at the fund level. The "primary share class", as defined by Morningstar, denotes the share class recommended as being the best proxy for the portfolio and in most cases will be the most retail version (based upon annual management charge, minimum investment, currency and other factors). The performance data could have been different if all funds/accounts would have been included. Past performance is not indicative of future results.

• **Percentage of mutual fund assets under management in funds ranked in the 1st or 2nd quartile (one, three and five years):** All quartile rankings, the assigned peer categories and the asset values used to derive this analysis are sourced from the fund ranking providers mentioned in footnote (b). Quartile rankings are done on the net-of-fee absolute return of each fund. The data providers re-denominate the asset values into U.S. dollars. This % of AUM is based on fund performance and associated peer rankings at the share class level for U.S. domiciled funds, at a "primary share class" level to represent the quartile ranking of the U.K., Luxembourg and Hong Kong funds and at the fund level for all other funds. The "primary share class", as defined by Morningstar, denotes the share class recommended as being the best proxy for the portfolio and in most cases will be the most retail version (based upon annual management charge, minimum investment, currency and other factors). Where peer group rankings given for a fund are in more than one "primary share class" territory both rankings are included to reflect local market competitiveness (applies to "Offshore Territories" and "HK SFC Authorized" funds only). The performance data could have been different if all funds/accounts would have been included. Past performance is not indicative of future results.

Selected metrics

As of or for the year ended December 31, (in millions, except ranking data and ratios)	2018	2017	2016
% of JPM mutual fund assets rated as 4- or 5-star ^(a)	58%	60%	63%
% of JPM mutual fund assets ranked in 1 st or 2 nd quartile: ^(b)			
1 year	68	64	54
3 years	73	75	72
5 years	85	83	79

Selected balance sheet data (period-end)

Total assets	\$ 170,024	\$ 151,909	\$ 138,384
Loans	147,632	130,640	118,039
Core loans	147,632	130,640	118,039
Deposits	138,546	146,407	161,577
Equity	9,000	9,000	9,000

Selected balance sheet data (average)

Total assets	\$ 160,269	\$ 144,206	\$ 132,875
Loans	138,622	123,464	112,876
Core loans	138,622	123,464	112,876
Deposits	137,272	148,982	153,334
Equity	9,000	9,000	9,000

Credit data and quality statistics

Net charge-offs	\$ 10	\$ 14	\$ 16
Nonaccrual loans	263	375	390
Allowance for credit losses:			
Allowance for loan losses	326	290	274
Allowance for lending- related commitments	16	10	4
Total allowance for credit losses	342	300	278
Net charge-off rate	0.01%	0.01%	0.01%
Allowance for loan losses to period-end loans	0.22	0.22	0.23
Allowance for loan losses to nonaccrual loans	124	77	70
Nonaccrual loans to period- end loans	0.18	0.29	0.33

- (a) Represents the "overall star rating" derived from Morningstar for the U.S., the U.K., Luxembourg, Hong Kong and Taiwan domiciled funds; and Nomura "star rating" for Japan domiciled funds. Includes only Asset Management retail open-ended mutual funds that have a rating. Excludes money market funds, Undiscovered Managers Fund, and Brazil domiciled funds.
- (b) Quartile ranking sourced from: Lipper for the U.S. and Taiwan domiciled funds; Morningstar for the U.K., Luxembourg and Hong Kong domiciled funds; Nomura for Japan domiciled funds and Fund Doctor for South Korea domiciled funds. Includes only Asset Management retail open-ended mutual funds that are ranked by the aforementioned sources. Excludes money market funds, Undiscovered Managers Fund, and Brazil domiciled funds.

Management's discussion and analysis

Client assets

2018 compared with 2017

Client assets were \$2.7 trillion, a decrease of 2%. Assets under management were \$2.0 trillion, a decrease of 2% reflecting lower spot market levels, largely offset by net inflows into liquidity and long-term products.

2017 compared with 2016

Client assets were \$2.8 trillion, an increase of 14% compared with the prior year. Assets under management were \$2.0 trillion, an increase of 15% from the prior year reflecting higher market levels, and net inflows into long-term and liquidity products.

Client assets

December 31, (in billions)	2018	2017	2016
Assets by asset class			
Liquidity	\$ 480	\$ 459	\$ 436
Fixed income	464	474	420
Equity	384	428	351
Multi-asset and alternatives	659	673	564
Total assets under management	1,987	2,034	1,771
Custody/brokerage/ administration/deposits	746	755	682
Total client assets	\$ 2,733	\$ 2,789	\$ 2,453
Memo:			
Alternatives client assets ^(a)	\$ 171	\$ 166	\$ 154
Assets by client segment			
Private Banking	\$ 552	\$ 526	\$ 435
Institutional	926	968	869
Retail	509	540	467
Total assets under management	\$ 1,987	\$ 2,034	\$ 1,771
Private Banking	\$ 1,274	\$ 1,256	\$ 1,098
Institutional	946	990	886
Retail	513	543	469
Total client assets	\$ 2,733	\$ 2,789	\$ 2,453

(a) Represents assets under management, as well as client balances in brokerage accounts.

Client assets (continued)

Year ended December 31, (in billions)	2018	2017	2016
Assets under management rollforward			
Beginning balance	\$ 2,034	\$ 1,771	\$ 1,723
Net asset flows:			
Liquidity	31	9	24
Fixed income	(1)	36	30
Equity	2	(11)	(29)
Multi-asset and alternatives	24	43	22
Market/performance/other impacts	(103)	186	1
Ending balance, December 31	\$ 1,987	\$ 2,034	\$ 1,771

Client assets rollforward

Beginning balance	\$ 2,789	\$ 2,453	\$ 2,350
Net asset flows	88	93	63
Market/performance/other impacts	(144)	243	40
Ending balance, December 31	\$ 2,733	\$ 2,789	\$ 2,453

International metrics

Year ended December 31, (in billions, except where otherwise noted)	2018	2017	2016
Total net revenue (in millions)^(a)			
Europe/Middle East/Africa	\$ 2,721	\$ 2,715	\$ 2,425
Asia/Pacific	1,518	1,385	1,278
Latin America/Caribbean	904	844	726
Total international net revenue	5,143	4,944	4,429
North America	8,933	8,891	8,393
Total net revenue	\$ 14,076	\$ 13,835	\$ 12,822
Assets under management			
Europe/Middle East/Africa	\$ 355	\$ 384	\$ 309
Asia/Pacific	162	160	123
Latin America/Caribbean	63	61	45
Total international assets under management	580	605	477
North America	1,407	1,429	1,294
Total assets under management	\$ 1,987	\$ 2,034	\$ 1,771
Client assets			
Europe/Middle East/Africa	\$ 414	\$ 441	\$ 359
Asia/Pacific	222	225	177
Latin America/Caribbean	155	154	114
Total international client assets	791	820	650
North America	1,942	1,969	1,803
Total client assets	\$ 2,733	\$ 2,789	\$ 2,453

(a) Regional revenue is based on the domicile of the client.

The Corporate segment consists of Treasury and Chief Investment Office and Other Corporate, which includes corporate staff functions and expense that is centrally managed. Treasury and CIO is predominantly responsible for measuring, monitoring, reporting and managing the Firm's liquidity, funding, capital, structural interest rate and foreign exchange risks. The major Other Corporate functions include Real Estate, Technology, Legal, Corporate Finance, Human Resources, Internal Audit, Risk Management, Compliance, Control Management, Corporate Responsibility and various Other Corporate groups.

2018 compared with 2017

Net loss was \$1.2 billion.

Net revenue was a loss of \$128 million, compared with net revenue of \$1.1 billion in the prior year. The current year includes markdowns on certain legacy private equity investments and investment securities losses related to the repositioning of the investment securities portfolio, partially offset by higher net interest income primarily driven by higher rates. The prior year included a \$645 million benefit from a legal settlement.

Noninterest expense of \$902 million includes a pre-tax loss of \$174 million on the liquidation of a legal entity recorded in the second quarter of 2018, as well as investments in technology and real estate.

Current period income tax expense reflects a net benefit of \$302 million resulting from changes in estimates under the TCJA related to the remeasurement of certain deferred taxes and the deemed repatriation tax on non-U.S. earnings. This amount was more than offset by changes to certain tax reserves and other tax adjustments. The prior year income tax expense included a \$2.7 billion expense related to the impact of the TCJA.

2017 compared with 2016

Net loss was \$1.6 billion, compared with a net loss of \$704 million in the prior year. The current year net loss included a \$2.7 billion increase to income tax expense related to the impact of the TCJA.

Net revenue was \$1.1 billion, compared with a loss of \$487 million in the prior year. The increase in current year net revenue was driven by a \$645 million benefit from a legal settlement with the FDIC receivership for Washington Mutual and with Deutsche Bank as trustee of certain Washington Mutual trusts and by the net impact of higher interest rates.

Net interest income was \$55 million, compared with a loss of \$1.4 billion in the prior year. The gain in the current year was primarily driven by higher interest income on deposits with banks due to higher interest rates and balances, partially offset by higher interest expense on long-term debt primarily driven by higher interest rates.

Selected income statement and balance sheet data

Year ended December 31, (in millions, except headcount)	2018	2017	2016
Revenue			
Principal transactions	\$ (426)	\$ 284	\$ 210
Securities gains/(losses)	(395)	(66)	140
All other income/(loss) ^(a)	558	867	588
Noninterest revenue	(263)	1,085	938
Net interest income	135	55	(1,425)
Total net revenue^(b)	(128)	1,140	(487)
Provision for credit losses	(4)	—	(4)
Noninterest expense^(c)	902	501	462
Income/(loss) before income tax benefit	(1,026)	639	(945)
Income tax expense/(benefit)	215	2,282	(241)
Net income/(loss)	\$ (1,241)	\$ (1,643)	\$ (704)
Total net revenue			
Treasury and CIO	510	566	(787)
Other Corporate	(638)	574	300
Total net revenue	\$ (128)	\$ 1,140	\$ (487)
Net income/(loss)			
Treasury and CIO	(69)	60	(715)
Other Corporate	(1,172)	(1,703)	11
Total net income/(loss)	\$ (1,241)	\$ (1,643)	\$ (704)
Total assets (period-end)	\$771,787	\$ 781,478	\$ 799,426
Loans (period-end)	1,597	1,653	1,592
Core loans ^(d)	1,597	1,653	1,589
Headcount^(e)	37,145	34,601	31,789

- (a) Included revenue related to a legal settlement of \$645 million for the year ended December 31, 2017.
- (b) Included tax-equivalent adjustments, driven by tax-exempt income from municipal bond investments, of \$382 million, \$905 million and \$885 million for the years ended December 31, 2018, 2017 and 2016, respectively. The decrease in taxable-equivalent adjustments reflects the impact of the TCJA.
- (c) Included legal expense/(benefit) of \$(241) million, \$(593) million and \$(385) million for the years ended December 31, 2018, 2017 and 2016, respectively.
- (d) Average core loans were \$1.7 billion, \$1.6 billion and \$1.9 billion for the years ended December 31, 2018, 2017 and 2016, respectively.
- (e) Effective in the first quarter of 2018, certain Compliance staff were transferred from Corporate to CB. The prior period amounts have been revised to conform with the current period presentation. For a further discussion of this transfer, refer to CB segment results on page 71.

Management's discussion and analysis

Treasury and CIO overview

Treasury and CIO is predominantly responsible for measuring, monitoring, reporting and managing the Firm's liquidity, funding, capital, structural interest rate and foreign exchange risks. The risks managed by Treasury and CIO arise from the activities undertaken by the Firm's four major reportable business segments to serve their respective client bases, which generate both on- and off-balance sheet assets and liabilities.

Treasury and CIO seek to achieve the Firm's asset-liability management objectives generally by investing in high-quality securities that are managed for the longer-term as part of the Firm's investment securities portfolio. Treasury and CIO also use derivatives to meet the Firm's asset-liability management objectives. For further information on derivatives, refer to Note 5. In addition, Treasury and CIO manage the Firm's cash position primarily through depositing at central banks and investing in short-term instruments. For further information on liquidity and funding risk, refer to Liquidity Risk Management on pages 95-100. For information on interest rate, foreign exchange and other risks, refer to Market Risk Management on pages 124-131.

The investment securities portfolio primarily consists of agency and nonagency mortgage-backed securities, U.S. and non-U.S. government securities, obligations of U.S. states and municipalities, other ABS and corporate debt securities. At December 31, 2018, the investment securities portfolio was \$260.1 billion, and the average credit rating of the securities comprising the portfolio was AA+ (based upon external ratings where available and, where not available, based primarily upon internal ratings that correspond to ratings as defined by S&P and Moody's). Refer to Note 10 for further information on the Firm's investment securities portfolio.

Selected income statement and balance sheet data

As of or for the year ended December 31, (in millions)	2018	2017	2016
Investment securities gains/ (losses)	\$ (395)	\$ (78)	\$ 132
Available-for-sale ("AFS") investment securities (average)	203,449	219,345	226,892
Held-to-maturity ("HTM") investment securities (average)	31,747	47,927	51,358
Investment securities portfolio (average)	235,197	267,272	278,250
AFS investment securities (period-end)	228,681	200,247	236,670
HTM investment securities (period-end)	31,434	47,733	50,168
Investment securities portfolio (period-end)	260,115	247,980	286,838

As permitted by the new hedge accounting guidance, the Firm elected to transfer certain investment securities from HTM to AFS in the first quarter of 2018. For additional information, refer to Notes 1 and 10.

ENTERPRISE-WIDE RISK MANAGEMENT

Risk is an inherent part of JPMorgan Chase's business activities. When the Firm extends a consumer or wholesale loan, advises customers on their investment decisions, makes markets in securities, or offers other products or services, the Firm takes on some degree of risk. The Firm's overall objective is to manage its businesses, and the associated risks, in a manner that balances serving the interests of its clients, customers and investors and protects the safety and soundness of the Firm.

The Firm believes that effective risk management requires:

- Acceptance of responsibility, including identification and escalation of risk issues, by all individuals within the Firm;
- Ownership of risk identification, assessment, data and management within each of the lines of business and Corporate; and
- Firmwide structures for risk governance.

The Firm strives for continual improvement through efforts to enhance controls, ongoing employee training and development, talent retention, and other measures. The Firm follows a disciplined and balanced compensation framework with strong internal governance and independent Board oversight. The impact of risk and control issues are carefully considered in the Firm's performance evaluation and incentive compensation processes.

Firmwide Risk Management is overseen and managed on an enterprise-wide basis. The Firm's risk management governance and oversight framework involves understanding drivers of risks, types of risks, and impacts of risks.



Drivers of Risks

Drivers of risks include, but are not limited to, the economic environment, regulatory or government policy, competitor or market evolution, business decisions, process or judgment error, deliberate wrongdoing, dysfunctional markets, and natural disasters.

Types of Risks

The Firm's risks are generally categorized in the following four risk types:

- Strategic risk is the risk associated with the Firm's current and future business plans and objectives, including capital risk, liquidity risk, and the impact to the Firm's reputation.
- Credit and investment risk is the risk associated with the default or change in credit profile of a client, counterparty or customer; or loss of principal or a reduction in expected returns on investments, including consumer credit risk, wholesale credit risk, and investment portfolio risk.
- Market risk is the risk associated with the effect of changes in market factors, such as interest and foreign exchange rates, equity and commodity prices, credit spreads or implied volatilities, on the value of assets and liabilities held for both the short and long term.
- Operational risk is the risk associated with inadequate or failed internal processes, people and systems, or from external events and includes compliance risk, conduct risk, legal risk, and estimations and model risk.

Impacts of Risks

There may be many consequences of risks manifesting, including quantitative impacts such as reduction in earnings and capital, liquidity outflows, and fines or penalties, or qualitative impacts, such as reputation damage, loss of clients, and regulatory and enforcement actions.

Governance and Oversight Functions

The Firm manages its risk through risk governance and oversight functions. The scope of a particular function may include one or more drivers, types and/or impacts of risk. For example, Country Risk Management oversees country risk which may be a driver of risk or an aggregation of exposures that could give rise to multiple risk types such as credit or market risk.

The following sections discuss the risk governance and oversight functions in place to manage the risks inherent in the Firm's business activities.

Risk governance and oversight functions	Page
Strategic risk	84
Capital risk	85-94
Liquidity risk	95-100
Reputation risk	101
Consumer credit risk	106-111
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Management's discussion and analysis

Governance and oversight

The Firm's overall appetite for risk is governed by a "Risk Appetite" framework. The framework and the Firm's risk appetite are set and approved by the Firm's Chief Executive Officer ("CEO"), Chief Financial Officer ("CFO") and Chief Risk Officer ("CRO"). LOB-level risk appetite is set by the respective LOB CEO, CFO and CRO and is approved by the Firm's CEO, CFO and CRO. Quantitative parameters and qualitative factors are used to monitor and measure the Firm's capacity to take risk consistent with its stated risk appetite. Quantitative parameters have been established to assess select strategic risks, credit risks and market risks. Qualitative factors have been established to assess select operational risks, and impact to the Firm's reputation. Risk Appetite results are reported quarterly to the Board of Directors' Risk Policy Committee ("DRPC").

The Firm has an Independent Risk Management ("IRM") function, which consists of the Risk Management and Compliance organizations. The CEO appoints, subject to DRPC approval, the Firm's CRO to lead the IRM organization and manage the risk governance structure of the Firm. The framework is subject to approval by the DRPC in the form of the primary risk management policies. The Firm's CRO oversees and delegates authorities to LOB CROs, Firmwide Risk Executives ("FREs"), and the Firm's Chief Compliance Officer ("CCO"). The CCO oversees and delegates authorities to the LOB CCOs, and is responsible for the creation and effective execution of the Global Compliance Program.

The Firm places reliance on each of its LOBs and other functional areas giving rise to risk to operate within the parameters identified by the IRM function, and within its own management-identified risk and control standards. Each LOB and Treasury and CIO, inclusive of their aligned Operations, Technology and Control Management are considered the "first line of defense" and owns the identification of risks, as well as the design and execution of controls, inclusive of IRM-specified controls, to manage those risks. The first line of defense is responsible for adherence to applicable laws, rules, and regulations and for the implementation of the risk management structure (which may include policy, standards, limits, thresholds and controls) established by IRM.

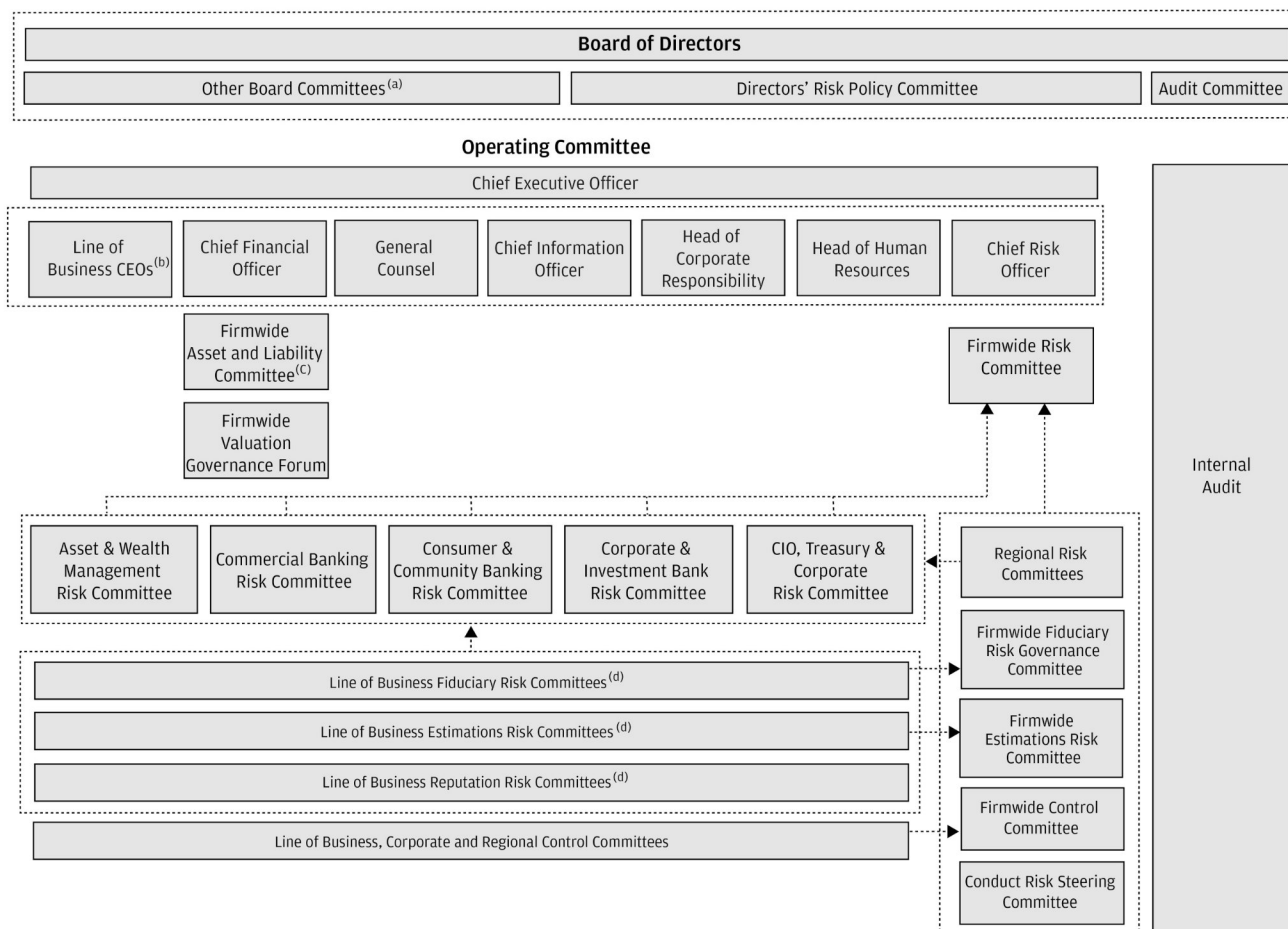
The IRM function is independent of the businesses and is "the second line of defense". The IRM function sets and oversees the risk management structure for firmwide risk governance, and independently assesses and challenges the first line of defense risk management practices. IRM is also responsible for its own adherence to applicable laws, rules, regulations and for the implementation of policies and standards established by IRM with respect to its own processes.

The Internal Audit function operates independently from other parts of the Firm and performs independent testing and evaluation of processes and controls across the entire enterprise as the Firm's "third line of defense". The Internal Audit Function is headed by the General Auditor, who reports to the Audit Committee.

In addition, there are other functions that contribute to the firmwide control environment including Finance, Human Resources, Legal, and Control Management.

The independent status of the IRM function is supported by a governance structure that provides for escalation of risk issues to senior management, the Firmwide Risk Committee, and the Board of Directors, as appropriate.

The chart below illustrates the Board of Directors and key senior management level committees in the Firm's risk governance structure. In addition, there are other committees, forums and paths of escalation that support the oversight of risk which are not shown in the chart below.



(a) Other Board Committees include the Compensation & Management Development Committee, Corporate Governance & Nominating Committee and Public Responsibility Committee.
 (b) The Line of Business CEOs for CIB and CCB are also the Firm's Co-Presidents and Co-Chief Operating Officers.
 (c) The Capital Governance Committee and Treasurer Committee report to the Firmwide Asset and Liability Committee.
 (d) As applicable.

The Firm's Operating Committee, which consists of the Firm's CEO, CRO, CFO and other senior executives, is accountable to and may refer matters to the Firm's Board of Directors. The Operating Committee is responsible to escalate to the Board the information necessary to facilitate the Board's exercise of its duties.

The Board of Directors provides oversight of risk. The DRPC is the principal committee that oversees risk matters. The Audit Committee oversees the control environment, and the Compensation & Management Development Committee oversees compensation and other management-related matters. Each committee of the Board oversees reputation risk and/or conduct risk issues within its scope of responsibility.

The Directors' Risk Policy Committee of the Board assists the board in its oversight of the Firm's global risk management framework and approves the primary risk management policies of the Firm. The Committee's responsibilities include oversight of management's exercise of its responsibility to assess and manage the Firm's risks, and its capital and liquidity planning and analysis. Breaches in risk appetite, capital and liquidity issues that may have a material adverse impact on the Firm and other significant risk-related matters are escalated to the DRPC.

Management's discussion and analysis

The Audit Committee of the Board assists the Board in its oversight of management's responsibilities to assure that there is an effective system of controls reasonably designed to safeguard the assets and income of the Firm, assure the integrity of the Firm's financial statements and maintain compliance with the Firm's ethical standards, policies, plans and procedures, and with laws and regulations. In addition, the Audit Committee assists the Board in its oversight of the Firm's independent registered public accounting firm's qualifications, independence and performance, and of the performance of the Firm's Internal Audit function.

The Compensation & Management Development Committee ("CMDC") of the Board assists the Board in its oversight of the Firm's compensation programs and reviews and approves the Firm's overall compensation philosophy, incentive compensation pools, and compensation practices consistent with key business objectives and safety and soundness. The CMDC reviews Operating Committee members' performance against their goals, and approves their compensation awards. The CMDC also periodically reviews the Firm's diversity programs and management development and succession planning, and provides oversight of the Firm's culture, including reviewing management updates regarding significant conduct issues and any related employee actions, including but not limited to compensation actions.

The Public Responsibility Committee of the Board assists the Board in its oversight of the Firm's positions and practices on public responsibility matters such as community investment, fair lending, sustainability, consumer practices and other public policy issues that reflect the Firm's values and character and impact the Firm's reputation among all of its stakeholders. The Committee also provides guidance on these matters to management and the Board as appropriate.

Among the Firm's senior management-level committees that are primarily responsible for key risk-related functions are:

The Firmwide Risk Committee ("FRC") is the Firm's highest management-level risk committee. It provides oversight of the risks inherent in the Firm's businesses. The FRC is co-chaired by the Firm's CEO and CRO. The FRC serves as an escalation point for risk topics and issues raised by its members, the Line of Business Risk Committees, Firmwide Control Committee, Firmwide Fiduciary Risk Governance Committee, Firmwide Estimations Risk Committee, Conduct Risk Steering Committee and Regional Risk Committees, as appropriate. The FRC escalates significant issues to the DRPC, as appropriate.

The Firmwide Control Committee ("FCC") provides a forum for senior management to review and discuss firmwide operational risks, including existing and emerging issues and operational risk metrics, and to review operational risk management execution in the context of the Operational Risk Management Framework ("ORMF"). The ORMF provides the framework for the governance, risk identification and assessment, measurement, monitoring and reporting of

operational risk. The FCC is co-chaired by the Chief Control Manager and the Firmwide Risk Executive for Operational Risk Management. The FCC relies on the prompt escalation of operational risk and control issues from businesses and functions as the primary owners of the operational risk. Operational risk and control issues may be escalated by business or function control committees to the FCC, which in turn, may escalate to the FRC, as appropriate.

The Firmwide Fiduciary Risk Governance Committee ("FFRGC") is a forum for risk matters related to the Firm's fiduciary activities. The FFRGC oversees the governance framework for fiduciary risk inherent in each of the Firm's LOBs. The governance framework supports the consistent identification and escalation of fiduciary risk or fiduciary related conflict of interest risk. The FFRGC approves risk or compliance policy exceptions and reviews periodic reports from the LOBs and control functions including fiduciary metrics and control trends. The FFRGC is co-chaired by the Wealth Management CEO and the Asset & Wealth Management CRO. The FFRGC escalates significant fiduciary issues to the FRC, the DRPC and the Audit Committee, as appropriate.

The Firmwide Estimations Risk Committee ("FERC") reviews and oversees governance and execution activities related to quantitative and qualitative estimations, such as those used in risk management, budget forecasting and capital planning and analysis. The FERC is chaired by the Firmwide Risk Executive for Model Risk Governance and Review. The FERC serves as an escalation channel for relevant topics and issues raised by its members and the Line of Business Estimation Risk Committees. The FERC escalates significant issues to the FRC, as appropriate.

The Conduct Risk Steering Committee ("CRSC") provides oversight of the Firm's conduct initiatives to develop a more holistic view of conduct risks and to connect key programs across the Firm to identify opportunities and emerging areas of focus. The CRSC is co-chaired by the Conduct Risk Compliance Executive and the Human Resources Chief Administrative Officer. The CRSC may escalate systemic conduct risk issues to the FRC and as appropriate to the DRPC.

Line of Business and Regional Risk Committees review the ways in which the particular line of business or the business operating in a particular region could be exposed to adverse outcomes with a focus on identifying, accepting, escalating and/or requiring remediation of matters brought to these committees. These committees may escalate matters to the FRC, as appropriate. LOB risk committees are co-chaired by the LOB CEO and the LOB CRO. Each LOB risk committee may create sub-committees with requirements for escalation. The regional committees are established similarly, as appropriate, for the region.

Line of Business and Corporate Control Committees oversee the control environment of their respective business or function. As part of that mandate, they are responsible for reviewing data that indicates the quality and stability of the

processes in a business or function, addressing key operational risk issues, focusing on processes with control concerns and overseeing control remediation. These committees escalate issues to the FCC, as appropriate.

The Firmwide Asset and Liability Committee (“ALCO”), chaired by the Firm’s Treasurer and Chief Investment Officer, is responsible for overseeing the Firm’s asset and liability management (“ALM”) activities and the management of liquidity risk, balance sheet, interest rate risk, and capital risk. The ALCO is supported by the Treasurer Committee and the Capital Governance Committee. The Treasurer Committee is responsible for monitoring the Firm’s overall balance sheet, liquidity risk and interest rate risk. The Capital Governance Committee is responsible for overseeing the Firm’s strategic end-to-end capital management and governance framework, including capital planning, capital strategy, and the implementation of regulatory capital requirements.

The Firmwide Valuation Governance Forum (“VGF”) is composed of senior finance and risk executives and is responsible for overseeing the management of fair value risks arising from valuation activities conducted across the Firm. The VGF is chaired by the Firmwide head of the Valuation Control Group (“VCG”) under the direction of the Firm’s Controller, and includes sub-forums covering the Corporate & Investment Bank, Consumer & Community Banking, Commercial Banking, Asset & Wealth Management and Corporate, including Treasury and CIO.

In addition, the JPMorgan Chase Bank, N.A. Board of Directors is responsible for the oversight of management of the bank. The JPMorgan Chase Bank, N.A. Board accomplishes this function acting directly and through the principal standing committees of the Firm’s Board of Directors. Risk and control oversight on behalf of JPMorgan Chase Bank N.A. is primarily the responsibility of the DRPC and the Audit Committee of the Firm’s Board of Directors, respectively, and, with respect to compensation and other management-related matters, the Compensation & Management Development Committee of the Firm’s Board of Directors.

Risk Identification

The Firm has a Risk Identification process designed to facilitate the first line of defense’s responsibility to identify material risks inherent to the Firm, catalog them in a central repository and review the most material risks on a regular basis. The second line of defense reviews and challenges the first line’s identification of risks, maintains the central repository and provides the consolidated Firmwide results to the FRC and DRPC.

STRATEGIC RISK MANAGEMENT

Strategic risk is the risk associated with the Firm's current and future business plans and objectives. Strategic risk includes the risk to current or anticipated earnings, capital, liquidity, enterprise value, or the Firm's reputation arising from adverse business decisions, poor implementation of business decisions, or lack of responsiveness to changes in the industry or external environment.

Overview

The Operating Committee and the senior leadership of each LOB and Corporate are responsible for managing the Firm's most significant strategic risks. Strategic risks are overseen by IRM through participation in business reviews, LOB and Corporate senior management committees, ongoing management of the Firm's risk appetite and limit framework, and other relevant governance forums. The Board of Directors oversees management's strategic decisions, and the DRPC oversees IRM and the Firm's risk management framework.

The Firm's strategic planning process, which includes the development and execution of strategic priorities and initiatives by the Operating Committee and the management teams of the lines of business and Corporate, is an important process for managing the Firm's strategic risk. Guided by the Firm's How We Do Business Principles (the "Principles"), the strategic priorities and initiatives are updated annually and include evaluating performance against prior year initiatives, assessment of the operating environment, refinement of existing strategies and development of new strategies.

These strategic priorities and initiatives are then incorporated in the Firm's budget, and are reviewed by the Board of Directors.

In the process of developing the strategic initiatives, line of business and Corporate leadership identify the strategic risks associated with their strategic initiatives and those risks are incorporated into the Firmwide Risk Identification process and monitored and assessed as part of the Firmwide Risk Appetite framework. For further information on Risk Identification, refer to Enterprise-Wide Risk Management on page 79. For further information on the Risk Appetite framework, refer to Enterprise-Wide Risk Management on page 80.

The Firm's balance sheet strategy, which focuses on risk-adjusted returns, strong capital and robust liquidity, is key to management of strategic risk. For further information on capital risk, refer to Capital Risk Management on pages 85-94. For further information on liquidity risk, refer to Liquidity Risk Management on pages 95-100

For further information on reputation risk, refer to Reputation Risk Management on page 101.

Governance and oversight

On at least an annual basis, the Firm's Operating Committee defines the most significant strategic priorities and initiatives, including those of the Firm, the LOBs and Corporate, for the coming year and evaluates performance against the prior year. As part of the strategic planning process, IRM conducts a qualitative assessment of those significant initiatives to determine the impact on the risk profile of the Firm. The Firm's priorities, initiatives and IRM's assessment are provided to the Board for its review.

As part of its ongoing oversight and management of risk across the Firm, IRM is regularly engaged in significant discussions and decision-making across the Firm, including decisions to pursue new business opportunities or modify or exit existing businesses.

CAPITAL RISK MANAGEMENT

Capital risk is the risk the Firm has an insufficient level and composition of capital to support the Firm's business activities and associated risks during normal economic environments and under stressed conditions.

A strong capital position is essential to the Firm's business strategy and competitive position. Maintaining a strong balance sheet to manage through economic volatility is considered a strategic imperative of the Firm's Board of Directors, CEO and Operating Committee. The Firm's fortress balance sheet philosophy focuses on risk-adjusted returns, strong capital and robust liquidity. The Firm's capital risk management strategy focuses on maintaining long-term stability to enable it to build and invest in market-leading businesses, even in a highly stressed environment. Senior management considers the implications on the Firm's capital prior to making any significant decisions that could impact future business activities. In addition to considering the Firm's earnings outlook, senior management evaluates all sources and uses of capital with a view to ensuring the Firm's capital strength.

Capital management

Treasury & CIO assumed responsibility for capital management in March 2018.

The primary objectives of effective capital management are to:

- Maintain sufficient capital in order to continue to build and invest in the Firm's businesses through the cycle and in stressed environments;
- Retain flexibility to take advantage of future investment opportunities;
- Promote the Firm's ability to serve as a source of strength to its subsidiaries;
- Ensure the Firm operates above the minimum regulatory capital ratios as well as maintain "well-capitalized" status for the Firm and its insured depository institution ("IDI") subsidiaries at all times under applicable regulatory capital requirements;
- Meet capital distribution objectives; and
- Maintain sufficient capital resources to operate throughout a resolution period in accordance with the Firm's preferred resolution strategy.

The Firm meets these objectives through the establishment of internal minimum capital requirements and a strong capital management governance framework, both in business as usual conditions and in the event of stress.

Capital risk management is intended to be flexible in order to react to a range of potential events. In its management of capital, the Firm takes into consideration economic risk and all applicable regulatory capital requirements to determine the level of capital needed.

The Firm's minimum capital levels are based on the most binding of three pillars: an internal assessment of the Firm's

capital needs; an estimate of required capital under the CCAR and other stress testing requirements; and Basel III Fully Phased-In regulatory minimums. Where necessary, each pillar may include a management-established buffer. The capital governance framework requires regular monitoring of the Firm's capital positions, stress testing and defining escalation protocols, both at the Firm and material legal entity levels.

Contingency capital plan

The Firm's contingency capital plan, which is approved by the firmwide ALCO and the DRPC, establishes the capital management framework for the Firm and specifies the principles underlying the Firm's approach towards capital management in normal economic times and during stress. The contingency capital plan defines how the Firm calibrates its targeted capital levels and meets minimum capital requirements, monitors the ongoing appropriateness of planned distributions, and sets out the capital contingency actions that must be taken or considered at various levels of capital depletion during a period of stress.

Capital planning and stress testing

Comprehensive Capital Analysis and Review

The Federal Reserve requires large bank holding companies, including the Firm, to submit on an annual basis a capital plan that has been reviewed and approved by the Board of Directors. The Federal Reserve uses the CCAR and other stress testing processes to ensure that large BHCs have sufficient capital during periods of economic and financial stress, and have robust, forward-looking capital assessment and planning processes in place that address each BHC's unique risks to enable it to absorb losses under certain stress scenarios. Through CCAR, the Federal Reserve evaluates each BHC's capital adequacy and internal capital adequacy assessment processes ("ICAAP"), as well as its plans to make capital distributions, such as dividend payments or stock repurchases.

On June 28, 2018, the Federal Reserve informed the Firm that it did not object, on either a quantitative or qualitative basis, to the Firm's 2018 capital plan. For information on actions taken by the Firm's Board of Directors following the 2018 CCAR results, refer to Capital actions on pages 91-92.

Internal Capital Adequacy Assessment Process

Annually, the Firm prepares the ICAAP, which informs the Board of Directors of the ongoing assessment of the Firm's processes for managing the sources and uses of capital as well as compliance with supervisory expectations for capital planning and capital adequacy. The Firm's ICAAP integrates stress testing protocols with capital planning. The Firm's Audit Committee is responsible for reviewing and approving the capital stress testing control framework.

The CCAR and other stress testing processes assess the potential impact of alternative economic and business scenarios on the Firm's earnings and capital. Economic scenarios, and the parameters underlying those scenarios, are defined centrally and applied uniformly across the

Management's discussion and analysis

businesses. These scenarios are articulated in terms of macroeconomic factors, which are key drivers of business results; global market shocks, which generate short-term but severe trading losses; and idiosyncratic operational risk events. The scenarios are intended to capture and stress key vulnerabilities and idiosyncratic risks facing the Firm. However, when defining a broad range of scenarios, actual events can always be worse. Accordingly, management considers additional stresses outside these scenarios, as necessary. These results are reviewed by management and the Board of Directors.

Capital management oversight

With the reorganization of the Capital Management group into the Treasury and CIO organization, the Firm established a Capital Management oversight function within the CTC risk function. The CTC CRO, who reports to the Firm's CRO, is responsible for Firmwide Capital Management Oversight. Capital Management's Oversight responsibilities include:

- Establishing, calibrating and monitoring capital risk limits and indicators, including capital risk appetite tolerances;
- Performing independent assessment of the Firm's capital management activities; and
- Monitoring the Firm's capital position and balance sheet activities

In addition, the Basel Independent Review function ("BIR"), which is now a part of the IRM function, conducts independent assessments of the Firm's regulatory capital framework. These assessments are intended to ensure compliance with the applicable regulatory capital rules in support of senior management's responsibility for managing capital and for the DRPC's oversight of management in executing that responsibility.

Governance

Committees responsible for overseeing the Firm's capital management include the Capital Governance Committee, the Treasurer Committee and the ALCO. Capital management oversight is governed through the CTC risk committee. In addition, the DRPC approves the Firm's capital management oversight policy and reviews and recommends to the Board of Directors, for formal approval, the Firm's capital risk tolerances. For additional discussion on the DRPC and the ALCO, refer to Enterprise-wide Risk Management on pages 79-140.

Regulatory capital

The Federal Reserve establishes capital requirements, including well-capitalized standards, for the consolidated financial holding company. The OCC establishes similar minimum capital requirements for the Firm's national banks, including JPMorgan Chase Bank, N.A. and Chase Bank USA, N.A. The U.S. capital requirements generally follow the Capital Accord of the Basel Committee, as amended from time to time.

Basel III Overview

Capital rules under Basel III establish minimum capital ratios and overall capital adequacy standards for large and internationally active U.S. bank holding companies ("BHC") and banks, including the Firm and its IDI subsidiaries. Basel III sets forth two comprehensive approaches for calculating RWA: a standardized approach ("Basel III Standardized"), and an advanced approach ("Basel III Advanced"). Certain of the requirements of Basel III were subject to phase-in periods that began on January 1, 2014 and continued through the end of 2018 ("transitional period"). While the required capital remained subject to the transitional rules during 2018, the Firm's capital ratios as of December 31, 2018 were equivalent whether calculated on a transitional or fully phased-in basis.

Basel III establishes capital requirements for calculating credit risk RWA and market risk RWA, and in the case of Basel III Advanced, operational risk RWA. Key differences in the calculation of credit risk RWA between the Standardized and Advanced approaches are that for Basel III Advanced, credit risk RWA is based on risk-sensitive approaches which largely rely on the use of internal credit models and parameters, whereas for Basel III Standardized, credit risk RWA is generally based on supervisory risk-weightings which vary primarily by counterparty type and asset class. Market risk RWA is calculated on a generally consistent basis between Basel III Standardized and Basel III Advanced. In addition to the RWA calculated under these methodologies, the Firm may supplement such amounts to incorporate management judgment and feedback from its regulators.

Basel III also includes a requirement for Advanced Approach banking organizations, including the Firm, to calculate the SLR. For additional information on the SLR, refer to page 91.

Key Regulatory Developments

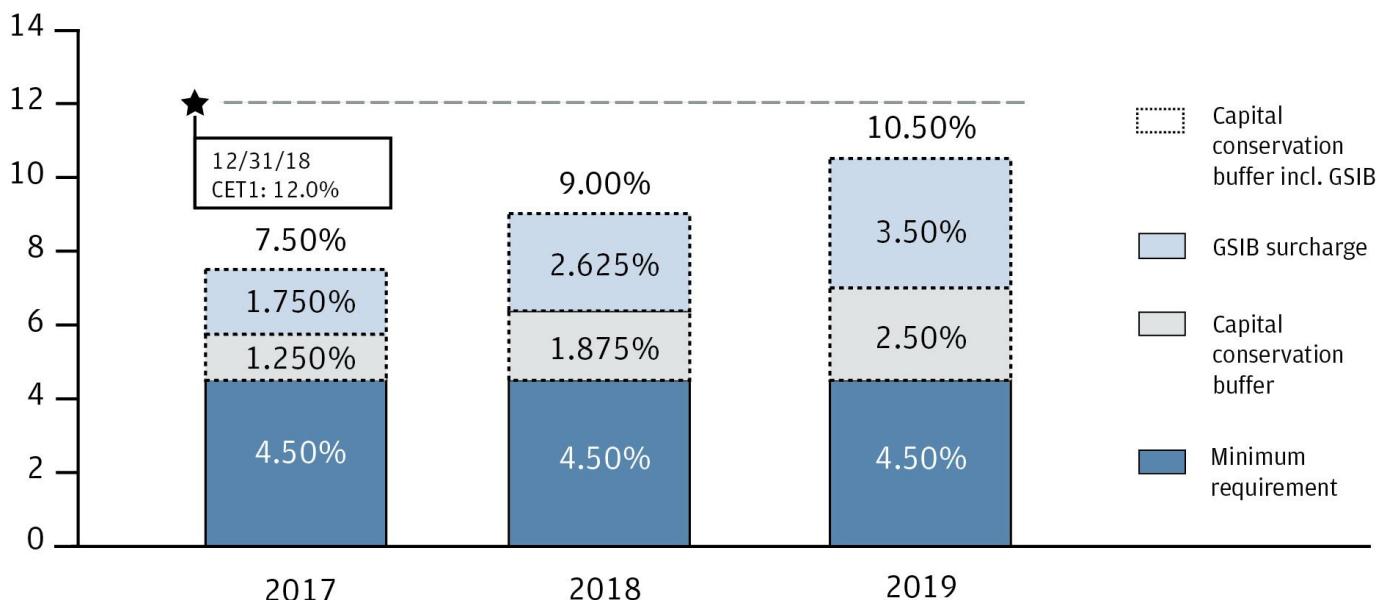
Banking supervisors globally continue to consider refinements and enhancements to the Basel III capital framework for financial institutions, and in December 2017, the Basel Committee issued Basel III: Finalizing post-crisis reforms ("Basel III Reforms"). The Basel Committee expects national regulatory authorities to implement the Basel III Reforms in the laws of their respective jurisdictions and to require banking organizations subject to such laws to meet most of the revised requirements by January 1, 2022, with certain elements being phased in through January 1, 2027.

In April 2018, the Federal Reserve proposed the introduction of a stress buffer framework that would create a single, integrated set of capital requirements by combining the supervisory stress test results of the CCAR assessment and those under the Dodd-Frank Act with current point-in-time capital requirements. The U.S. banking regulators will be proposing final requirements applicable to U.S. financial institutions.

Also in April 2018, the Federal Reserve and the OCC released a proposal to revise the enhanced supplementary leverage ratio (“eSLR”) requirements applicable to the U.S. global systemically important banks (“GSIBs”) and their IDIs and to make conforming changes to the rules which are applicable to U.S. GSIBs relating to TLAC and external long-term debt that must satisfy certain eligibility criteria.

Risk-based Capital Regulatory Minimums

The following chart presents the Basel III minimum CET1 capital ratio during the transitional periods and on a fully phased-in basis under the Basel III rules currently in effect.



The capital adequacy of the Firm and its IDI subsidiaries, both during the transitional period and upon full phase-in, is evaluated against the Basel III approach (Standardized or Advanced) which, for each quarter, results in the lower ratio. The Firm’s Basel III Standardized Fully Phased-In risk-based ratios are currently more binding than the Basel III Advanced Fully Phased-In risk-based ratios, and the Firm expects that this will remain the case for the foreseeable future.

Additional information regarding the Firm’s capital ratios, as well as the U.S. federal regulatory capital standards to which the Firm is subject, is presented in Note 26. For further information on the Firm’s Basel III measures, refer to the Firm’s Pillar 3 Regulatory Capital Disclosures reports, which are available on the Firm’s website (<https://jpmorganchaseco.gcs-web.com/financial-information/basel-pillar-3-us-lcr-disclosures>).

All banking institutions are currently required to have a minimum CET1 capital ratio of 4.5% of risk weighted assets. Certain banking organizations, including the Firm, are required to hold additional amounts of capital to serve as a “capital conservation buffer”. The capital conservation buffer is intended to be used to absorb potential losses in times of financial or economic stress. The capital conservation buffer was subject to a phase-in period that

began January 1, 2016 and continued through the end of 2018.

As an expansion of the capital conservation buffer, the Firm is also required to hold additional levels of capital in the form of a GSIB surcharge and a countercyclical capital buffer.

Under the Federal Reserve’s final rule, the Firm is required to calculate its GSIB surcharge on an annual basis under two separately prescribed methods, and is subject to the higher of the two. The first (“Method 1”), reflects the GSIB surcharge as prescribed by the Basel Committee’s assessment methodology, and is calculated across five criteria: size, cross-jurisdictional activity, interconnectedness, complexity and substitutability. The second (“Method 2”), modifies the Method 1 requirements to include a measure of short-term wholesale funding in place of substitutability, and introduces a GSIB score “multiplication factor”. The following table represents the Firm’s GSIB surcharge.

	2018	2017
Fully Phased-In:		
Method 1	2.50%	2.50%
Method 2	3.50%	3.50%
Transitional ^(a)	2.625%	1.75%

(a) The GSIB surcharge is subject to transition provisions (in 25% increments) through the end of 2018.

Management's discussion and analysis

The Firm's effective GSIB surcharge as calculated under Method 2 for 2019 is anticipated to be 3.5%.

The Federal Reserve's framework for setting the countercyclical capital buffer takes into account the macro financial environment in which large, internationally active banks function. As of December 31, 2018, the U.S. countercyclical capital buffer remained at 0%. The Federal Reserve will continue to review the buffer at least annually. The buffer can be increased if the Federal Reserve, FDIC and OCC determine that credit growth in the economy has become excessive and can be calibrated up to an additional 2.5% of RWA subject to a 12-month implementation period.

Failure to maintain regulatory capital equal to or in excess of the risk-based regulatory capital minimum plus the capital conservation buffer (inclusive of the GSIB surcharge) and any countercyclical buffer may result in limitations to the amount of capital that the Firm may distribute, such as through dividends and common equity repurchases.

Leverage-based Capital Regulatory Minimums

Supplementary leverage ratio

The SLR is defined as Tier 1 capital under Basel III divided by the Firm's total leverage exposure. Total leverage exposure is calculated by taking the Firm's total average on balance sheet assets, less amounts permitted to be deducted for Tier 1 capital, and adding certain off-balance sheet exposures, such as undrawn commitments and derivatives potential future exposure.

Failure to maintain an SLR ratio equal to or greater than the regulatory minimum may result in limitations on the amount of capital that the Firm may distribute.

In addition to meeting the capital ratio requirements of Basel III, the Firm and its IDI subsidiaries also must maintain minimum capital and leverage ratios in order to be "well-capitalized" under the regulations issued by the Federal Reserve and the Prompt Corrective Action ("PCA") requirements of the FDIC Improvement Act ("FDICIA"), respectively. For additional information, refer to Note 26.

The following tables present the Firm's Transitional and Fully Phased-In risk-based and leverage-based capital metrics under both the Basel III Standardized and Advanced Approaches. The Firm's Basel III ratios exceeded both the Transitional and Fully Phased-In regulatory minimums as of December 31, 2018 and 2017.

December 31, 2018 (in millions, except ratios)	Transitional/Fully Phased-In ^(c)		Transitional	Fully Phased-In
	Standardized	Advanced	Minimum capital ratios	Minimum capital ratios
Risk-based capital metrics:				
CET1 capital	\$ 183,474	\$ 183,474		
Tier 1 capital	209,093	209,093		
Total capital	237,511	227,435		
Risk-weighted assets	1,528,916	1,421,205		
CET1 capital ratio	12.0%	12.9%	9.0%	10.5%
Tier 1 capital ratio	13.7	14.7	10.5	12.0
Total capital ratio	15.5	16.0	12.5	14.0
Leverage-based capital metrics:				
Adjusted average assets ^(a)	\$ 2,589,887	\$ 2,589,887		
Tier 1 leverage ratio	8.1%	8.1%	4.0%	4.0%
Total leverage exposure	NA	\$ 3,269,988		
SLR ^(b)	NA	6.4%	NA	5.0% ^(b)

December 31, 2017 (in millions, except ratios)	Transitional			Fully Phased-In		
	Standardized	Advanced	Minimum capital ratios	Standardized	Advanced	Minimum capital ratios
Risk-based capital metrics:						
CET1 capital	\$ 183,300	\$ 183,300		\$ 183,244	\$ 183,244	
Tier 1 capital	208,644	208,644		208,564	208,564	
Total capital	238,395	227,933		237,960	227,498	
Risk-weighted assets	1,499,506	1,435,825		1,509,762	1,446,696	
CET1 capital ratio	12.2%	12.8%	7.50%	12.1%	12.7%	10.5%
Tier 1 capital ratio	13.9	14.5	9.00	13.8	14.4	12.0
Total capital ratio	15.9	15.9	11.00	15.8	15.7	14.0
Leverage-based capital metrics:						
Adjusted average assets ^(a)	\$ 2,514,270	\$ 2,514,270		\$ 2,514,822	\$ 2,514,822	
Tier 1 leverage ratio	8.3%	8.3%	4.0%	8.3%	8.3%	4.0%
Total leverage exposure	NA	\$ 3,204,463		NA	\$ 3,205,015	
SLR	NA	6.5%	NA	NA	6.5%	5.0% ^(b)

(a) Adjusted average assets, for purposes of calculating the Tier 1 leverage ratio, includes total quarterly average assets adjusted for on-balance sheet assets that are subject to deduction from Tier 1 capital, predominantly goodwill and other intangible assets.

(b) Effective January 1, 2018, the SLR was fully phased-in under Basel III. The December 31, 2017 amounts were calculated under the Basel III Transitional rules.

(c) The Firm's capital ratios as of December 31, 2018 were equivalent whether calculated on a transitional or fully phased-in basis.

The Firm believes that it will operate with a Basel III CET1 capital ratio between 11% and 12% over the medium term.

For additional information on the Firm, JPMorgan Chase Bank, N.A. and Chase Bank USA, N.A.'s capital, RWA and capital ratios under Basel III Standardized and Advanced Fully Phased-In rules and the SLR calculated under the Basel III Advanced Fully Phased-In rules, all of which are considered key regulatory capital measures, refer to Explanation and Reconciliation of the Firm's Use of Non-GAAP Financial Measures and Key Performance Measures on pages 57-59.

Management's discussion and analysis

Capital components

The following table presents reconciliations of total stockholders' equity to Basel III Fully Phased-In CET1 capital, Tier 1 capital and Basel III Advanced and Standardized Fully Phased-In Total capital as of December 31, 2018 and 2017.

(in millions)	December 31, 2018	December 31, 2017
Total stockholders' equity	\$ 256,515	\$ 255,693
Less: Preferred stock	26,068	26,068
Common stockholders' equity	230,447	229,625
Less:		
Goodwill	47,471	47,507
Other intangible assets	748	855
Other CET1 capital adjustments	1,034	223
Add:		
Deferred tax liabilities ^(a)	2,280	2,204
Standardized/Advanced Fully Phased-In CET1 capital	183,474	183,244
Preferred stock	26,068	26,068
Less:		
Other Tier 1 adjustments	449	748
Standardized/Advanced Fully Phased-In Tier 1 capital	209,093	208,564
Long-term debt and other instruments qualifying as Tier 2 capital	13,772	14,827
Qualifying allowance for credit losses	14,500	14,672
Other	146	(103)
Standardized Fully Phased-In Tier 2 capital	28,418	29,396
Standardized Fully Phased-in Total capital	237,511	237,960
Adjustment in qualifying allowance for credit losses for Advanced Tier 2 capital	(10,076)	(10,462)
Advanced Fully Phased-In Tier 2 capital	18,342	18,934
Advanced Fully Phased-In Total capital	\$ 227,435	\$ 227,498

(a) Represents certain deferred tax liabilities related to tax-deductible goodwill and identifiable intangibles created in nontaxable transactions, which are netted against goodwill and other intangibles when calculating TCE.

Capital rollforward

The following table presents the changes in Basel III Fully Phased-In CET1 capital, Tier 1 capital and Tier 2 capital for the year ended December 31, 2018.

Year Ended December 31, (in millions)	2018
Standardized/Advanced CET1 capital at December 31, 2017	\$ 183,244
Net income applicable to common equity	30,923
Dividends declared on common stock	(9,214)
Net purchase of treasury stock	(17,899)
Changes in additional paid-in capital	(1,417)
Changes related to AOCI	(1,203)
Adjustment related to DVA ^(a)	(1,165)
Changes related to other CET1 capital adjustments	205
Increase in Standardized/Advanced CET1 capital	230
Standardized/Advanced CET1 capital at December 31, 2018	183,474
Standardized/Advanced Tier 1 capital at December 31, 2017	208,564
Change in CET1 capital	230
Net issuance of noncumulative perpetual preferred stock	–
Other	299
Increase in Standardized/Advanced Tier 1 capital	529
Standardized/Advanced Tier 1 capital at December 31, 2018	209,093
Standardized Tier 2 capital at December 31, 2017	29,396
Change in long-term debt and other instruments qualifying as Tier 2	(1,055)
Change in qualifying allowance for credit losses	(172)
Other	249
Decrease in Standardized Tier 2 capital	(978)
Standardized Tier 2 capital at December 31, 2018	28,418
Standardized Total capital at December 31, 2018	237,511
Advanced Tier 2 capital at December 31, 2017	18,934
Change in long-term debt and other instruments qualifying as Tier 2	(1,055)
Change in qualifying allowance for credit losses	214
Other	249
Decrease in Advanced Tier 2 capital	(592)
Advanced Tier 2 capital at December 31, 2018	18,342
Advanced Total capital at December 31, 2018	\$ 227,435

(a) Includes DVA related to structured notes recorded in AOCI.

RWA rollforward

The following table presents changes in the components of RWA under Basel III Standardized and Advanced Fully Phased-In for the year ended December 31, 2018. The amounts in the rollforward categories are estimates, based on the predominant driver of the change.

Year ended December 31, 2018 (in millions)	Standardized			Advanced			
	Credit risk RWA	Market risk RWA	Total RWA	Credit risk RWA	Market risk RWA	Operational risk	Total RWA
December 31, 2017	\$ 1,386,060	\$ 123,702	\$ 1,509,762	\$ 922,905	\$ 123,791	\$ 400,000	\$ 1,446,696
Model & data changes ^(a)	(10,431)	(13,191)	(23,622)	3,750	(13,191)	–	(9,441)
Portfolio runoff ^(b)	(8,381)	–	(8,381)	(10,161)	–	–	(10,161)
Movement in portfolio levels ^(c)	55,805	(4,648)	51,157	10,153	(4,624)	(11,418)	(5,889)
Changes in RWA	36,993	(17,839)	19,154	3,742	(17,815)	(11,418)	(25,491)
December 31, 2018	\$ 1,423,053	\$ 105,863	\$ 1,528,916	\$ 926,647	\$ 105,976	\$ 388,582	\$ 1,421,205

(a) Model & data changes refer to material movements in levels of RWA as a result of revised methodologies and/or treatment per regulatory guidance (exclusive of rule changes).

(b) Portfolio runoff for credit risk RWA primarily reflects reduced risk from position rollofs in legacy portfolios in Home Lending.

(c) Movement in portfolio levels (inclusive of rule changes) refers to: changes in book size, composition, credit quality, and market movements for credit risk RWA; changes in position and market movements for market risk RWA; and updates to cumulative losses for operational risk RWA.

Supplementary leverage ratio

The following table presents the components of the Firm's Fully Phased-In SLR as of December 31, 2018 and 2017.

(in millions, except ratio)	December 31, 2018	December 31, 2017
Tier 1 capital	\$ 209,093	\$ 208,564
Total average assets	2,636,505	\$ 2,562,155
Less: Adjustments for deductions from Tier 1 capital	46,618	47,333
Total adjusted average assets ^(a)	2,589,887	2,514,822
Off-balance sheet exposures ^(b)	680,101	690,193
Total leverage exposure	\$ 3,269,988	\$ 3,205,015
SLR	6.4%	6.5%

(a) Adjusted average assets, for purposes of calculating the SLR, includes total quarterly average assets adjusted for on-balance sheet assets that are subject to deduction from Tier 1 capital, predominantly goodwill and other intangible assets.

(b) Off-balance sheet exposures are calculated as the average of the three month-end spot balances during the reporting quarter.

For JPMorgan Chase Bank, N.A.'s and Chase Bank USA, N.A.'s SLR ratios, refer to Note 26.

Line of business equity

Each business segment is allocated capital by taking into consideration capital levels of similarly rated peers and applicable regulatory capital requirements. ROE is measured and internal targets for expected returns are established as key measures of a business segment's performance.

The Firm's allocation methodology incorporates Basel III Standardized RWA, Basel III Advanced RWA, leverage, the GSIB surcharge, and a simulation of capital in a severe stress environment. On at least an annual basis, the assumptions and methodologies used in capital allocation are assessed and as a result, the capital allocated to lines of business may change. As of January 1, 2019, line of business capital allocations have increased due to a combination of changes in the relative weights toward Standardized RWA and stress, a higher capitalization rate, updated stress simulations, and general business growth.

The table below presents the Firm's assessed level of capital allocated to each line of business as of the dates indicated.

Line of business equity (Allocated capital)

(in billions)	January 1, 2019	December 31,	
		2018	2017
Consumer & Community Banking	\$ 52.0	\$ 51.0	\$ 51.0
Corporate & Investment Bank	80.0	70.0	70.0
Commercial Banking	22.0	20.0	20.0
Asset & Wealth Management	10.5	9.0	9.0
Corporate	65.9	80.4	79.6
Total common stockholders' equity	\$ 230.4	\$ 230.4	\$ 229.6

Capital actions

Preferred stock

Preferred stock dividends declared were \$1.6 billion for the year ended December 31, 2018.

On January 24, 2019, the Firm issued \$1.85 billion of 6.00% non-cumulative preferred stock, Series EE, and on January 30, 2019, the Firm announced that it will redeem all \$925 million of its outstanding 6.70% non-cumulative preferred stock, Series T, on March 1, 2019. On September 21, 2018, the Firm issued \$1.7 billion of 5.75% non-cumulative preferred stock, Series DD. On October 30, 2018, the Firm redeemed \$1.7 billion of its fixed-to-floating rate non-cumulative perpetual preferred stock, Series I.

On October 20, 2017, the Firm issued \$1.3 billion of fixed-to-floating rate non-cumulative preferred stock, Series CC, with an initial dividend rate of 4.625%. On December 1, 2017, the Firm redeemed all \$1.3 billion of its outstanding 5.50% non-cumulative preferred stock, Series O.

For additional information on the Firm's preferred stock, refer to Note 20.

Management's discussion and analysis

Trust preferred securities

On September 10, 2018, the Firm's last remaining issuer of outstanding trust preferred securities ("issuer trust") was liquidated, resulting in \$475 million of trust preferred securities and \$15 million of trust common securities originally issued by the issuer trust being cancelled.

On December 18, 2017, the Delaware trusts that issued seven series of outstanding trust preferred securities were liquidated, and \$1.6 billion of trust preferred and \$56 million of trust common securities originally issued by those trusts were cancelled.

For additional information, refer to Note 19.

Common stock dividends

The Firm's common stock dividends are planned as part of the Capital Management governance framework in line with the Firm's capital management objectives.

On September 18, 2018, the Firm announced that its Board of Directors increased the quarterly common stock dividend from \$0.56 per share to \$0.80 per share, effective with the dividend paid on October 31, 2018. The Firm's dividends are subject to the Board of Directors' approval on a quarterly basis.

For information regarding dividend restrictions, refer to Note 20 and Note 25.

The following table shows the common dividend payout ratio based on net income applicable to common equity.

Year ended December 31,	2018	2017	2016
Common dividend payout ratio	30%	33%	30%

Common equity

During the year ended December 31, 2018, warrant holders exercised their right to purchase 14.9 million shares of the Firm's common stock. The Firm issued from treasury stock 9.4 million shares of its common stock as a result of these exercises. There were no warrants outstanding at December 31, 2018, as any warrants that were not exercised on or before October 29, 2018, have expired. At December 31, 2017, the Firm had 15.0 million warrants outstanding.

Effective June 28, 2018, the Firm's Board of Directors authorized the repurchase of up to \$20.7 billion of common equity between July 1, 2018 and June 30, 2019, as part of its annual capital plan. As of December 31, 2018, \$10.4 billion of authorized repurchase capacity remained under the common equity repurchase program.

The following table sets forth the Firm's repurchases of common equity for the years ended December 31, 2018, 2017 and 2016. There were no repurchases of warrants during the years ended December 31, 2018, 2017 and 2016.

Year ended December 31, (in millions)	2018	2017	2016
Total number of shares of common stock repurchased	181.5	166.6	140.4
Aggregate purchase price of common stock repurchases	\$19,983	\$15,410	\$ 9,082

The Firm from time to time enters into written trading plans under Rule 10b5-1 of the Securities Exchange Act of 1934 to facilitate repurchases in accordance with the common equity repurchase program. A Rule 10b5-1 repurchase plan allows the Firm to repurchase its equity during periods when it would not otherwise be repurchasing common equity – for example, during internal trading blackout periods. All purchases under Rule 10b5-1 plans must be made according to predefined schedules established when the Firm is not aware of material nonpublic information.

The authorization to repurchase common equity will be utilized at management's discretion, and the timing of purchases and the exact amount of common equity that may be repurchased is subject to various factors, including market conditions; legal and regulatory considerations affecting the amount and timing of repurchase activity; the Firm's capital position (taking into account goodwill and intangibles); internal capital generation; and alternative investment opportunities. The repurchase program does not include specific price targets or timetables; may be executed through open market purchases or privately negotiated transactions, or utilizing Rule 10b5-1 plans; and may be suspended by management at any time.

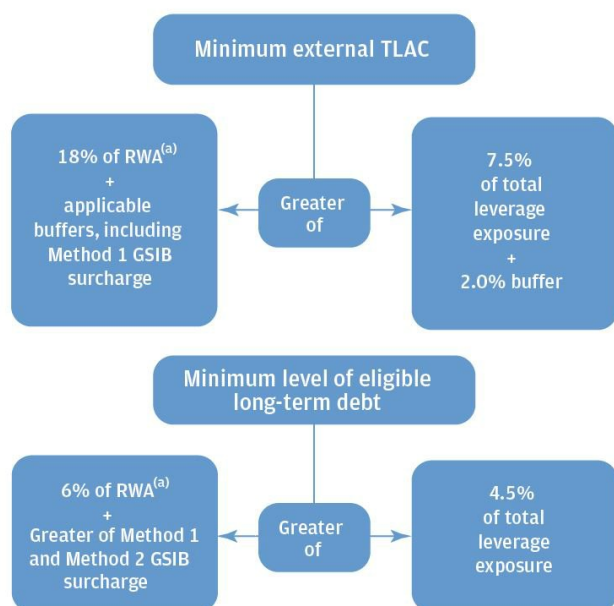
For additional information regarding repurchases of the Firm's equity securities, refer to Part II, Item 5: Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities on page 30.

Other capital requirements

Total Loss-Absorbing Capacity (“TLAC”)

On December 15, 2016, the Federal Reserve issued its final TLAC rule which requires the top-tier holding companies of eight U.S. GSIB holding companies, including the Firm, to maintain minimum levels of external TLAC and external long-term debt that satisfies certain eligibility criteria (“eligible LTD”), effective January 1, 2019.

The minimum external TLAC and the minimum level of eligible long-term debt requirements are shown below:



(a) RWA is the greater of Standardized and Advanced.

Failure to maintain TLAC equal to or in excess of the regulatory minimum plus applicable buffers may result in limitations to the amount of capital that the Firm may distribute, such as through dividends and common equity repurchases.

The final TLAC rule permanently grandfathered all long-term debt issued before December 31, 2016, to the extent these securities would be ineligible because they contained impermissible acceleration rights or were governed by non-U.S. law. As of December 31, 2018, the Firm exceeded the minimum requirements under the rule to which it became subject to on January 1, 2019.

The following table presents the eligible external TLAC and LTD amounts, as well as a representation of the amounts as a percentage of the Firm’s total RWA and total leverage exposure.

December 31, 2018			
(in billions, except ratio)	Eligible		
	External TLAC	Eligible LTD	
Total eligible TLAC & LTD	\$ 380.5	\$ 160.5	
% of RWA	24.9%	10.5%	
Minimum requirement	23.0	9.5	
Surplus/(shortfall)	\$ 28.9	\$ 15.3	
% of total leverage exposure	11.6%	4.9%	
Minimum requirement ^(a)	9.5	4.5	
Surplus/(shortfall)	\$ 69.9	\$ 13.4	

For information on the financial consequences to holders of the Firm’s debt and equity securities in a resolution scenario, refer to Part I, Item 1A: Risk Factors on pages 7-28 of the Firm’s 2018 Form 10-K.

Management’s discussion and analysis

Broker-dealer regulatory capital

J.P. Morgan Securities

JPMorgan Chase’s principal U.S. broker-dealer subsidiary is J.P. Morgan Securities. J.P. Morgan Securities is subject to Rule 15c3-1 under the Securities Exchange Act of 1934 (the “Net Capital Rule”). J.P. Morgan Securities is also registered as a futures commission merchant and subject to Rule 1.17 of the CFTC.

J.P. Morgan Securities has elected to compute its minimum net capital requirements in accordance with the “Alternative Net Capital Requirements” of the Net Capital Rule.

Under the market and credit risk standards of Appendix E of the Net Capital Rule, J.P. Morgan Securities is eligible to use the alternative method of computing net capital if, in addition to meeting its minimum net capital requirements, it maintains tentative net capital of at least \$1.0 billion. J.P. Morgan Securities is required to notify the SEC in the event that tentative net capital is less than \$5.0 billion. As of December 31, 2018, J.P. Morgan Securities maintained tentative net capital in excess of the minimum and notification requirements.

The following table presents J.P.Morgan Securities’ net capital information:

December 31, 2018 (in millions)	Net capital	
	Actual	Minimum
J.P. Morgan Securities	\$ 16,648	\$ 3,069

J.P. Morgan Securities plc

J.P. Morgan Securities plc is a wholly-owned subsidiary of JPMorgan Chase Bank, N.A. and is the Firm’s principal operating subsidiary in the U.K. It has authority to engage in banking, investment banking and broker-dealer activities.

J.P. Morgan Securities plc is jointly regulated by the PRA and the FCA. J.P. Morgan Securities plc is subject to the European Union Capital Requirements Regulation and the PRA capital rules, each of which implemented Basel III and thereby subject J.P. Morgan Securities plc to its requirements.

The following table presents J.P. Morgan Securities plc’s capital information:

December 31, 2018 (in millions, except ratios)	Total capital ^(a)	CET1 ratio		Total capital ratio	
	Estimated	Estimated	Minimum	Estimated	Minimum
J.P. Morgan Securities plc	\$ 53,086	17.4%	4.5%	22.5%	8.0%

(a) Includes the tier 2 qualifying subordinated debt securities issued to meet the MREL requirements to which J.P. Morgan Securities plc became subject to on January 1, 2019. For additional information on MREL, refer to Supervision & Regulation on pages 1-6

LIQUIDITY RISK MANAGEMENT

Liquidity risk is the risk that the Firm will be unable to meet its contractual and contingent financial obligations as they arise or that it does not have the appropriate amount, composition and tenor of funding and liquidity to support its assets and liabilities.

Liquidity risk oversight

The Firm has a liquidity risk oversight function whose primary objective is to provide assessment, measurement, monitoring, and control of liquidity risk across the Firm. Liquidity risk oversight is managed through a dedicated firmwide Liquidity Risk Oversight group. The CTC CRO, who reports to the Firm's CRO, is responsible for firmwide Liquidity Risk Oversight. Liquidity Risk Oversight's responsibilities include:

- Establishing and monitoring limits and indicators, including liquidity risk appetite tolerances;
- Monitoring and reporting internal firmwide and legal entity liquidity stress tests as well as regulatory defined liquidity stress tests;
- Approving or escalating for review new or updated liquidity stress assumptions;
- Monitoring liquidity positions, balance sheet variances and funding activities;
- Conducting ad hoc analysis to identify potential emerging liquidity risks; and
- Performing independent review of liquidity risk management processes.

Liquidity management

Treasury and CIO is responsible for liquidity management. The primary objectives of effective liquidity management are to:

- Ensure that the Firm's core businesses and material legal entities are able to operate in support of client needs and meet contractual and contingent financial obligations through normal economic cycles as well as during stress events, and
- Manage an optimal funding mix and availability of liquidity sources.

As part of the Firm's overall liquidity management strategy, the Firm manages liquidity and funding using a centralized, global approach in order to:

- Optimize liquidity sources and uses;
- Monitor exposures;
- Identify constraints on the transfer of liquidity between the Firm's legal entities; and
- Maintain the appropriate amount of surplus liquidity at a firmwide and legal entity level, where relevant.

In the context of the Firm's liquidity management, Treasury and CIO is responsible for:

- Analyzing and understanding the liquidity characteristics of the assets and liabilities of the Firm, lines of business

and legal entities, taking into account legal, regulatory, and operational restrictions;

- Developing internal liquidity stress testing assumptions;
- Defining and monitoring firmwide and legal entity-specific liquidity strategies, policies, reporting and contingency funding plans;
- Managing liquidity within the Firm's approved liquidity risk appetite tolerances and limits;
- Managing compliance with regulatory requirements related to funding and liquidity risk; and
- Setting transfer pricing in accordance with underlying liquidity characteristics of balance sheet assets and liabilities as well as certain off-balance sheet items.

Risk governance

Committees responsible for liquidity governance include the firmwide ALCO as well as line of business and regional ALCOs, the Treasurer Committee, and the CTC Risk Committee. In addition, the DRPC reviews and recommends to the Board of Directors, for formal approval, the Firm's liquidity risk tolerances, liquidity strategy, and liquidity policy at least annually. For further discussion of ALCO and other risk-related committees, refer to Enterprise-wide Risk Management on pages 79-140.

Internal stress testing

Liquidity stress tests are intended to ensure that the Firm has sufficient liquidity under a variety of adverse scenarios, including scenarios analyzed as part of the Firm's resolution and recovery planning. Stress scenarios are produced for JPMorgan Chase & Co. ("Parent Company") and the Firm's material legal entities on a regular basis, and ad hoc stress tests are performed, as needed, in response to specific market events or concerns. Liquidity stress tests assume all of the Firm's contractual financial obligations are met and take into consideration:

- Varying levels of access to unsecured and secured funding markets,
- Estimated non-contractual and contingent cash outflows, and
- Potential impediments to the availability and transferability of liquidity between jurisdictions and material legal entities such as regulatory, legal or other restrictions.

Liquidity outflow assumptions are modeled across a range of time horizons and currency dimensions and contemplate both market and idiosyncratic stresses.

Results of stress tests are considered in the formulation of the Firm's funding plan and assessment of its liquidity position. The Parent Company acts as a source of funding for the Firm through equity and long-term debt issuances, and the IHC provides funding support to the ongoing operations of the Parent Company and its subsidiaries, as necessary. The Firm maintains liquidity at the Parent Company and the IHC, in addition to liquidity held at the

Management’s discussion and analysis

operating subsidiaries, at levels sufficient to comply with liquidity risk tolerances and minimum liquidity requirements, and to manage through periods of stress where access to normal funding sources is disrupted.

Contingency funding plan

The Firm’s contingency funding plan (“CFP”), which is approved by the firmwide ALCO and the DRPC, is a compilation of procedures and action plans for managing liquidity through stress events. The CFP incorporates the limits and indicators set by the Liquidity Risk Oversight group. These limits and indicators are reviewed regularly to identify emerging risks or vulnerabilities in the Firm’s liquidity position. The CFP identifies the alternative contingent funding and liquidity resources available to the Firm and its legal entities in a period of stress.

Liquidity Coverage Ratio

The LCR rule requires the Firm to maintain an amount of unencumbered High Quality Liquid Assets (“HQLA”) that is sufficient to meet its estimated total net cash outflows over a prospective 30 calendar-day period of significant stress. HQLA is the amount of liquid assets that qualify for inclusion in the LCR. HQLA primarily consist of unencumbered cash and certain high quality liquid securities as defined in the LCR rule.

Under the LCR rule, the amounts of HQLA held by JPMorgan Chase Bank N.A. and Chase Bank USA, N.A that are in excess of each entity’s standalone 100% minimum LCR requirement, and that are not transferable to non-bank affiliates, must be excluded from the Firm’s reported HQLA. The LCR is required to be a minimum of 100%.

The following table summarizes the Firm’s average LCR for the three months ended December 31, 2018, September 30, 2018 and December 31, 2017 based on the Firm’s current interpretation of the finalized LCR framework.

Average amount (in millions)	Three months ended		
	December 31, 2018	September 30, 2018	December 31, 2017
HQLA			
Eligible cash ^(a)	\$ 297,069	\$ 344,660	\$ 370,126
Eligible securities ^{(b)(c)}	232,201	190,349	189,955
Total HQLA^(d)	\$ 529,270	\$ 535,009	\$ 560,081
Net cash outflows	\$ 467,704	\$ 466,803	\$ 472,078
LCR	113%	115%	119%
Net excess HQLA^(d)	\$ 61,566	\$ 68,206	\$ 88,003

(a) Represents cash on deposit at central banks, primarily Federal Reserve Banks.

(b) Predominantly U.S. Treasuries, U.S. Agency MBS, and sovereign bonds net of applicable haircuts under the LCR rules.

(c) HQLA eligible securities may be reported in securities borrowed or purchased under resale agreements, trading assets, or investment securities on the Firm’s Consolidated balance sheets.

(d) Excludes average excess HQLA at JPMorgan Chase Bank, N.A. and Chase Bank USA, N.A. that are not transferable to non-bank affiliates.

The Firm’s average LCR decreased during the three months ended December 31, 2018, compared with the three month period ended September 30, 2018 due to a decrease in the average amount of reportable HQLA. Although HQLA increased in JPMorgan Chase Bank, N.A. during the period,

there was a decrease in the amount of HQLA in JPMorgan Chase Bank, N.A. and Chase Bank USA, N.A. that was determined to be transferable to non-bank affiliates. This decrease was based on a change in the Firm’s interpretation of amounts available for transfer.

The Firm’s average LCR decreased for the three months ended December 31, 2018, compared with the prior year period, due to a reduction in average HQLA primarily driven by (a) long-term debt maturities and CIB activities, and (b) a decrease in the amount of HQLA in JPMorgan Chase Bank, N.A. and Chase Bank USA, N.A that was determined to be transferable to non-bank affiliates based on a change in the Firm’s interpretation of amounts available for transfer.

The Firm’s average LCR may fluctuate from period to period, due to changes in its HQLA and estimated net cash outflows under the LCR as a result of ongoing business activity. The Firm’s HQLA are expected to be available to meet its liquidity needs in a time of stress. For a further discussion of the Firm’s LCR, refer to the Firm’s US LCR Disclosure reports, which are available on the Firm’s website at: (<https://jpmorganchaseco.gcs-web.com/financial-information/basel-pillar-3-us-lcr-disclosures>).

Other liquidity sources

As of December 31, 2018, in addition to assets reported in the Firm’s HQLA under the LCR rule, the Firm had approximately \$226 billion of unencumbered marketable securities, such as equity securities and fixed income debt securities, available to raise liquidity, if required. This includes HQLA-eligible securities included as part of the excess liquidity at JPMorgan Chase Bank, N.A. that are not transferable to non-bank affiliates.

As of December 31, 2018, the Firm also had approximately \$276 billion of available borrowing capacity at various FHLBs, discount windows at the Federal Reserve Banks and various other central banks as a result of collateral pledged by the Firm to such banks. This borrowing capacity excludes the benefit of securities reported in the Firm’s HQLA or other unencumbered securities that are currently pledged at the Federal Reserve Bank discount windows. Although available, the Firm does not view the borrowing capacity at Federal Reserve Bank discount windows and the various other central banks as a primary source of liquidity.

Funding

Sources of funds

Management believes that the Firm's unsecured and secured funding capacity is sufficient to meet its on- and off-balance sheet obligations.

The Firm funds its global balance sheet through diverse sources of funding including a stable deposit franchise as well as secured and unsecured funding in the capital markets. The Firm's loan portfolio is funded with a portion of the Firm's deposits, through securitizations and, with respect to a portion of the Firm's real estate-related loans, with secured borrowings from the FHLBs. Deposits in excess of the amount utilized to fund loans are primarily invested by Treasury and CIO in the Firm's investment securities portfolio or deployed in cash or other short-term liquid investments based on their interest rate and liquidity risk

characteristics. Securities borrowed or purchased under resale agreements and trading assets-debt and equity instruments are primarily funded by the Firm's securities loaned or sold under agreements to repurchase, trading liabilities-debt and equity instruments, and a portion of the Firm's long-term debt and stockholders' equity. In addition to funding securities borrowed or purchased under resale agreements and trading assets-debt and equity instruments, proceeds from the Firm's debt and equity issuances are used to fund certain loans and other financial and non-financial assets, or may be invested in the Firm's investment securities portfolio. Refer to the discussion below for additional information relating to Deposits, Short-term funding, and Long-term funding and issuance.

Deposits

The table below summarizes, by line of business, the period-end and average deposit balances as of and for the years ended December 31, 2018 and 2017.

Deposits As of or for the year ended December 31, (in millions)	Year ended December 31,			
			Average	
	2018	2017	2018	2017
Consumer & Community Banking	\$ 678,854	\$ 659,885	\$ 670,388	\$ 640,219
Corporate & Investment Bank	482,084	455,883	477,250	447,697
Commercial Banking	170,859	181,512	170,822	176,884
Asset & Wealth Management	138,546	146,407	137,272	148,982
Corporate	323	295	729	3,604
Total Firm	\$ 1,470,666	\$ 1,443,982	\$ 1,456,461	\$ 1,417,386

A key strength of the Firm is its diversified deposit franchise, through each of its lines of business, which provides a stable source of funding and limits reliance on the wholesale funding markets. A significant portion of the Firm's deposits are consumer and wholesale operating deposits, which are both considered to be stable sources of liquidity. Wholesale operating deposits are considered to be stable sources of liquidity because they are generated from customers that maintain operating service relationships with the Firm.

The table below shows the loan and deposit balances, the loans-to-deposits ratios, and deposits as a percentage of total liabilities, as of December 31, 2018 and 2017.

As of December 31, (in billions except ratios)	2018	2017
Deposits	\$ 1,470.7	\$ 1,444.0
Deposits as a % of total liabilities	62%	63%
Loans	984.6	930.7
Loans-to-deposits ratio	67%	64%

The Firm believes that average deposit balances are generally more representative of deposit trends than period-end deposit balances.

Average deposits increased for the year ended December 31, 2018 in CCB and CIB, partially offset by decreases in AWM, CB and Corporate.

- The increase in CCB reflects the continuation of growth from new accounts, and in CIB reflects growth in operating deposits in both Treasury Services and Securities Services driven by growth in client activity.
- The decrease in AWM was driven by balance migration predominantly into the Firm's investment-related products. The decrease in CB was driven by a reduction in non-operating deposits. The decrease in Corporate was predominantly due to maturities of wholesale non-operating deposits, consistent with the Firm's efforts to reduce such deposits.

For further information on deposit and liability balance trends, refer to the discussion of the Firm's Business Segment Results and the Consolidated Balance Sheets Analysis on pages 60-78 and pages 52-53, respectively.

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The following table summarizes short-term and long-term funding, excluding deposits, as of December 31, 2018 and 2017, and average balances for the years ended December 31, 2018 and 2017. For additional information, refer to the Consolidated Balance Sheets Analysis on pages 52-53 and Note 19.

Sources of funds (excluding deposits)

As of or for the year ended December 31, (in millions)	2018	2017	Average	
			2018	2017
Commercial paper	\$ 30,059	\$ 24,186	\$ 27,834	\$ 19,920
Other borrowed funds ^(a)	8,789	10,727	11,369	10,755
Total short-term unsecured funding^(a)	\$ 38,848	\$ 34,913	\$ 39,203	\$ 30,675
Securities sold under agreements to repurchase ^{(a)(b)}	\$ 171,975	\$ 147,713	\$ 177,629	\$ 173,450
Securities loaned ^{(a)(b)}	9,481	9,211	10,692	12,798
Other borrowed funds ^{(a)(c)}	30,428	16,889	24,320	15,857
Obligations of Firm-administered multi-seller conduits ^(d)	4,843	3,045	3,396	3,206
Total short-term secured funding^(a)	\$ 216,727	\$ 176,858	\$ 216,037	\$ 205,311
Senior notes	\$ 162,733	\$ 155,852	\$ 153,162	\$ 154,352
Trust preferred securities	—	690	471	2,276
Subordinated debt	16,743	16,553	16,178	18,832
Structured notes ^(e)	53,090	45,727	49,640	42,918
Total long-term unsecured funding	\$ 232,566	\$ 218,822	\$ 219,451	\$ 218,378
Credit card securitization ^(d)	\$ 13,404	\$ 21,278	\$ 15,900	\$ 25,933
Other securitizations ^{(d)(f)}	—	—	—	626
Federal Home Loan Bank ("FHLB") advances	44,455	60,617	52,121	69,916
Other long-term secured funding ^(g)	5,010	4,641	4,842	3,195
Total long-term secured funding	\$ 62,869	\$ 86,536	\$ 72,863	\$ 99,670
Preferred stock^(h)	\$ 26,068	\$ 26,068	\$ 26,249	\$ 26,212
Common stockholders' equity^(h)	\$ 230,447	\$ 229,625	\$ 229,222	\$ 230,350

(a) The prior period amounts have been revised to conform with the current period presentation.

(b) Primarily consists of short-term securities loaned or sold under agreements to repurchase.

(c) Includes FHLB advances with original maturities of less than one year of \$11.4 billion as of December 31, 2018; there were no FHLB advances with original maturities of less than one year as of December 31, 2017.

(d) Included in beneficial interests issued by consolidated variable interest entities on the Firm's Consolidated balance sheets.

(e) Includes certain TLAC-eligible long-term unsecured debt issued by the Parent Company.

(f) Other securitizations includes securitizations of student loans. The Firm deconsolidated the student loan securitization entities in the second quarter of 2017 as it no longer had a controlling financial interest in these entities as a result of the sale of the student loan portfolio. The Firm's wholesale businesses also securitize loans for client-driven transactions, which are not considered to be a source of funding for the Firm and are not included in the table.

(g) Includes long-term structured notes which are secured.

(h) For additional information on preferred stock and common stockholders' equity refer to Capital Risk Management on pages 85-94, Consolidated statements of changes in stockholders' equity, Note 20 and Note 21.

Short-term funding

The Firm's sources of short-term secured funding primarily consist of securities loaned or sold under agreements to repurchase. These instruments are secured predominantly by high-quality securities collateral, including government-issued debt and agency MBS, and constitute a significant portion of the federal funds purchased and securities loaned or sold under repurchase agreements on the Consolidated balance sheets. The increase at December 31, 2018, compared to December 31, 2017, was primarily due to higher client-driven market-making activities and higher secured financing of trading assets-debt and equity instruments in CIB. The balances associated with securities loaned or sold under agreements to repurchase fluctuate over time due to customers' investment and financing activities; the Firm's demand for financing; the ongoing management of the mix of the Firm's liabilities, including its secured and unsecured financing (for both the investment

securities and market-making portfolios); and other market and portfolio factors.

The Firm's sources of short-term unsecured funding primarily consist of issuance of wholesale commercial paper. The increase in commercial paper was due to higher net issuance primarily for short-term liquidity management.

Long-term funding and issuance

Long-term funding provides additional sources of stable funding and liquidity for the Firm. The Firm's long-term funding plan is driven primarily by expected client activity, liquidity considerations, and regulatory requirements, including TLAC. Long-term funding objectives include maintaining diversification, maximizing market access and optimizing funding costs. The Firm evaluates various funding markets, tenors and currencies in creating its optimal long-term funding plan.

The significant majority of the Firm's long-term unsecured funding is issued by the Parent Company to provide maximum flexibility in support of both bank and non-bank subsidiary funding needs. The Parent Company advances substantially all net funding proceeds to its subsidiary, the IHC. The IHC does not issue debt to external counterparties. The following table summarizes long-term unsecured issuance and maturities or redemptions for the years ended December 31, 2018 and 2017. For additional information, refer to Note 19.

Long-term unsecured funding

Year ended December 31,	2018		2017					
(Notional in millions)	Parent Company ^(b)		Subsidiaries ^(b)					
Issuance								
Senior notes issued in the U.S. market	\$	22,000	\$	21,250	\$	9,562	\$	62
Senior notes issued in non-U.S. markets		1,502		2,220		–		–
Total senior notes		23,502		23,470		9,562		62
Structured notes ^(a)		2,444		2,516		25,410		26,524
Total long-term unsecured funding - issuance	\$	25,946	\$	25,986	\$	34,972	\$	26,586
Maturities/redemptions								
Senior notes	\$	19,141	\$	20,971	\$	4,466	\$	1,366
Subordinated debt		136		3,401		–		3,500
Structured notes		2,678		5,440		15,049		17,141
Total long-term unsecured funding - maturities/redemptions	\$	21,955	\$	29,812	\$	19,515	\$	22,007

(a) Includes certain TLAC-eligible long-term unsecured debt issued by the Parent Company.

(b) The prior period amounts have been revised to conform with the current period presentation.

The Firm raises secured long-term funding through securitization of consumer credit card loans and advances from the FHLBs. The following table summarizes the securitization issuance and FHLB advances and their respective maturities or redemptions for the years ended December 31, 2018 and 2017.

Long-term secured funding

Year ended December 31,	Issuance		Maturities/Redemptions					
(in millions)	2018	2017	2018	2017				
Credit card securitization	\$	1,396	\$	1,545	\$	9,250	\$	11,470
Other securitizations ^(a)		–		–		–		55
FHLB advances		9,000		–		25,159		18,900
Other long-term secured funding ^(b)		377		2,354		289		731
Total long-term secured funding	\$	10,773	\$	3,899	\$	34,698	\$	31,156

(a) Other securitizations includes securitizations of student loans. The Firm deconsolidated the student loan securitization entities in the second quarter of 2017 as it no longer had a controlling financial interest in these entities as a result of the sale of the student loan portfolio.

(b) Includes long-term structured notes which are secured.

The Firm's wholesale businesses also securitize loans for client-driven transactions; those client-driven loan securitizations are not considered to be a source of funding for the Firm and are not included in the table above. For further description of the client-driven loan securitizations, refer to Note 14.

Management's discussion and analysis

Credit ratings

The cost and availability of financing are influenced by credit ratings. Reductions in these ratings could have an adverse effect on the Firm's access to liquidity sources, increase the cost of funds, trigger additional collateral or funding requirements and decrease the number of investors and counterparties willing to lend to the Firm. Additionally, the Firm's funding requirements for VIEs and other third-

party commitments may be adversely affected by a decline in credit ratings. For additional information on the impact of a credit ratings downgrade on the funding requirements for VIEs, and on derivatives and collateral agreements, refer to SPEs on page 55, and liquidity risk and credit-related contingent features in Note 5.

The credit ratings of the Parent Company and the Firm's principal bank and non-bank subsidiaries as of December 31, 2018, were as follows.

December 31, 2018	JPMorgan Chase & Co.			JPMorgan Chase Bank, N.A. Chase Bank USA, N.A.			J.P. Morgan Securities LLC J.P. Morgan Securities plc		
	Long-term issuer	Short-term issuer	Outlook	Long-term issuer	Short-term issuer	Outlook	Long-term issuer	Short-term issuer	Outlook
Moody's Investors Service	A2	P-1	Stable	Aa2	P-1	Stable	Aa3	P-1	Stable
Standard & Poor's	A-	A-2	Stable	A+	A-1	Stable	A+	A-1	Stable
Fitch Ratings	AA-	F1+	Stable	AA	F1+	Stable	AA	F1+	Stable

On October 25, 2018, Moody's upgraded the Parent Company's long-term issuer rating to A2 (previously A3) and short-term issuer rating to P-1 (previously P-2). The long-term issuer ratings were also upgraded for JPMorgan Chase Bank, N.A. and Chase Bank USA, N.A. to Aa2 (previously Aa3), and for J.P. Morgan Securities LLC and J.P. Morgan Securities plc to Aa3 (previously A1).

On June 21, 2018, Fitch upgraded the Parent Company's long-term issuer rating to AA- (previously A+) and short-term issuer rating to F1+ (previously F1). The long-term issuer ratings were also upgraded to AA for JPMorgan Chase Bank, N.A., Chase Bank USA, N.A., J.P. Morgan Securities LLC and J.P. Morgan Securities plc (all previously AA-).

Downgrades of the Firm's long-term ratings by one or two notches could result in an increase in its cost of funds, and access to certain funding markets could be reduced. The nature and magnitude of the impact of ratings downgrades depends on numerous contractual and behavioral factors which the Firm believes are incorporated in its liquidity risk and stress testing metrics. The Firm believes that it

maintains sufficient liquidity to withstand a potential decrease in funding capacity due to ratings downgrades.

JPMorgan Chase's unsecured debt does not contain requirements that would call for an acceleration of payments, maturities or changes in the structure of the existing debt, provide any limitations on future borrowings or require additional collateral, based on unfavorable changes in the Firm's credit ratings, financial ratios, earnings, or stock price.

Critical factors in maintaining high credit ratings include a stable and diverse earnings stream, strong capital and liquidity ratios, strong credit quality and risk management controls, and diverse funding sources. Rating agencies continue to evaluate economic and geopolitical trends, regulatory developments, future profitability, risk management practices, and litigation matters, as well as their broader ratings methodologies. Changes in any of these factors could lead to changes in the Firm's credit ratings.

REPUTATION RISK MANAGEMENT

Reputation risk is the potential that an action, inaction, transaction, investment or event will reduce trust in the Firm's integrity or competence by its various constituents, including clients, counterparties, customers, investors, regulators, employees, communities or the broader public.

Organization and management

Reputation Risk Management is an independent risk management function that establishes the governance framework for managing reputation risk across the Firm. The Firmwide Risk Executive for Reputation Risk reports to the Firm's CRO.

The Firm's reputation risk management function includes the following activities:

- Establishing a firmwide Reputation Risk Governance policy and standards
- Managing the governance infrastructure and processes that support consistent identification, escalation, management and monitoring of reputation risk issues firmwide
- Providing oversight to LOB Reputation Risk Offices ("RRO") on certain situations that have the potential to damage the reputation of the LOB or the Firm

The types of events that give rise to reputation risk are broad and could be introduced in various ways, including by the Firm's employees and the clients, customers and counterparties with which the Firm does business. These events could result in financial losses, litigation and regulatory fines, as well as other damages to the Firm. As reputation risk is inherently difficult to identify, manage, and quantify, an independent reputation risk management governance function is critical.

Governance and oversight

The Firm's Reputation Risk Governance policy establishes the principles for managing reputation risk for the Firm, and is approved annually by the Directors' Risk Policy Committee. It is the responsibility of employees in each LOB and Corporate to consider the reputation of the Firm when deciding whether to offer a new product, engage in a transaction or client relationship, enter a new jurisdiction, initiate a business process or other matters. Increasingly, sustainability, social responsibility and environmental impacts are important considerations in assessing the Firm's reputation risk, and are considered as part of reputation risk governance.

The Firm's reputation risk governance framework applies to each LOB and Corporate. Each LOB RRO advises their business on potential reputation risk issues and provides oversight of policy and standards created to guide the identification and assessment of reputation risk. LOB Reputation Risk Committees and forums review and assess reputation risk for their respective businesses. Each function also applies appropriate diligence to reputation risk arising from their day-to-day activities. Reputation risk issues deemed significant are escalated to the appropriate LOB Risk Committee and/or to the Firmwide Risk Committee.

CREDIT AND INVESTMENT RISK MANAGEMENT

Credit and investment risk is the risk associated with the default or change in credit profile of a client, counterparty or customer; or loss of principal or a reduction in expected returns on investments, including consumer credit risk, wholesale credit risk, and investment portfolio risk.

Credit risk management

Credit risk is the risk associated with the default or change in credit profile of a client, counterparty or customer. The Firm provides credit to a variety of customers, ranging from large corporate and institutional clients to individual consumers and small businesses. In its consumer businesses, the Firm is exposed to credit risk primarily through its home lending, credit card, auto, and business banking businesses. In its wholesale businesses, the Firm is exposed to credit risk through its underwriting, lending, market-making, and hedging activities with and for clients and counterparties, as well as through its operating services activities (such as cash management and clearing activities), securities financing activities, investment securities portfolio, and cash placed with banks.

Credit Risk Management is an independent risk management function that monitors, measures and manages credit risk throughout the Firm and defines credit risk policies and procedures. The credit risk function reports to the Firm's CRO. The Firm's credit risk management governance includes the following activities:

- Establishing a comprehensive credit risk policy framework
- Monitoring, measuring and managing credit risk across all portfolio segments, including transaction and exposure approval
- Setting industry and geographic concentration limits, as appropriate, and establishing underwriting guidelines
- Assigning and managing credit authorities in connection with the approval of all credit exposure
- Managing criticized exposures and delinquent loans
- Estimating credit losses and ensuring appropriate credit risk-based capital management

Risk identification and measurement

The Credit Risk Management function monitors, measures, manages and limits credit risk across the Firm's businesses. To measure credit risk, the Firm employs several methodologies for estimating the likelihood of obligor or counterparty default. Methodologies for measuring credit risk vary depending on several factors, including type of asset (e.g., consumer versus wholesale), risk measurement parameters (e.g., delinquency status and borrower's credit score versus wholesale risk-rating) and risk management and collection processes (e.g., retail collection center versus centrally managed workout groups). Credit risk measurement is based on the probability of default of an obligor or counterparty, the loss severity given a default event and the exposure at default.

Based on these factors and related market-based inputs, the Firm estimates credit losses for its exposures. Probable credit losses inherent in the consumer and wholesale held-for-investment loan portfolios are reflected in the allowance for loan losses, and probable credit losses inherent in lending-related commitments are reflected in the allowance for lending-related commitments. These losses are estimated using statistical analyses and other factors as described in Note 13. In addition, potential and unexpected credit losses are reflected in the allocation of credit risk capital and represent the potential volatility of actual losses relative to the established allowances for loan losses and lending-related commitments. The analyses for these losses include stress testing that considers alternative economic scenarios as described in the Stress testing section below. For further information, refer to Critical Accounting Estimates used by the Firm on pages 141-143.

The methodologies used to estimate credit losses depend on the characteristics of the credit exposure, as described below.

Scored exposure

The scored portfolio is generally held in CCB and predominantly includes residential real estate loans, credit card loans, and certain auto and business banking loans. For the scored portfolio, credit loss estimates are based on statistical analysis of credit losses over discrete periods of time. The statistical analysis uses portfolio modeling, credit scoring, and decision-support tools, which consider loan-level factors such as delinquency status, credit scores, collateral values, and other risk factors. Credit loss analyses also consider, as appropriate, uncertainties and other factors, including those related to current macroeconomic and political conditions, the quality of underwriting standards, and other internal and external factors. The factors and analysis are updated on a quarterly basis or more frequently as market conditions dictate.

Risk-rated exposure

Risk-rated portfolios are generally held in CIB, CB and AWM, but also include certain business banking and auto dealer loans held in CCB that are risk-rated because they have characteristics similar to commercial loans. For the risk-rated portfolio, credit loss estimates are based on estimates of the probability of default (“PD”) and loss severity given a default. The probability of default is the likelihood that a borrower will default on its obligation; the loss given default (“LGD”) is the estimated loss on the loan that would be realized upon default and takes into consideration collateral and structural support for each credit facility. The estimation process includes assigning risk ratings to each borrower and credit facility to differentiate risk within the portfolio. These risk ratings are reviewed regularly by Credit Risk Management and revised as needed to reflect the borrower’s current financial position, risk profile and related collateral. The calculations and assumptions are based on both internal and external historical experience and management judgment and are reviewed regularly.

Stress testing

Stress testing is important in measuring and managing credit risk in the Firm’s credit portfolio. The process assesses the potential impact of alternative economic and business scenarios on estimated credit losses for the Firm. Economic scenarios and the underlying parameters are defined centrally, articulated in terms of macroeconomic factors and applied across the businesses. The stress test results may indicate credit migration, changes in delinquency trends and potential losses in the credit portfolio. In addition to the periodic stress testing processes, management also considers additional stresses outside these scenarios, including industry and country-specific stress scenarios, as necessary. The Firm uses stress testing to inform decisions on setting risk appetite both at a Firm and LOB level, as well as to assess the impact of stress on individual counterparties.

Risk monitoring and management

The Firm has developed policies and practices that are designed to preserve the independence and integrity of the approval and decision-making process of extending credit to ensure credit risks are assessed accurately, approved properly, monitored regularly and managed actively at both the transaction and portfolio levels. The policy framework establishes credit approval authorities, concentration limits, risk-rating methodologies, portfolio review parameters and guidelines for management of distressed exposures. In addition, certain models, assumptions and inputs used in evaluating and monitoring credit risk are independently validated by groups that are separate from the line of businesses.

Consumer credit risk is monitored for delinquency and other trends, including any concentrations at the portfolio level, as certain of these trends can be modified through changes in underwriting policies and portfolio guidelines. Consumer Risk Management evaluates delinquency and other trends against business expectations, current and forecasted economic conditions, and industry benchmarks. Historical and forecasted economic performance and trends are incorporated into the modeling of estimated consumer credit losses and are part of the monitoring of the credit risk profile of the portfolio.

Wholesale credit risk is monitored regularly at an aggregate portfolio, industry, and individual client and counterparty level with established concentration limits that are reviewed and revised as deemed appropriate by management, typically on an annual basis. Industry and counterparty limits, as measured in terms of exposure and economic risk appetite, are subject to stress-based loss constraints. In addition, wrong-way risk – the risk that exposure to a counterparty is positively correlated with the impact of a default by the same counterparty, which could cause exposure to increase at the same time as the counterparty’s capacity to meet its obligations is decreasing – is actively monitored as this risk could result in greater exposure at default compared with a transaction with another counterparty that does not have this risk.

Management of the Firm’s wholesale credit risk exposure is accomplished through a number of means, including:

- Loan underwriting and credit approval process
- Loan syndications and participations
- Loan sales and securitizations
- Credit derivatives
- Master netting agreements
- Collateral and other risk-reduction techniques

Management's discussion and analysis

In addition to Credit Risk Management, an independent Credit Review function is responsible for:

- Independently validating or changing the risk grades assigned to exposures in the Firm's wholesale and commercial-oriented retail credit portfolios, and assessing the timeliness of risk grade changes initiated by responsible business units; and
- Evaluating the effectiveness of business units' credit management processes, including the adequacy of credit analyses and risk grading/LGD rationales, proper monitoring and management of credit exposures, and compliance with applicable grading policies and underwriting guidelines.

For further discussion of consumer and wholesale loans, refer to Note 12.

Risk reporting

To enable monitoring of credit risk and effective decision-making, aggregate credit exposure, credit quality forecasts, concentration levels and risk profile changes are reported regularly to senior members of Credit Risk Management. Detailed portfolio reporting of industry; clients, counterparties and customers; product and geographic concentrations occurs monthly, and the appropriateness of the allowance for credit losses is reviewed by senior management at least on a quarterly basis. Through the risk reporting and governance structure, credit risk trends and limit exceptions are provided regularly to, and discussed with, risk committees, senior management and the Board of Directors as appropriate.

CREDIT PORTFOLIO

Credit risk is the risk associated with the default or change in credit profile of a client, counterparty or customer.

In the following tables, reported loans include loans retained (i.e., held-for-investment); loans held-for-sale; and certain loans accounted for at fair value. The following tables do not include loans which the Firm accounts for at fair value and classifies as trading assets. For further information regarding these loans, refer to Notes 2 and 3. For additional information on the Firm's loans, lending-related commitments and derivative receivables, including the Firm's accounting policies, refer to Notes 12, 27, and 5, respectively.

For further information regarding the credit risk inherent in the Firm's cash placed with banks, refer to Wholesale credit exposure - industry exposures on pages 113-115 ; for information regarding the credit risk inherent in the Firm's investment securities portfolio, refer to Note 10; and for information regarding credit risk inherent in the securities financing portfolio, refer to Note 11.

For a further discussion of the consumer credit environment and consumer loans, refer to Consumer Credit Portfolio on pages 106-111 and Note 12. For a further discussion of the wholesale credit environment and wholesale loans, refer to Wholesale Credit Portfolio on pages 112-119 and Note 12.

Total credit portfolio

December 31, (in millions)	Credit exposure		Nonperforming ^{(d)(e)}	
	2018	2017	2018	2017
Loans retained	\$ 969,415	\$ 924,838	\$ 4,611	\$ 5,943
Loans held-for-sale	11,988	3,351	—	—
Loans at fair value	3,151	2,508	220	—
Total loans - reported	984,554	930,697	4,831	5,943
Derivative receivables	54,213	56,523	60	130
Receivables from customers and other ^(a)	30,217	26,272	—	—
Total credit-related assets	1,068,984	1,013,492	4,891	6,073
Assets acquired in loan satisfactions				
Real estate owned	NA	NA	269	311
Other	NA	NA	30	42
Total assets acquired in loan satisfactions	NA	NA	299	353
Lending-related commitments	1,039,258	991,482	469	731
Total credit portfolio	\$ 2,108,242	\$ 2,004,974	\$ 5,659	\$ 7,157
Credit derivatives used in credit portfolio management activities ^(b)	\$ (12,682)	\$ (17,609)	\$ —	\$ —
Liquid securities and other cash collateral held against derivatives ^(c)	(15,322)	(16,108)	NA	NA
Year ended December 31, (in millions, except ratios)				
	2018		2017	
Net charge-offs ^(f)	\$ 4,856		\$ 5,387	
Average retained loans				
Loans	936,829		898,979	
Loans - reported, excluding residential real estate PCI loans	909,386		865,887	
Net charge-off rates ^(f)				
Loans	0.52%		0.60%	
Loans - excluding PCI	0.53		0.62	

- Receivables from customers and other primarily represents held-for-investment margin loans to brokerage customers.
- Represents the net notional amount of protection purchased and sold through credit derivatives used to manage both performing and nonperforming wholesale credit exposures; these derivatives do not qualify for hedge accounting under U.S. GAAP. For additional information, refer to Credit derivatives on page 119 and Note 5.
- Includes collateral related to derivative instruments where an appropriate legal opinion has not been either sought or obtained.
- Excludes PCI loans. The Firm is recognizing interest income on each pool of PCI loans as each of the pools is performing.
- At December 31, 2018 and 2017, nonperforming assets excluded mortgage loans 90 or more days past due and insured by U.S. government agencies of \$2.6 billion and \$4.3 billion, respectively, and real estate owned ("REO") insured by U.S. government agencies of \$75 million and \$95 million, respectively. These amounts have been excluded based upon the government guarantee. In addition, the Firm's policy is generally to exempt credit card loans from being placed on nonaccrual status as permitted by regulatory guidance issued by the Federal Financial Institutions Examination Council ("FFIEC").
- For the year ended December 31, 2017, excluding net charge-offs of \$467 million related to the student loan portfolio transfer, the net charge-off rate for loans would have been 0.55% and for loans - excluding PCI would have been 0.57%.

CONSUMER CREDIT PORTFOLIO

The Firm's retained consumer portfolio consists primarily of residential real estate loans, credit card loans, auto loans, and business banking loans, as well as associated lending-related commitments. The Firm's focus is on serving primarily the prime segment of the consumer credit market. Originated mortgage loans are retained in the mortgage portfolio, securitized or sold to U.S. government agencies and U.S. government-sponsored enterprises; other types of consumer loans are typically retained on the balance sheet. The credit performance of the consumer portfolio continues to benefit from discipline in credit underwriting as well as improvement in the economy driven by low unemployment and increasing home prices. The total amount of residential real estate loans delinquent 30+ days, excluding government guaranteed and purchased credit-impaired loans, decreased from December 31, 2017 due to improved credit performance and the impact of loans that were delinquent in 2017 due to hurricanes. The Credit Card 30+ day delinquency rate and the net charge-off rate increased from the prior year, in line with expectations. For further information on consumer loans, refer to Note 12. For further information on lending-related commitments, refer to Note 27.

The following table presents consumer credit-related information with respect to the credit portfolio held by CCB, prime mortgage and home equity loans held by AWM, and prime mortgage loans held by Corporate. For further information about the Firm's nonaccrual and charge-off accounting policies, refer to Note 12.

Consumer credit portfolio

As of or for the year ended December 31, (in millions, except ratios)	Credit exposure		Nonaccrual loans ^{(i)(j)}		Net charge-offs/ (recoveries) ^{(d)(k)}		Net charge-off/ (recovery) rate ^{(d)(k)(l)}	
	2018	2017	2018	2017	2018	2017	2018	2017
Consumer, excluding credit card								
Loans, excluding PCI loans and loans held-for-sale								
Residential mortgage	\$ 231,078	\$ 216,496	\$ 1,765	\$ 2,175	\$ (291)	\$ (10)	(0.13)%	—%
Home equity	28,340	33,450	1,323	1,610	(5)	69	(0.02)	0.19
Auto ^{(a)(b)}	63,573	66,242	128	141	243	331	0.38	0.51
Consumer & Business Banking ^{(b)(c)}	26,612	25,789	245	283	236	257	0.90	1.03
Student ^(d)	—	—	—	—	—	498	—	NM
Total loans, excluding PCI loans and loans held-for-sale	349,603	341,977	3,461	4,209	183	1,145	0.05	0.34
Loans - PCI								
Home equity	8,963	10,799	NA	NA	NA	NA	NA	NA
Prime mortgage	4,690	6,479	NA	NA	NA	NA	NA	NA
Subprime mortgage	1,945	2,609	NA	NA	NA	NA	NA	NA
Option ARMs ^(e)	8,436	10,689	NA	NA	NA	NA	NA	NA
Total loans - PCI	24,034	30,576	NA	NA	NA	NA	NA	NA
Total loans - retained	373,637	372,553	3,461	4,209	183	1,145	0.05	0.31
Loans held-for-sale	95	128	—	—	—	—	—	—
Total consumer, excluding credit card loans	373,732	372,681	3,461	4,209	183	1,145	0.05	0.31
Lending-related commitments ^(f)	46,066	48,553						
Receivables from customers ^(g)	154	133						
Total consumer exposure, excluding credit card	419,952	421,367						
Credit Card								
Loans retained ^(h)	156,616	149,387	—	—	4,518	4,123	3.10	2.95
Loans held-for-sale	16	124	—	—	—	—	—	—
Total credit card loans	156,632	149,511	—	—	4,518	4,123	3.10	2.95
Lending-related commitments ^(f)	605,379	572,831						
Total credit card exposure	762,011	722,342						
Total consumer credit portfolio	\$ 1,181,963	\$ 1,143,709	\$ 3,461	\$ 4,209	\$ 4,701	\$ 5,268	0.90 %	1.04%
Memo: Total consumer credit portfolio, excluding PCI	\$ 1,157,929	\$ 1,113,133	\$ 3,461	\$ 4,209	\$ 4,701	\$ 5,268	0.95 %	1.11%

- (a) At December 31, 2018 and 2017, excluded operating lease assets of \$20.5 billion and \$17.1 billion, respectively. These operating lease assets are included in other assets on the Firm's Consolidated balance sheets. The risk of loss on these assets relates to the residual value of the leased vehicles, which is managed through projection of the lease residual value at lease origination, periodic review of residual values, and through arrangements with certain auto manufacturers that mitigates this risk.
- (b) Includes certain business banking and auto dealer risk-rated loans that apply the wholesale methodology for determining the allowance for loan losses; these loans are managed by CCB, and therefore, for consistency in presentation, are included within the consumer portfolio.
- (c) Predominantly includes Business Banking loans.
- (d) For the year ended December 31, 2017, excluding net charge-offs of \$467 million related to the student loan portfolio sale, the net charge-off rate for Total consumer, excluding credit card and PCI loans and loans held-for-sale would have been 0.20%; Total consumer - retained excluding credit card loans would have been 0.18%; Total consumer credit portfolio would have been 0.95%; and Total consumer credit portfolio, excluding PCI loans would have been 1.01%.
- (e) At December 31, 2018 and 2017, approximately 69% and 68%, respectively, of the PCI option adjustable rate mortgages ("ARMs") portfolio has been modified into fixed-rate, fully amortizing loans.
- (f) Credit card and home equity lending-related commitments represent the total available lines of credit for these products. The Firm has not experienced, and does not anticipate, that all available lines of credit would be used at the same time. For credit card commitments, and if certain conditions are met, home equity commitments, the Firm can reduce or cancel these lines of credit by providing the borrower notice or, in some cases as permitted by law, without notice. For further information, refer to Note 27.
- (g) Receivables from customers represent held-for-investment margin loans to brokerage customers that are collateralized through assets maintained in the clients' brokerage accounts. These receivables are reported within accrued interest and accounts receivable on the Firm's Consolidated balance sheets.
- (h) Includes billed interest and fees net of an allowance for uncollectible interest and fees.
- (i) At December 31, 2018 and 2017, nonaccrual loans excluded mortgage loans 90 or more days past due and insured by U.S. government agencies of \$2.6 billion and \$4.3 billion, respectively. These amounts have been excluded from nonaccrual loans based upon the government guarantee. In addition, the Firm's policy is generally to exempt credit card loans from being placed on nonaccrual status, as permitted by regulatory guidance issued by the FFIEC.
- (j) Excludes PCI loans. The Firm is recognizing interest income on each pool of PCI loans as each of the pools is performing.
- (k) Net charge-offs/(recoveries) and net charge-off/(recovery) rates excluded write-offs in the PCI portfolio of \$187 million and \$86 million for the years ended December 31, 2018 and 2017, respectively. These write-offs decreased the allowance for loan losses for PCI loans. Refer to Allowance for Credit Losses on pages 120-122 for further information.
- (l) Average consumer loans held-for-sale were \$387 million and \$1.5 billion for the years ended December 31, 2018 and 2017, respectively. These amounts were excluded when calculating net charge-off/(recovery) rates.

Management's discussion and analysis

Consumer, excluding credit card

Portfolio analysis

Consumer loan balances increased from December 31, 2017 predominantly due to originations of high-quality prime mortgage loans that have been retained on the balance sheet, largely offset by paydowns and the charge-off or liquidation of delinquent loans.

PCI loans are excluded from the following discussions of individual loan products and are addressed separately below. For further information about the Firm's consumer portfolio, including information about delinquencies, loan modifications and other credit quality indicators, refer to Note 12.

Residential mortgage: The residential mortgage portfolio, including loans held-for-sale, predominantly consists of high-quality prime mortgage loans with approximately 1% consisting of subprime mortgage loans, which continue to run off. The residential mortgage portfolio increased from December 31, 2017 driven by the retention of originated high-quality prime mortgage loans, which exceeded paydowns and mortgage loan sales. Residential mortgage 30+ day delinquencies decreased from December 31, 2017. Nonaccrual loans decreased from December 31, 2017 due to lower delinquencies. Net recoveries for the year ended December 31, 2018 improved when compared with the prior year, reflecting loan sales and continued improvement in home prices and delinquencies.

At December 31, 2018 and 2017, the Firm's residential mortgage portfolio included \$21.6 billion and \$20.2 billion, respectively, of interest-only loans. These loans have an interest-only payment period generally followed by an adjustable-rate or fixed-rate fully amortizing payment period to maturity and are typically originated as higher-balance loans to higher-income borrowers. Performance of this portfolio for the year ended December 31, 2018 was in line with the performance of the broader residential mortgage portfolio for the same period. The Firm continues to monitor the risks associated with these loans.

The following table provides a summary of the Firm's residential mortgage portfolio insured and/or guaranteed by U.S. government agencies, including loans held-for-sale. The Firm monitors its exposure to certain potential unrecoverable claim payments related to government insured loans and considers this exposure in estimating the allowance for loan losses.

(in millions)	December 31, 2018	December 31, 2017
Current	\$ 2,884	\$ 2,401
30-89 days past due	1,528	1,958
90 or more days past due	2,600	4,264
Total government guaranteed loans	\$ 7,012	\$ 8,623

Home equity: The home equity portfolio declined from December 31, 2017 primarily reflecting loan paydowns. The amount of 30+ day delinquencies decreased from December 31, 2017. Nonaccrual loans decreased from December 31, 2017 due to lower delinquencies. There was a net recovery for the year ended December 31, 2018 compared to a net charge-off for the prior year, as a result of continued improvement in home prices and lower delinquencies.

At December 31, 2018, approximately 90% of the Firm's home equity portfolio consists of home equity lines of credit ("HELOCs") and the remainder consisted of home equity loans ("HELOANS"). HELOANS are generally fixed-rate, closed-end, amortizing loans, with terms ranging from 3-30 years. In general, HELOCs originated by the Firm are revolving loans for a 10-year period, after which time the HELOC recasts into a loan with a 20-year amortization period.

The carrying value of HELOCs outstanding was \$26 billion at December 31, 2018. This amount included \$12 billion of HELOCs that have recast from interest-only to fully amortizing payments or have been modified and \$4 billion of interest-only balloon HELOCs, which primarily mature after 2030. The Firm manages the risk of HELOCs during their revolving period by closing or reducing the undrawn line to the extent permitted by law when borrowers are exhibiting a material deterioration in their credit risk profile.

The Firm monitors risks associated with junior lien loans where the borrower has a senior lien loan that is either delinquent or has been modified. These loans are considered “high-risk seconds” and are classified as nonaccrual as they are considered to pose a higher risk of default than other junior lien loans. At December 31, 2018, the Firm estimated that the carrying value of its home equity portfolio contained approximately \$550 million of current junior lien loans that were considered high-risk seconds, compared with approximately \$725 million at December 31, 2017.

Auto: The auto loan portfolio, which predominantly consists of prime-quality loans, declined when compared with December 31, 2017, as paydowns and the charge-off or liquidation of delinquent loans were predominantly offset by new originations. Nonaccrual loans decreased from December 31, 2017. Net charge-offs for the year ended December 31, 2018 declined when compared with the prior year primarily as a result of an incremental adjustment recorded in 2017 in accordance with regulatory guidance regarding the timing of loss recognition for certain loans in bankruptcy and loans where assets were acquired in loan satisfactions.

Consumer & Business banking: Consumer & Business Banking loans increased when compared with December 31, 2017 due to loan originations, predominantly offset by paydowns and charge-offs of delinquent loans. Nonaccrual loans and net charge-offs decreased when compared with the prior year.

Purchased credit-impaired loans: PCI loans represent certain loans that were acquired and deemed to be credit-impaired on the acquisition date. PCI loans decreased from December 31, 2017 due to portfolio run off and loan sales. As of December 31, 2018, approximately 10% of the option ARM PCI loans were delinquent and approximately 69% of the portfolio had been modified into fixed-rate, fully amortizing loans. The borrowers for substantially all of the remaining option ARM loans are making amortizing payments, although such payments are not necessarily fully amortizing. This latter group of loans is subject to the risk of payment shock due to future payment recast. Default rates generally increase on option ARM loans when payment recast results in a payment increase. The expected increase in default rates is considered in the Firm’s quarterly impairment assessment.

The following table provides a summary of lifetime principal loss estimates included in either the nonaccretable difference or the allowance for loan losses.

Summary of PCI loans lifetime principal loss estimates

December 31, (in billions)	Lifetime loss estimates ^(a)		Life-to-date liquidation losses ^(b)	
	2018	2017	2018	2017
Home equity	\$ 14.1	\$ 14.2	\$ 13.0	\$ 12.9
Prime mortgage	4.1	4.0	3.9	3.8
Subprime mortgage	3.3	3.3	3.2	3.1
Option ARMs	10.3	10.0	9.9	9.7
Total	\$ 31.8	\$ 31.5	\$ 30.0	\$ 29.5

(a) Includes the original nonaccretable difference established in purchase accounting of \$30.5 billion for principal losses plus additional principal losses recognized subsequent to acquisition through the provision and allowance for loan losses. The remaining nonaccretable difference for principal losses was \$512 million and \$842 million at December 31, 2018 and 2017, respectively.

(b) Represents both realization of loss upon loan resolution and any principal forgiven upon modification.

For further information on the Firm’s PCI loans, including write-offs, refer to Note 12.

Geographic composition of residential real estate loans

At December 31, 2018, \$160.3 billion, or 63% of the total retained residential real estate loan portfolio, excluding mortgage loans insured by U.S. government agencies and PCI loans, were concentrated in California, New York, Illinois, Texas and Florida, compared with \$152.8 billion, or 63%, at December 31, 2017. For additional information on the geographic composition of the Firm’s residential real estate loans, refer to Note 12.

Current estimated loan-to-values of residential real estate loans

Average current estimated loan-to-value (“LTV”) ratios have declined consistent with improvements in home prices, customer pay downs, and charge-offs or liquidations of higher LTV loans. For further information on current estimated LTVs of residential real estate loans, refer to Note 12.

Loan modification activities for residential real estate loans

The performance of modified loans generally differs by product type due to differences in both the credit quality and the types of modifications provided. Performance metrics for modifications to the residential real estate portfolio, excluding PCI loans, that have been seasoned more than six months show weighted-average redefault rates of 22% for residential mortgages and 20% for home equity. Performance metrics for modifications to the PCI residential real estate portfolio that have been seasoned more than six months show weighted average redefault rates of 19% for home equity, 18% for prime mortgages, 16% for option ARMs and 32% for subprime mortgages. The cumulative redefault rates reflect the performance of modifications completed from October 1, 2009 through December 31, 2018.

Management's discussion and analysis

Certain modified loans have interest rate reset provisions ("step-rate modifications") where the interest rates on these loans generally began to increase commencing in 2014 by 1% per year, and will continue to do so until the rate reaches a specified cap. The cap on these loans is typically at a prevailing market interest rate for a fixed-rate mortgage loan as of the modification date. At December 31, 2018, the carrying value of non-PCI loans and the unpaid principal balance of PCI loans modified in step-rate modifications, which have not yet met their specified caps, were \$2 billion and \$3 billion, respectively. The Firm continues to monitor this risk exposure and the impact of these potential interest rate increases is considered in the Firm's allowance for loan losses.

The following table presents information as of December 31, 2018 and 2017, relating to modified retained residential real estate loans for which concessions have been granted to borrowers experiencing financial difficulty. For further information on modifications for the years ended December 31, 2018 and 2017, refer to Note 12.

Modified residential real estate loans

December 31, (in millions)	2018		2017	
	Retained loans	Nonaccrual retained loans ^(d)	Retained loans	Nonaccrual retained loans ^(d)
Modified residential real estate loans, excluding PCI loans^{(a)(b)}				
Residential mortgage	\$ 4,565	\$ 1,459	\$ 5,620	\$ 1,743
Home equity	2,012	955	2,118	1,032
Total modified residential real estate loans, excluding PCI loans	\$ 6,577	\$ 2,414	\$ 7,738	\$ 2,775
Modified PCI loans^(c)				
Home equity	\$ 2,086	NA	\$ 2,277	NA
Prime mortgage	3,179	NA	4,490	NA
Subprime mortgage	2,041	NA	2,678	NA
Option ARMs	6,410	NA	8,276	NA
Total modified PCI loans	\$13,716	NA	\$17,721	NA

- (a) Amounts represent the carrying value of modified residential real estate loans.
- (b) At December 31, 2018 and 2017, \$4.1 billion and \$3.8 billion, respectively, of loans modified subsequent to repurchase from Ginnie Mae in accordance with the standards of the appropriate government agency (i.e., Federal Housing Administration ("FHA"), U.S. Department of Veterans Affairs ("VA"), Rural Housing Service of the U.S. Department of Agriculture ("RHS")) are not included in the table above. When such loans perform subsequent to modification in accordance with Ginnie Mae guidelines, they are generally sold back into Ginnie Mae loan pools. Modified loans that do not re-perform become subject to foreclosure. For additional information about sales of loans in securitization transactions with Ginnie Mae, refer to Note 14.
- (c) Amounts represent the unpaid principal balance of modified PCI loans.
- (d) As of December 31, 2018 and 2017, nonaccrual loans included \$2.0 billion and \$2.2 billion, respectively, of troubled debt restructurings ("TDRs") for which the borrowers were less than 90 days past due. For additional information about loans modified in a TDR that are on nonaccrual status, refer to Note 12.

Nonperforming assets

The following table presents information as of December 31, 2018 and 2017, about consumer, excluding credit card, nonperforming assets.

Nonperforming assets^(a)

December 31, (in millions)	2018	2017
Nonaccrual loans^(b)		
Residential real estate	\$ 3,088	\$ 3,785
Other consumer	373	424
Total nonaccrual loans	3,461	4,209
Assets acquired in loan satisfactions		
Real estate owned	210	225
Other	30	40
Total assets acquired in loan satisfactions	240	265
Total nonperforming assets	\$ 3,701	\$ 4,474

- (a) At December 31, 2018 and 2017, nonperforming assets excluded mortgage loans 90 or more days past due and insured by U.S. government agencies of \$2.6 billion and \$4.3 billion, respectively, and real estate owned ("REO") insured by U.S. government agencies of \$75 million and \$95 million, respectively. These amounts have been excluded based upon the government guarantee.
- (b) Excludes PCI loans which are accounted for on a pool basis. Since each pool is accounted for as a single asset with a single composite interest rate and an aggregate expectation of cash flows, the past-due status of the pools, or that of individual loans within the pools, is not meaningful. The Firm is recognizing interest income on each pool of loans as each of the pools is performing.

Nonaccrual loans in the residential real estate portfolio at December 31, 2018 decreased to \$3.1 billion from \$3.8 billion at December 31, 2017, of which 24% and 26% were greater than 150 days past due, respectively. In the aggregate, the unpaid principal balance of residential real estate loans greater than 150 days past due was charged down by approximately 32% and 40% to the estimated net realizable value of the collateral at December 31, 2018 and 2017, respectively.

Nonaccrual loans: The following table presents changes in the consumer, excluding credit card, nonaccrual loans for the years ended December 31, 2018 and 2017.

Nonaccrual loan activity

Year ended December 31, (in millions)	2018	2017
Beginning balance	\$ 4,209	\$ 4,820
Additions	2,799	3,525
Reductions:		
Principal payments and other ^(a)	1,407	1,577
Charge-offs	468	699
Returned to performing status	1,399	1,509
Foreclosures and other liquidations	273	351
Total reductions	3,547	4,136
Net changes	(748)	(611)
Ending balance	\$ 3,461	\$ 4,209

- (a) Other reductions includes loan sales.

Active and suspended foreclosure: For information on loans that were in the process of active or suspended foreclosure, refer to Note 12.

Credit card

Total credit card loans increased from December 31, 2017 due to new account growth and higher sales volume. The December 31, 2018 30+ day delinquency rate increased to 1.83% from 1.80% at December 31, 2017, but the December 31, 2018 90+ day delinquency rate of 0.92% was flat compared to December 31, 2017. Net charge-offs increased for the year ended December 31, 2018 when compared with the prior year, primarily due to the seasoning of more recent vintages with higher loss rates, as anticipated given underwriting standards at the time of origination.

Consistent with the Firm's policy, all credit card loans typically remain on accrual status until charged off. However, the Firm establishes an allowance, which is offset against loans and reduces interest income, for the estimated uncollectible portion of accrued and billed interest and fee income.

Geographic and FICO composition of credit card loans

At December 31, 2018, \$71.2 billion, or 45% of the total retained credit card loan portfolio, were concentrated in California, Texas, New York, Florida and Illinois, compared with \$67.2 billion, or 45%, at December 31, 2017. For additional information on the geographic and FICO composition of the Firm's credit card loans, refer to Note 12.

Modifications of credit card loans

At December 31, 2018 and 2017, the Firm had \$1.3 billion and \$1.2 billion, respectively, of credit card loans outstanding that have been modified in TDRs. For additional information about loan modification programs to borrowers, refer to Note 12.

WHOLESALE CREDIT PORTFOLIO

In its wholesale businesses, the Firm is exposed to credit risk primarily through its underwriting, lending, market-making, and hedging activities with and for clients and counterparties, as well as through various operating services (such as cash management and clearing activities), securities financing activities and cash placed with banks. A portion of the loans originated or acquired by the Firm's wholesale businesses is generally retained on the balance sheet. The Firm distributes a significant percentage of the loans that it originates into the market as part of its syndicated loan business and to manage portfolio concentrations and credit risk.

The credit quality of the wholesale portfolio was stable for the year ended December 31, 2018, characterized by low levels of criticized exposure, nonaccrual loans and charge-offs. Refer to the industry discussion on pages 113-115 for further information. Retained loans increased across all wholesale lines of business, primarily driven by commercial and industrial and financial institution clients in CIB, and Wealth Management clients globally in AWM. The wholesale portfolio is actively managed, in part by conducting ongoing, in-depth reviews of client credit quality and transaction structure inclusive of collateral where applicable, and of industry, product and client concentrations.

In the following tables, the Firm's wholesale credit portfolio includes exposure held in CIB, CB, AWM and Corporate, and excludes all exposure managed by CCB.

Wholesale credit portfolio

December 31, (in millions)	Credit exposure		Nonperforming ^(c)	
	2018	2017	2018	2017
Loans retained	\$ 439,162	\$ 402,898	\$ 1,150	\$ 1,734
Loans held-for-sale	11,877	3,099	–	–
Loans at fair value	3,151	2,508	220	–
Loans - reported	454,190	408,505	1,370	1,734
Derivative receivables	54,213	56,523	60	130
Receivables from customers and other ^(a)	30,063	26,139	–	–
Total wholesale credit-related assets	538,466	491,167	1,430	1,864
Lending-related commitments	387,813	370,098	469	731
Total wholesale credit exposure	\$ 926,279	\$ 861,265	\$ 1,899	\$ 2,595
Credit derivatives used in credit portfolio management activities ^(b)	\$ (12,682)	\$ (17,609)	\$ –	\$ –
Liquid securities and other cash collateral held against derivatives	(15,322)	(16,108)	NA	NA

(a) Receivables from customers and other include \$30.1 billion and \$26.0 billion of held-for-investment margin loans at December 31, 2018 and 2017, respectively, to prime brokerage customers in CIB and AWM; these are classified in accrued interest and accounts receivable on the Consolidated balance sheets.

(b) Represents the net notional amount of protection purchased and sold through credit derivatives used to manage both performing and nonperforming wholesale credit exposures; these derivatives do not qualify for hedge accounting under U.S. GAAP. For additional information, refer to Credit derivatives on page 119, and Note 5.

(c) Excludes assets acquired in loan satisfactions.

The following tables present the maturity and ratings profiles of the wholesale credit portfolio as of December 31, 2018 and 2017. The ratings scale is based on the Firm's internal risk ratings, which generally correspond to the ratings assigned by S&P and Moody's. For additional information on wholesale loan portfolio risk ratings, refer to Note 12.

Wholesale credit exposure - maturity and ratings profile

December 31, 2018 (in millions, except ratios)	Maturity profile ^(d)				Ratings profile			
	Due in 1 year or less	Due after 1 year through 5 years	Due after 5 years	Total	Investment-grade AAA/Aaa to BBB-/Baa3	Noninvestment-grade BB+/Ba1 & below	Total	Total % of IG
Loans retained	\$ 138,458	\$ 196,974	\$ 103,730	\$ 439,162	\$ 339,729	\$ 99,433	\$ 439,162	77%
Derivative receivables				54,213			54,213	
Less: Liquid securities and other cash collateral held against derivatives				(15,322)			(15,322)	
Total derivative receivables, net of all collateral	11,038	9,169	18,684	38,891	31,794	7,097	38,891	82
Lending-related commitments	79,400	294,855	13,558	387,813	288,724	99,089	387,813	74
Subtotal	228,896	500,998	135,972	865,866	660,247	205,619	865,866	76
Loans held-for-sale and loans at fair value ^(a)				15,028			15,028	
Receivables from customers and other				30,063			30,063	
Total exposure - net of liquid securities and other cash collateral held against derivatives				\$ 910,957			\$ 910,957	
Credit derivatives used in credit portfolio management activities ^{(b)(c)}	\$ (447)	\$ (9,318)	\$ (2,917)	\$ (12,682)	\$ (11,213)	\$ (1,469)	\$ (12,682)	88%

December 31, 2017 (in millions, except ratios)	Maturity profile ^(d)				Ratings profile			
	Due in 1 year or less	Due after 1 year through 5 years	Due after 5 years	Total	Investment-grade AAA/Aaa to BBB-/Baa3	Noninvestment-grade BB+/Ba1 & below	Total	Total % of IG
Loans retained	\$ 121,643	\$ 177,033	\$ 104,222	\$ 402,898	\$ 311,681	\$ 91,217	\$ 402,898	77%
Derivative receivables				56,523			56,523	
Less: Liquid securities and other cash collateral held against derivatives				(16,108)			(16,108)	
Total derivative receivables, net of all collateral	9,882	10,463	20,070	40,415	32,373	8,042	40,415	80
Lending-related commitments	80,273	275,317	14,508	370,098	274,127	95,971	370,098	74
Subtotal	211,798	462,813	138,800	813,411	618,181	195,230	813,411	76
Loans held-for-sale and loans at fair value ^(a)				5,607			5,607	
Receivables from customers and other				26,139			26,139	
Total exposure - net of liquid securities and other cash collateral held against derivatives				\$ 845,157			\$ 845,157	
Credit derivatives used in credit portfolio management activities ^{(b)(c)}	\$ (1,807)	\$ (11,011)	\$ (4,791)	\$ (17,609)	\$ (14,984)	\$ (2,625)	\$ (17,609)	85%

(a) Represents loans held-for-sale, primarily related to syndicated loans and loans transferred from the retained portfolio, and loans at fair value.

(b) These derivatives do not qualify for hedge accounting under U.S. GAAP.

(c) The notional amounts are presented on a net basis by underlying reference entity and the ratings profile shown is based on the ratings of the reference entity on which protection has been purchased. Predominantly all of the credit derivatives entered into by the Firm where it has purchased protection used in credit portfolio management activities are executed with investment-grade counterparties.

(d) The maturity profile of retained loans, lending-related commitments and derivative receivables is based on remaining contractual maturity. Derivative contracts that are in a receivable position at December 31, 2018, may become payable prior to maturity based on their cash flow profile or changes in market conditions.

Wholesale credit exposure - industry exposures

The Firm focuses on the management and diversification of its industry exposures, and pays particular attention to industries with actual or potential credit concerns. Exposures deemed criticized align with the U.S. banking regulators' definition of criticized exposures, which consist of the special mention, substandard and doubtful

categories. The total criticized component of the portfolio, excluding loans held-for-sale and loans at fair value, was \$12.1 billion at December 31, 2018, compared with \$15.6 billion at December 31, 2017. The decrease was driven by Oil & Gas, including credit quality improvements in the portfolio, and a loan sale in the first quarter of 2018.

Management's discussion and analysis

Below are summaries of the Firm's exposures as of December 31, 2018 and 2017. The industry of risk category is generally based on the client or counterparty's primary business activity. For additional information on industry concentrations, refer to Note 4.

As a result of continued growth and the relative size of the portfolio, exposure to "Individuals," which was previously disclosed in "All Other," is now separately disclosed in the table below as "Individuals and Individual Entities." This category predominantly consists of Wealth Management clients within AWM and includes exposure to personal investment companies and personal and testamentary trusts. Predominantly all of this exposure is secured, largely by cash and marketable securities. In the table below, prior period amounts have been revised to conform with the current period presentation.

Wholesale credit exposure - industries^(a)

As of or for the year ended December 31, 2018 (in millions)	Noninvestment-grade						Selected metrics			
	Credit exposure ^(f)	Investment-grade	Noncriticized	Criticized performing	Criticized nonperforming	30 days or more past due and accruing loans	Net charge-offs/ (recoveries)	Credit derivative hedges ^(g)	Liquid securities and other cash collateral held against derivative receivables	
Real Estate	\$ 143,316	\$ 117,988	\$ 24,174	\$ 1,019	\$ 135	\$ 70	\$ (20)	\$ (2)	\$ (1)	
Individuals and Individual Entities ^(b)	97,077	86,581	10,164	174	158	703	12	—	(915)	
Consumer & Retail	94,815	60,678	31,901	2,033	203	43	55	(248)	(14)	
Technology, Media & Telecommunications	72,646	46,334	24,081	2,170	61	8	12	(1,011)	(12)	
Industrials	58,528	38,487	18,594	1,311	136	171	20	(207)	(29)	
Banks & Finance Cos	49,920	34,120	15,496	299	5	11	—	(575)	(2,290)	
Healthcare	48,142	36,687	10,625	761	69	23	(5)	(150)	(133)	
Asset Managers	42,807	36,722	6,067	4	14	10	—	—	(5,829)	
Oil & Gas	42,600	23,356	17,451	1,158	635	6	36	(248)	—	
Utilities	28,172	23,558	4,326	138	150	—	38	(142)	(60)	
State & Municipal Govt ^(c)	27,351	26,746	603	2	—	18	(1)	—	(42)	
Central Govt	18,456	18,251	124	81	—	4	—	(7,994)	(2,130)	
Automotive	17,339	9,637	7,310	392	—	1	—	(125)	—	
Chemicals & Plastics	16,035	11,490	4,427	118	—	4	—	—	—	
Transportation	15,660	10,508	4,699	393	60	21	6	(31)	(112)	
Metals & Mining	15,359	8,188	6,767	385	19	1	—	(174)	(22)	
Insurance	12,639	9,777	2,830	—	32	—	—	(36)	(2,080)	
Financial Markets Infrastructure	7,484	6,746	738	—	—	—	—	—	(26)	
Securities Firms	4,558	3,099	1,459	—	—	—	—	(158)	(823)	
All other ^(d)	68,284	64,664	3,606	12	2	2	2	(1,581)	(804)	
Subtotal	\$ 881,188	\$ 673,617	\$ 195,442	\$ 10,450	\$ 1,679	\$ 1,096	\$ 155	\$ (12,682)	\$ (15,322)	
Loans held-for-sale and loans at fair value	15,028									
Receivables from customers and other	30,063									
Total^(e)	\$ 926,279									

As of or for the year ended December 31, 2017 (in millions)	Selected metrics								
	Credit exposure ^(f)	Investment- grade	Noninvestment-grade			30 days or more past due and accruing loans	Net charge- offs/ (recoveries)	Credit derivative hedges ^(g)	Liquid securities and other cash collateral held against derivative receivables
			Noncriticized	Criticized performing	Criticized nonperforming				
Real Estate	\$ 139,409	\$ 115,401	\$ 23,012	\$ 859	\$ 137	\$ 254	\$ (4)	\$ –	\$ (2)
Individuals and Individual Entities ^(b)	87,371	77,029	10,024	80	238	899	10	–	(762)
Consumer & Retail	87,679	55,737	29,619	1,791	532	30	34	(275)	(9)
Technology, Media & Telecommunications	59,274	36,510	20,453	2,258	53	14	(12)	(910)	(19)
Industrials	55,272	37,198	16,770	1,159	145	150	(1)	(196)	(21)
Banks & Finance Cos	49,037	34,654	13,767	612	4	1	6	(1,216)	(3,174)
Healthcare	55,997	42,643	12,731	585	38	82	(1)	–	(207)
Asset Managers	32,531	28,029	4,484	4	14	27	–	–	(5,290)
Oil & Gas	41,317	21,430	14,854	4,046	987	22	71	(747)	(1)
Utilities	29,317	24,486	4,383	227	221	–	11	(160)	(56)
State & Municipal Govt ^(c)	28,633	27,977	656	–	–	12	5	(130)	(524)
Central Govt	19,182	18,741	376	65	–	4	–	(10,095)	(2,520)
Automotive	14,820	9,321	5,278	221	–	10	1	(284)	–
Chemicals & Plastics	15,945	11,107	4,764	74	–	4	–	–	–
Transportation	15,797	9,870	5,302	527	98	9	14	(32)	(131)
Metals & Mining	14,171	6,989	6,822	321	39	3	(13)	(316)	(1)
Insurance	14,089	11,028	2,981	–	80	1	–	(157)	(2,195)
Financial Markets Infrastructure	5,036	4,775	261	–	–	–	–	–	(23)
Securities Firms	4,113	2,559	1,553	1	–	–	–	(274)	(335)
All other ^(d)	60,529	57,081	3,259	180	9	2	(2)	(2,817)	(838)
Subtotal	\$ 829,519	\$ 632,565	\$ 181,349	\$ 13,010	\$ 2,595	\$ 1,524	\$ 119	\$ (17,609)	\$ (16,108)
Loans held-for-sale and loans at fair value	5,607								
Receivables from customers and other	26,139								
Total^(e)	\$ 861,265								

- (a) The industry rankings presented in the table as of December 31, 2017, are based on the industry rankings of the corresponding exposures at December 31, 2018, not actual rankings of such exposures at December 31, 2017.
- (b) Individuals and Individual Entities predominantly consists of Wealth Management clients within AWM and includes exposure to personal investment companies and personal and testamentary trusts.
- (c) In addition to the credit risk exposure to states and municipal governments (both U.S. and non-U.S.) at December 31, 2018 and 2017, noted above, the Firm held: \$7.8 billion and \$9.8 billion, respectively, of trading securities; \$37.7 billion and \$32.3 billion, respectively, of AFS securities; and \$4.8 billion and \$14.4 billion, respectively, of held-to-maturity (“HTM”) securities, issued by U.S. state and municipal governments. For further information, refer to Note 2 and Note 10.
- (d) All other includes: SPEs and Private education and civic organizations, representing approximately 92% and 8%, respectively, at December 31, 2018 and 90% and 10%, respectively, at December 31, 2017.
- (e) Excludes cash placed with banks of \$268.1 billion and \$421.0 billion, at December 31, 2018 and 2017, respectively, which is predominantly placed with various central banks, primarily Federal Reserve Banks.
- (f) Credit exposure is net of risk participations and excludes the benefit of credit derivatives used in credit portfolio management activities held against derivative receivables or loans and liquid securities and other cash collateral held against derivative receivables.
- (g) Represents the net notional amounts of protection purchased and sold through credit derivatives used to manage the credit exposures; these derivatives do not qualify for hedge accounting under U.S. GAAP. The All other category includes purchased credit protection on certain credit indices.

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Real Estate

Presented below is additional information on the Real Estate industry to which the Firm has significant exposure.

Real Estate exposure increased \$3.9 billion to \$143.3 billion during the year ended December 31, 2018, while the investment-grade percentage of the portfolio remained relatively flat at 82%. For further information on Real Estate loans, refer to Note 12.

(in millions, except ratios)	December 31, 2018				
	Loans and Lending-related Commitments	Derivative Receivables	Credit exposure	% Investment-grade	% Drawn ^(c)
Multifamily ^(a)	\$ 85,683	\$ 33	\$ 85,716	89%	92%
Other	57,469	131	57,600	72	63
Total Real Estate Exposure^(b)	143,152	164	143,316	82	81

(in millions, except ratios)	December 31, 2017				
	Loans and Lending-related Commitments	Derivative Receivables	Credit exposure	% Investment-grade	% Drawn ^(c)
Multifamily ^(a)	\$ 84,635	\$ 34	\$ 84,669	89%	92%
Other	54,620	120	54,740	74	66
Total Real Estate Exposure^(b)	139,255	154	139,409	83	82

(a) Multifamily exposure is largely in California.

(b) Real Estate exposure is predominantly secured; unsecured exposure is predominantly investment-grade.

(c) Represents drawn exposure as a percentage of credit exposure.

Loans

In the normal course of its wholesale business, the Firm provides loans to a variety of clients, ranging from large corporate and institutional clients to high-net-worth individuals. For a further discussion on loans, including information on credit quality indicators and sales of loans, refer to Note 12.

The following table presents the change in the nonaccrual loan portfolio for the years ended December 31, 2018 and 2017.

Wholesale nonaccrual loan activity

Year ended December 31, (in millions)	2018	2017
Beginning balance	\$ 1,734	\$ 2,063
Additions	1,188	1,482
Reductions:		
Paydowns and other	692	1,137
Gross charge-offs	299	200
Returned to performing status	234	189
Sales	327	285
Total reductions	1,552	1,811
Net changes	(364)	(329)
Ending balance	\$ 1,370	\$ 1,734

The following table presents net charge-offs/recoveries, which are defined as gross charge-offs less recoveries, for the years ended December 31, 2018 and 2017. The amounts in the table below do not include gains or losses from sales of nonaccrual loans.

Wholesale net charge-offs/(recoveries)

Year ended December 31, (in millions, except ratios)	2018	2017
Loans - reported		
Average loans retained	\$ 416,828	\$ 392,263
Gross charge-offs	313	212
Gross recoveries	(158)	(93)
Net charge-offs	155	119
Net charge-off rate	0.04%	0.03%

Lending-related commitments

The Firm uses lending-related financial instruments, such as commitments (including revolving credit facilities) and guarantees, to address the financing needs of its clients. The contractual amounts of these financial instruments represent the maximum possible credit risk should the clients draw down on these commitments or the Firm fulfill its obligations under these guarantees, and the clients subsequently fail to perform according to the terms of these contracts. Most of these commitments and guarantees are refinanced, extended, cancelled, or expire without being drawn upon or a default occurring. In the Firm's view, the total contractual amount of these wholesale lending-related commitments is not representative of the Firm's expected future credit exposure or funding requirements. For further information on wholesale lending-related commitments, refer to Note 27.

Clearing services

The Firm provides clearing services for clients entering into certain securities and derivative contracts. Through the provision of these services the Firm is exposed to the risk of non-performance by its clients and may be required to share in losses incurred by CCPs. Where possible, the Firm seeks to mitigate its credit risk to its clients through the collection of adequate margin at inception and throughout the life of the transactions and can also cease provision of clearing services if clients do not adhere to their obligations under the clearing agreement. For further discussion of clearing services, refer to Note 27.

Derivative contracts

Derivatives enable clients and counterparties to manage risks including credit risk and risks arising from fluctuations in interest rates, foreign exchange, equities, and commodities. The Firm makes markets in derivatives in order to meet these needs and uses derivatives to manage certain risks associated with net open risk positions from its market-making activities, including the counterparty credit risk arising from derivative receivables. The Firm also uses derivative instruments to manage its own credit and other market risk exposure. The nature of the counterparty and the settlement mechanism of the derivative affect the credit risk to which the Firm is exposed. For OTC derivatives the Firm is exposed to the credit risk of the derivative counterparty. For exchange-traded derivatives ("ETD"), such as futures and options, and "cleared" over-the-counter ("OTC-cleared") derivatives, the Firm is generally exposed to the credit risk of the relevant CCP. Where possible, the Firm seeks to mitigate its credit risk exposures arising from derivative contracts through the use of legally enforceable master netting arrangements and collateral agreements. For a further discussion of derivative contracts, counterparties and settlement types, refer to Note 5.

The following table summarizes the net derivative receivables for the periods presented.

Derivative receivables

December 31, (in millions)	2018	2017
Total, net of cash collateral	\$ 54,213	\$ 56,523
Liquid securities and other cash collateral held against derivative receivables ^(a)	(15,322)	(16,108)
Total, net of all collateral	\$ 38,891	\$ 40,415

(a) Includes collateral related to derivative instruments where appropriate legal opinions have not been either sought or obtained with respect to master netting agreements.

The fair value of derivative receivables reported on the Consolidated balance sheets were \$54.2 billion and \$56.5 billion at December 31, 2018 and 2017, respectively. Derivative receivables represent the fair value of the derivative contracts after giving effect to legally enforceable master netting agreements and cash collateral held by the Firm. However, in management's view, the appropriate measure of current credit risk should also take into consideration additional liquid securities (primarily U.S. government and agency securities and other group of seven nations ("G7") government securities) and other cash collateral held by the Firm aggregating \$15.3 billion and \$16.1 billion at December 31, 2018 and 2017, respectively, that may be used as security when the fair value of the client's exposure is in the Firm's favor.

In addition to the collateral described in the preceding paragraph, the Firm also holds additional collateral (primarily cash, G7 government securities, other liquid government-agency and guaranteed securities, and corporate debt and equity securities) delivered by clients at the initiation of transactions, as well as collateral related to contracts that have a non-daily call frequency and collateral that the Firm has agreed to return but has not yet settled as of the reporting date. Although this collateral does not reduce the balances and is not included in the table above, it is available as security against potential exposure that could arise should the fair value of the client's derivative contracts move in the Firm's favor. The derivative receivables fair value, net of all collateral, also does not include other credit enhancements, such as letters of credit. For additional information on the Firm's use of collateral agreements, refer to Note 5.

While useful as a current view of credit exposure, the net fair value of the derivative receivables does not capture the potential future variability of that credit exposure. To capture the potential future variability of credit exposure, the Firm calculates, on a client-by-client basis, three measures of potential derivatives-related credit loss: Peak, Derivative Risk Equivalent ("DRE"), and Average exposure ("AVG"). These measures all incorporate netting and collateral benefits, where applicable.

Peak represents a conservative measure of potential exposure to a counterparty calculated in a manner that is broadly equivalent to a 97.5% confidence level over the life of the transaction. Peak is the primary measure used by the Firm for setting of credit limits for derivative contracts, senior management reporting and derivatives exposure management. DRE exposure is a measure that expresses the risk of derivative exposure on a basis intended to be

Management's discussion and analysis

equivalent to the risk of loan exposures. DRE is a less extreme measure of potential credit loss than Peak and is used as an input for aggregating derivative credit risk exposures with loans and other credit risk.

Finally, AVG is a measure of the expected fair value of the Firm's derivative receivables at future time periods, including the benefit of collateral. AVG over the total life of the derivative contract is used as the primary metric for pricing purposes and is used to calculate credit risk capital and the CVA, as further described below.

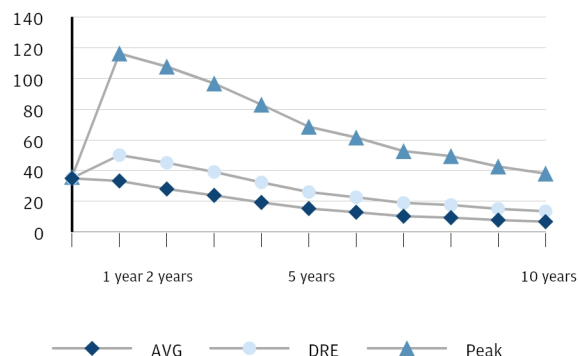
The fair value of the Firm's derivative receivables incorporates CVA to reflect the credit quality of counterparties. CVA is based on the Firm's AVG to a counterparty and the counterparty's credit spread in the credit derivatives market. The Firm believes that active risk management is essential to controlling the dynamic credit risk in the derivatives portfolio. In addition, the Firm's risk management process takes into consideration the potential impact of wrong-way risk, which is broadly defined as the potential for increased correlation between the Firm's exposure to a counterparty (AVG) and the counterparty's credit quality. Many factors may influence the nature and magnitude of these correlations over time. To the extent that these correlations are identified, the Firm may adjust the CVA associated with that counterparty's AVG. The Firm risk manages exposure to changes in CVA by entering into

credit derivative contracts, as well as interest rate, foreign exchange, equity and commodity derivative contracts.

The accompanying graph shows exposure profiles to the Firm's current derivatives portfolio over the next 10 years as calculated by the Peak, DRE and AVG metrics. The three measures generally show that exposure will decline after the first year, if no new trades are added to the portfolio.

Exposure profile of derivatives measures

December 31, 2018
(in billions)



The following table summarizes the ratings profile of the Firm's derivative receivables, including credit derivatives, net of all collateral, at the dates indicated. The ratings scale is based on the Firm's internal ratings, which generally correspond to the ratings as assigned by S&P and Moody's.

Ratings profile of derivative receivables

Rating equivalent December 31, (in millions, except ratios)	2018		2017	
	Exposure net of all collateral	% of exposure net of all collateral	Exposure net of all collateral	% of exposure net of all collateral
AAA/Aaa to AA-/Aa3	\$ 11,831	31%	\$ 11,529	29%
A+/A1 to A-/A3	7,428	19	6,919	17
BBB+/Baa1 to BBB-/Baa3	12,536	32	13,925	34
BB+/Ba1 to B-/B3	6,373	16	7,397	18
CCC+/Caa1 and below	723	2	645	2
Total	\$ 38,891	100%	\$ 40,415	100%

As previously noted, the Firm uses collateral agreements to mitigate counterparty credit risk. The percentage of the Firm's over-the-counter derivative transactions subject to collateral agreements – excluding foreign exchange spot trades, which are not typically covered by collateral agreements due to their short maturity and centrally cleared trades that are settled daily – was approximately 90% at both December 31, 2018, and December 31, 2017.

Credit derivatives

The Firm uses credit derivatives for two primary purposes: first, in its capacity as a market-maker, and second, as an end-user, to manage the Firm's own credit risk associated with various exposures. For a detailed description of credit derivatives, refer to Credit derivatives in Note 5.

Credit portfolio management activities

Included in the Firm's end-user activities are credit derivatives used to mitigate the credit risk associated with traditional lending activities (loans and unfunded commitments) and derivatives counterparty exposure in the Firm's wholesale businesses (collectively, "credit portfolio management" activities). Information on credit portfolio management activities is provided in the table below. For further information on derivatives used in credit portfolio management activities, refer to Credit derivatives in Note 5.

The Firm also uses credit derivatives as an end-user to manage other exposures, including credit risk arising from certain securities held in the Firm's market-making businesses. These credit derivatives are not included in credit portfolio management activities; for further information on these credit derivatives as well as credit derivatives used in the Firm's capacity as a market-maker in credit derivatives, refer to Credit derivatives in Note 5.

Credit derivatives used in credit portfolio management activities

December 31, (in millions)	Notional amount of protection purchased and sold ^(a)	
	2018	2017
Credit derivatives used to manage:		
Loans and lending-related commitments	\$ 1,272	\$ 1,867
Derivative receivables	11,410	15,742
Credit derivatives used in credit portfolio management activities	\$ 12,682	\$ 17,609

(a) Amounts are presented net, considering the Firm's net protection purchased or sold with respect to each underlying reference entity or index.

The credit derivatives used in credit portfolio management activities do not qualify for hedge accounting under U.S. GAAP; these derivatives are reported at fair value, with gains and losses recognized in principal transactions revenue. In contrast, the loans and lending-related commitments being risk-managed are accounted for on an accrual basis. This asymmetry in accounting treatment, between loans and lending-related commitments and the credit derivatives used in credit portfolio management activities, causes earnings volatility that is not representative, in the Firm's view, of the true changes in value of the Firm's overall credit exposure.

The effectiveness of credit default swaps ("CDS") as a hedge against the Firm's exposures may vary depending on a number of factors, including the named reference entity (i.e., the Firm may experience losses on specific exposures that are different than the named reference entities in the purchased CDS); the contractual terms of the CDS (which may have a defined credit event that does not align with an actual loss realized by the Firm); and the maturity of the Firm's CDS protection (which in some cases may be shorter than the Firm's exposures). However, the Firm generally seeks to purchase credit protection with a maturity date that is the same or similar to the maturity date of the exposure for which the protection was purchased, and remaining differences in maturity are actively monitored and managed by the Firm.

Management's discussion and analysis

ALLOWANCE FOR CREDIT LOSSES

The Firm's allowance for credit losses covers the retained consumer and wholesale loan portfolios, as well as the Firm's wholesale and certain consumer lending-related commitments.

For further information on the components of the allowance for credit losses and related management judgments, refer to Critical Accounting Estimates Used by the Firm on pages 141-143 and Note 13.

At least quarterly, the allowance for credit losses is reviewed by the CRO, the CFO and the Controller of the Firm. As of December 31, 2018, JPMorgan Chase deemed the allowance for credit losses to be appropriate and sufficient to absorb probable credit losses inherent in the portfolio.

The allowance for credit losses decreased compared with December 31, 2017 driven by:

- a reduction in the consumer allowance due to a \$250 million reduction in the CCB allowance for loan losses in the residential real estate PCI portfolio, reflecting continued improvement in home prices and lower delinquencies, as well as a \$187 million reduction in the allowance for write-offs of PCI loans partially due to loan sales. These reductions were largely offset by a \$300 million addition to the allowance in the credit card portfolio, due to loan growth and higher loss rates, as anticipated.

For additional information on the consumer and wholesale credit portfolios, refer to Consumer Credit Portfolio on pages 106-111, Wholesale Credit Portfolio on pages 112-119 and Note 12.

Summary of changes in the allowance for credit losses

Year ended December 31, (in millions, except ratios)	2018				2017			
	Consumer, excluding credit card	Credit card	Wholesale	Total	Consumer, excluding credit card	Credit card	Wholesale	Total
Allowance for loan losses								
Beginning balance at January 1,	\$ 4,579	\$ 4,884	\$ 4,141	\$ 13,604	\$ 5,198	\$ 4,034	\$ 4,544	\$ 13,776
Gross charge-offs	1,025	5,011	313	6,349	1,779	4,521	212	6,512
Gross recoveries	(842)	(493)	(158)	(1,493)	(634)	(398)	(93)	(1,125)
Net charge-offs^(a)	183	4,518	155	4,856	1,145	4,123	119	5,387
Write-offs of PCI loans ^(b)	187	—	—	187	86	—	—	86
Provision for loan losses	(63)	4,818	130	4,885	613	4,973	(286)	5,300
Other	—	—	(1)	(1)	(1)	—	2	1
Ending balance at December 31,	\$ 4,146	\$ 5,184	\$ 4,115	\$ 13,445	\$ 4,579	\$ 4,884	\$ 4,141	\$ 13,604
Impairment methodology								
Asset-specific ^(c)	\$ 196	\$ 440	\$ 297	\$ 933	\$ 246	\$ 383	\$ 461	\$ 1,090
Formula-based	2,162	4,744	3,818	10,724	2,108	4,501	3,680	10,289
PCI	1,788	—	—	1,788	2,225	—	—	2,225
Total allowance for loan losses	\$ 4,146	\$ 5,184	\$ 4,115	\$ 13,445	\$ 4,579	\$ 4,884	\$ 4,141	\$ 13,604
Allowance for lending-related commitments								
Beginning balance at January 1,	\$ 33	\$ —	\$ 1,035	\$ 1,068	\$ 26	\$ —	\$ 1,052	\$ 1,078
Provision for lending-related commitments	—	—	(14)	(14)	7	—	(17)	(10)
Other	—	—	1	1	—	—	—	—
Ending balance at December 31,	\$ 33	\$ —	\$ 1,022	\$ 1,055	\$ 33	\$ —	\$ 1,035	\$ 1,068
Impairment methodology								
Asset-specific	\$ —	\$ —	\$ 99	\$ 99	\$ —	\$ —	\$ 187	\$ 187
Formula-based	33	—	923	956	33	—	848	881
Total allowance for lending-related commitments^(d)	\$ 33	\$ —	\$ 1,022	\$ 1,055	\$ 33	\$ —	\$ 1,035	\$ 1,068
Total allowance for credit losses	\$ 4,179	\$ 5,184	\$ 5,137	\$ 14,500	\$ 4,612	\$ 4,884	\$ 5,176	\$ 14,672
Memo:								
Retained loans, end of period	\$ 373,637	\$ 156,616	\$ 439,162	\$ 969,415	\$ 372,553	\$ 149,387	\$ 402,898	\$ 924,838
Retained loans, average	374,395	145,606	416,828	936,829	366,798	139,918	392,263	898,979
PCI loans, end of period	24,034	—	3	24,037	30,576	—	3	30,579
Credit ratios								
Allowance for loan losses to retained loans	1.11%	3.31%	0.94%	1.39%	1.23%	3.27%	1.03%	1.47%
Allowance for loan losses to retained nonaccrual loans ^(e)	120	NM	358	292	109	NM	239	229
Allowance for loan losses to retained nonaccrual loans excluding credit card	120	NM	358	179	109	NM	239	147
Net charge-off rates ^(a)	0.05	3.10	0.04	0.52	0.31	2.95	0.03	0.60
Credit ratios, excluding residential real estate PCI loans								
Allowance for loan losses to retained loans	0.67	3.31	0.94	1.23	0.69	3.27	1.03	1.27
Allowance for loan losses to retained nonaccrual loans ^(e)	68	NM	358	253	56	NM	239	191
Allowance for loan losses to retained nonaccrual loans excluding credit card	68	NM	358	140	56	NM	239	109
Net charge-off rates ^(a)	0.05%	3.10%	0.04%	0.53%	0.34%	2.95%	0.03%	0.62%

Note: In the table above, the financial measures which exclude the impact of PCI loans are non-GAAP financial measures.

- (a) For the year ended December 31, 2017, excluding net charge-offs of \$467 million related to the student loan portfolio transfer, the net charge-off rate for Consumer, excluding credit card would have been 0.18%; total Firm would have been 0.55%; Consumer, excluding credit card and PCI loans would have been 0.20%; and total Firm, excluding PCI would have been 0.57%.
- (b) Write-offs of PCI loans are recorded against the allowance for loan losses when actual losses for a pool exceed estimated losses that were recorded as purchase accounting adjustments at the time of acquisition. A write-off of a PCI loan is recognized when the underlying loan is removed from a pool.
- (c) Includes risk-rated loans that have been placed on nonaccrual status and loans that have been modified in a TDR. The asset-specific credit card allowance for loan losses modified in a TDR is calculated based on the loans' original contractual interest rates and does not consider any incremental penalty rates.
- (d) The allowance for lending-related commitments is reported in accounts payable and other liabilities on the Consolidated balance sheets.
- (e) The Firm's policy is generally to exempt credit card loans from being placed on nonaccrual status as permitted by regulatory guidance.

Management's discussion and analysis

Provision for credit losses

The following table presents the components of the Firm's provision for credit losses:

Year ended December 31, (in millions)	Provision for loan losses			Provision for lending-related commitments			Total provision for credit losses		
	2018	2017	2016	2018	2017	2016	2018	2017	2016
Consumer, excluding credit card	\$ (63)	\$ 613	\$ 467	\$ –	\$ 7	\$ –	\$ (63)	\$ 620	\$ 467
Credit card	4,818	4,973	4,042	–	–	–	4,818	4,973	4,042
Total consumer	4,755	5,586	4,509	–	7	–	4,755	5,593	4,509
Wholesale	130	(286)	571	(14)	(17)	281	116	(303)	852
Total	\$ 4,885	\$ 5,300	\$ 5,080	\$ (14)	\$ (10)	\$ 281	\$ 4,871	\$ 5,290	\$ 5,361

Provision for credit losses

The **provision for credit losses** decreased for the year ended December 31, 2018 as a result of a decline in the consumer provision, partially offset by an increase in the wholesale provision

- the decrease in the **consumer, excluding credit card** portfolio in CCB was due to
 - lower net charge-offs in the residential real estate portfolio, largely driven by recoveries from loan sales, and
 - lower net charge-offs in the auto portfolio
 partially offset by
 - a \$250 million reduction in the allowance for loan losses in the residential real estate portfolio – PCI, reflecting continued improvement in home prices and lower delinquencies; the reduction was \$75 million lower than the prior year for the residential real estate portfolio – non credit-impaired
- the prior year also included a net \$218 million write-down recorded in connection with the sale of the student loan portfolio, and
- the decrease in the **credit card** portfolio was due to
 - a \$300 million addition to the allowance for loan losses, reflecting loan growth and higher loss rates, as anticipated; the addition was \$550 million lower than the prior year,
 largely offset by
 - higher net charge-offs due to seasoning of more recent vintages, as anticipated, and

- in **wholesale**, the current period expense of \$116 million reflected additions to the allowance for loan losses from select client downgrades, largely offset by
 - other net portfolio activity, including a reduction in the allowance for loan losses related to a single name in the Oil & Gas portfolio in the first quarter of 2018, compared to a net benefit of \$303 million in the prior year. The prior year benefit reflected a reduction in the allowance for loan losses on credit quality improvements in the Oil & Gas, Natural Gas Pipelines, and Metals and Mining portfolios.

INVESTMENT PORTFOLIO RISK MANAGEMENT

Investment portfolio risk is the risk associated with the loss of principal or a reduction in expected returns on investments arising from the investment securities portfolio held predominantly by Treasury and CIO in connection with the Firm's balance sheet or asset-liability management objectives or from principal investments managed in various LOBs and Corporate in predominantly privately-held financial instruments. Investments are typically intended to be held over extended periods and, accordingly, the Firm has no expectation for short-term realized gains with respect to these investments.

Investment securities risk

Investment securities risk includes the exposure associated with a default in the payment of principal and interest. This risk is minimized given that Treasury and CIO substantially invest in high-quality securities. At December 31, 2018, the investment securities portfolio was \$260.1 billion, and the average credit rating of the securities comprising the portfolio was AA+ (based upon external ratings where available and where not available, based primarily upon internal ratings that correspond to ratings as defined by S&P and Moody's). For further information on the investment securities portfolio, refer to Corporate segment results on pages 77-78 and Note 10. For further information on the market risk inherent in the portfolio, refer to Market Risk Management on pages 124-131. For further information on related liquidity risk, refer to Liquidity Risk on pages 95-100.

Governance and oversight

Investment securities risks are governed by the Firm's Risk Appetite framework, and discussed at the CIO, Treasury and Corporate (CTC) Risk Committee with regular updates to the DRPC.

The Firm's independent control functions are responsible for reviewing the appropriateness of the carrying value of investment securities in accordance with relevant policies. Approved levels for investment securities are established for each risk category, including capital and credit risks.

Principal investment risk

Principal investments are typically private non-traded financial instruments representing ownership or other forms of junior capital. Principal investments cover multiple asset classes and are made either in stand-alone investing businesses or as part of a broader business platform. In general, new principal investments include tax-oriented investments, as well as investments made to enhance or accelerate LOB and Corporate strategic business initiatives. The Firm's principal investments are managed by the various LOBs and Corporate and are reflected within their respective financial results. Effective January 1, 2018, the Firm adopted new accounting guidance related to the recognition and measurement of financial assets, which requires fair value adjustments upon observable price changes to certain equity investments previously held at cost in the principal investment portfolios. For additional information, refer to Notes 1 and 2.

As of December 31, 2018 and 2017, the aggregate carrying values of the principal investment portfolios were \$22.2 billion and \$19.5 billion, respectively, which included tax-oriented investments (e.g., affordable housing and alternative energy investments) of \$16.6 billion and \$14.0 billion, respectively, and private equity, various debt and equity instruments, and real assets of \$5.6 billion and \$5.5 billion, respectively.

Governance and oversight

The Firm's approach to managing principal risk is consistent with the Firm's general risk governance structure. A Firmwide risk policy framework exists for all principal investing activities. All investments are approved by investment committees that include executives who are independent from the investing businesses.

The Firm's independent control functions are responsible for reviewing the appropriateness of the carrying value of investments in accordance with relevant policies. As part of the risk governance structure, approved levels for investments are established and monitored for each relevant business or segment in order to manage the overall size of the portfolios. The Firm also conducts stress testing on these portfolios using specific scenarios that estimate losses based on significant market moves and/or other risk events.

MARKET RISK MANAGEMENT

Market risk is the risk associated with the effect of changes in market factors such as interest and foreign exchange rates, equity and commodity prices, credit spreads or implied volatilities, on the value of assets and liabilities held for both the short and long term.

Market Risk Management

Market Risk Management monitors market risks throughout the Firm and defines market risk policies and procedures. The Market Risk Management function reports to the Firm's CRO.

Market Risk Management seeks to manage risk, facilitate efficient risk/return decisions, reduce volatility in operating performance and provide transparency into the Firm's market risk profile for senior management, the Board of Directors and regulators. Market Risk Management is responsible for the following functions:

- Establishment of a market risk policy framework
- Independent measurement, monitoring and control of line of business, Corporate, and firmwide market risk
- Definition, approval and monitoring of limits
- Performance of stress testing and qualitative risk assessments

Risk measurement

Measures used to capture market risk

There is no single measure to capture market risk and therefore the Firm uses various metrics, both statistical and nonstatistical, to assess risk including:

- Value-at-risk (VaR)
- Stress testing
- Profit and loss drawdowns
- Earnings-at-risk
- Other sensitivity-based measures

Risk monitoring and control

Market risk exposure is managed primarily through a series of limits set in the context of the market environment and business strategy. In setting limits, the Firm takes into consideration factors such as market volatility, product liquidity, accommodation of client business, and management experience. The Firm maintains different levels of limits. Firm level limits include VaR and stress limits. Similarly, line of business and Corporate limits include VaR and stress limits and may be supplemented by certain nonstatistical risk measures such as profit and loss drawdowns. Limits may also be set within the lines of business and Corporate, as well as at the portfolio and/or legal entity level.

Market Risk Management sets limits and regularly reviews and updates them as appropriate, with any changes approved by line of business or Corporate management and Market Risk Management. Senior management, including the Firm's CEO and CRO, are responsible for reviewing and approving certain of these risk limits on an ongoing basis. Limits that have not been reviewed within specified time periods by Market Risk Management are escalated to senior management. The lines of business and Corporate are responsible for adhering to established limits against which exposures are monitored and reported.

Limit breaches are required to be reported in a timely manner to limit approvers, which include Market Risk Management and senior management. In the event of a breach, Market Risk Management consults with senior management of the Firm and of the line of business or Corporate to determine the appropriate course of action required to return the applicable positions to compliance, which may include a reduction in risk in order to remedy the breach or granting a temporary increase in limits to accommodate an expected increase in client activity and/or market volatility. Certain Firm, Corporate or line of business-level limits that have been breached are escalated to senior management, the LOB Risk Committee, and/or the Firmwide Risk Committee.

The following table summarizes, by line of business and Corporate, the predominant business activities that give rise to market risks, and certain measures used to capture those risks.

Predominant business activities that give rise to market risk by line of business and Corporate

LOBs and Corporate	Predominant business activities ^(a)	Related market risks	Positions included in Risk Management VaR	Positions included in earnings-at-risk	Positions included in other sensitivity-based measures
CCB	<ul style="list-style-type: none"> Services mortgage loans Originates loans and takes deposits 	<ul style="list-style-type: none"> Non-linear risk primarily from prepayment options embedded in mortgages and changes in the probability of newly originated mortgage commitments actually closing Basis risk from differences in the relative movements of the rate indices underlying mortgage exposure and other interest rates 	<ul style="list-style-type: none"> Mortgage pipeline loans, classified as derivatives Warehouse loans, classified as trading assets - debt instruments MSRs Hedges of pipeline loans, warehouse loans and MSRs, classified as derivatives Interest-only securities, classified as trading assets debt instruments, and related hedges, classified as derivatives 	<ul style="list-style-type: none"> Retained loan portfolio Deposits 	
CIB	<ul style="list-style-type: none"> Makes markets and services clients across fixed income, foreign exchange, equities and commodities Originates loans and takes deposits 	<ul style="list-style-type: none"> Risk of loss from adverse movements in market prices across interest rate, credit, currency, commodity and equity risk factors 	<ul style="list-style-type: none"> Trading assets/liabilities - debt and marketable equity instruments, and derivatives, including hedges of the retained loan portfolio Certain securities purchased, loaned or sold under resale agreements and securities borrowed Fair value option elected liabilities Derivative CVA and associated hedges Marketable equity investments 	<ul style="list-style-type: none"> Retained loan portfolio Deposits 	<ul style="list-style-type: none"> Privately held equity and other investments measured at fair value Derivatives FVA and fair value option elected liabilities DVA
CB	<ul style="list-style-type: none"> Originates loans and takes deposits 	<ul style="list-style-type: none"> Interest rate risk and prepayment risk 		<ul style="list-style-type: none"> Retained loan portfolio Deposits 	
AWM	<ul style="list-style-type: none"> Provides initial capital investments in products such as mutual funds and capital invested alongside third-party investors Originates loans and takes deposits 	<ul style="list-style-type: none"> Risk from changes in market factors (e.g., rates and credit spreads) 	<ul style="list-style-type: none"> Debt securities held in advance of distribution to clients, classified as trading assets - debt instruments^(b) 	<ul style="list-style-type: none"> Retained loan portfolio Deposits 	<ul style="list-style-type: none"> Initial seed capital investments and related hedges, classified as derivatives Capital invested alongside third-party investors, typically in privately distributed collective vehicles managed by AWM (i.e., co-investments)
Corporate	<ul style="list-style-type: none"> Manages the Firm's liquidity, funding, capital, structural interest rate and foreign exchange risks 	<ul style="list-style-type: none"> Structural interest rate risk from the Firm's traditional banking activities Structural non-USD foreign exchange risks 	<ul style="list-style-type: none"> Derivative positions measured at fair value through noninterest revenue in earnings Marketable equity investments 	<ul style="list-style-type: none"> Deposits with banks Investment securities portfolio and related interest rate hedges Long-term debt and related interest rate hedges 	<ul style="list-style-type: none"> Privately held equity and other investments measured at fair value Foreign exchange exposure related to Firm-issued non-USD long-term debt ("LTD") and related hedges

(a) In addition to the predominant business activities, each of the LOBs and Corporate may engage in principal investing activities. To the extent principal investments are deemed market risk sensitive, they are reflected in relevant risk measures (i.e., VaR or Other sensitivity-based measures) and captured in the table above. For additional discussion on principal investments refer to Investment Portfolio Risk Management on page 123.

(b) The AWM contribution to Firmwide average VaR was not material for the year ended December 31, 2018 and 2017.

Management's discussion and analysis

Value-at-risk

JPMorgan Chase utilizes VaR, a statistical risk measure, to estimate the potential loss from adverse market moves in the current market environment. The Firm has a single VaR framework used as a basis for calculating Risk Management VaR and Regulatory VaR.

The framework is employed across the Firm using historical simulation based on data for the previous 12 months. The framework's approach assumes that historical changes in market values are representative of the distribution of potential outcomes in the immediate future. The Firm believes the use of Risk Management VaR provides a daily measure of risk that is closely aligned to risk management decisions made by the lines of business and Corporate, and provides the appropriate information needed to respond to risk events.

The Firm's Risk Management VaR is calculated assuming a one-day holding period and an expected tail-loss methodology which approximates a 95% confidence level. Risk Management VaR provides a consistent framework to measure risk profiles and levels of diversification across product types and is used for aggregating risks and monitoring limits across businesses. VaR results are reported to senior management, the Board of Directors and regulators.

Under the Firm's Risk Management VaR methodology, assuming current changes in market values are consistent with the historical changes used in the simulation, the Firm would expect to incur VaR "back-testing exceptions," defined as losses greater than that predicted by VaR estimates, an average of five times every 100 trading days. The number of VaR back-testing exceptions observed can differ from the statistically expected number of back-testing exceptions if the current level of market volatility is materially different from the level of market volatility during the 12 months of historical data used in the VaR calculation.

Underlying the overall VaR model framework are individual VaR models that simulate historical market returns for individual risk factors and/or product types. To capture material market risks as part of the Firm's risk management framework, comprehensive VaR model calculations are performed daily for businesses whose activities give rise to market risk. These VaR models are granular and incorporate numerous risk factors and inputs to simulate daily changes in market values over the historical period; inputs are selected based on the risk profile of each portfolio, as sensitivities and historical time series used to generate daily market values may be different across product types or risk management systems. The VaR model results across all portfolios are aggregated at the Firm level.

As VaR is based on historical data, it is an imperfect measure of market risk exposure and potential future losses. In addition, based on their reliance on available historical data, limited time horizons, and other factors, VaR measures are inherently limited in their ability to measure certain risks and to predict losses, particularly those associated with market illiquidity and sudden or severe shifts in market conditions.

For certain products, specific risk parameters are not captured in VaR due to the lack of inherent liquidity and availability of appropriate historical data. The Firm uses proxies to estimate the VaR for these and other products when daily time series are not available. It is likely that using an actual price-based time series for these products, if available, would affect the VaR results presented. The Firm therefore considers other nonstatistical measures such as stress testing, in addition to VaR, to capture and manage its market risk positions.

The daily market data used in VaR models may be different than the independent third-party data collected for VCG price testing in its monthly valuation process. For example, in cases where market prices are not observable, or where proxies are used in VaR historical time series, the data sources may differ. For further information on the Firm's valuation process, refer to Valuation process in Note 2. Because VaR model calculations require daily data and a consistent source for valuation, it may not be practical to use the data collected in the VCG monthly valuation process for VaR model calculations.

The Firm's VaR model calculations are periodically evaluated and enhanced in response to changes in the composition of the Firm's portfolios, changes in market conditions, improvements in the Firm's modeling techniques and measurements, and other factors. Such changes may affect historical comparisons of VaR results. For information regarding model reviews and approvals, refer to Estimations and Model Risk Management on page 140.

The Firm calculates separately a daily aggregated VaR in accordance with regulatory rules ("Regulatory VaR"), which is used to derive the Firm's regulatory VaR-based capital requirements under Basel III. This Regulatory VaR model framework currently assumes a ten business-day holding period and an expected tail loss methodology which approximates a 99% confidence level. Regulatory VaR is applied to "covered" positions as defined by Basel III, which may be different than the positions included in the Firm's Risk Management VaR. For example, credit derivative hedges of accrual loans are included in the Firm's Risk Management VaR, while Regulatory VaR excludes these credit derivative hedges. In addition, in contrast to the Firm's Risk Management VaR, Regulatory VaR currently excludes the diversification benefit for certain VaR models.

For additional information on Regulatory VaR and the other components of market risk regulatory capital for the Firm (e.g., VaR-based measure, stressed VaR-based measure and the respective backtesting), refer to JPMorgan Chase's Basel

III Pillar 3 Regulatory Capital Disclosures reports, which are available on the Firm's website at: (<http://investor.shareholder.com/jpmorganchase/basel.cfm>).

The table below shows the results of the Firm's Risk Management VaR measure using a 95% confidence level.

Total VaR

As of or for the year ended December 31, (in millions)	2018			2017		
	Avg.	Min	Max	Avg.	Min	Max
CIB trading VaR by risk type						
Fixed income	\$ 33	\$ 25	\$ 46	\$ 28	\$ 20	\$ 40
Foreign exchange	6	3	15	10	4	20
Equities	17	13	26	12	8	19
Commodities and other	8	4	13	7	4	10
Diversification benefit to CIB trading VaR	(26) ^(a)	NM ^(b)	NM ^(b)	(30) ^(a)	NM ^(b)	NM ^(b)
CIB trading VaR	38	26^(b)	58^(b)	27	14^(b)	38^(b)
Credit portfolio VaR	3	3	4	7	3	12
Diversification benefit to CIB VaR	(2) ^(a)	NM ^(b)	NM ^(b)	(6) ^(a)	NM ^(b)	NM ^(b)
CIB VaR	39	26^(b)	59^(b)	28	17^(b)	39^(b)
CCB VaR	1	—	3	2	1	4
Corporate VaR	12	9	14	4	1	16
Diversification benefit to other VaR	(1) ^(a)	NM ^(b)	NM ^(b)	(1) ^(a)	NM ^(b)	NM ^(b)
Other VaR	12	9^(b)	14^(b)	5	2^(b)	16^(b)
Diversification benefit to CIB and other VaR	(10) ^(a)	NM ^(b)	NM ^(b)	(4) ^(a)	NM ^(b)	NM ^(b)
Total VaR	\$ 41	\$ 28^(b)	\$ 62^(b)	\$ 29	\$ 17^(b)	\$ 42^(b)

(a) Average portfolio VaR is less than the sum of the VaR of the components described above, which is due to portfolio diversification. The diversification effect reflects that the risks are not perfectly correlated.

(b) Diversification benefit represents the difference between the total VaR and each reported level and the sum of its individual components. Diversification benefit reflects the non-additive nature of VaR due to imperfect correlation across lines of business, Corporate, and risk types. The maximum and minimum VaR for each portfolio may have occurred on different trading days than the components and consequently diversification benefit is not meaningful.

Average Total VaR increased \$12 million for the year-ended December 31, 2018 as compared with the prior year.

The increase was primarily due to changes in the risk profile for Fixed Income and Equities risk types, the inclusion of certain CIB marketable equity investments and a Corporate private equity position that became publicly traded in the fourth quarter of 2017, as well as increased volatility in the one-year historical look-back period.

In addition, average Credit Portfolio VaR has declined by \$4 million, reflecting the sale of select positions in the prior year.

VaR can vary significantly over time as positions change, market volatility fluctuates, and diversification benefits change.

VaR back-testing

The Firm evaluates the effectiveness of its VaR methodology by back-testing, which compares the daily Risk Management VaR results with the daily gains and losses actually recognized on market-risk related revenue.

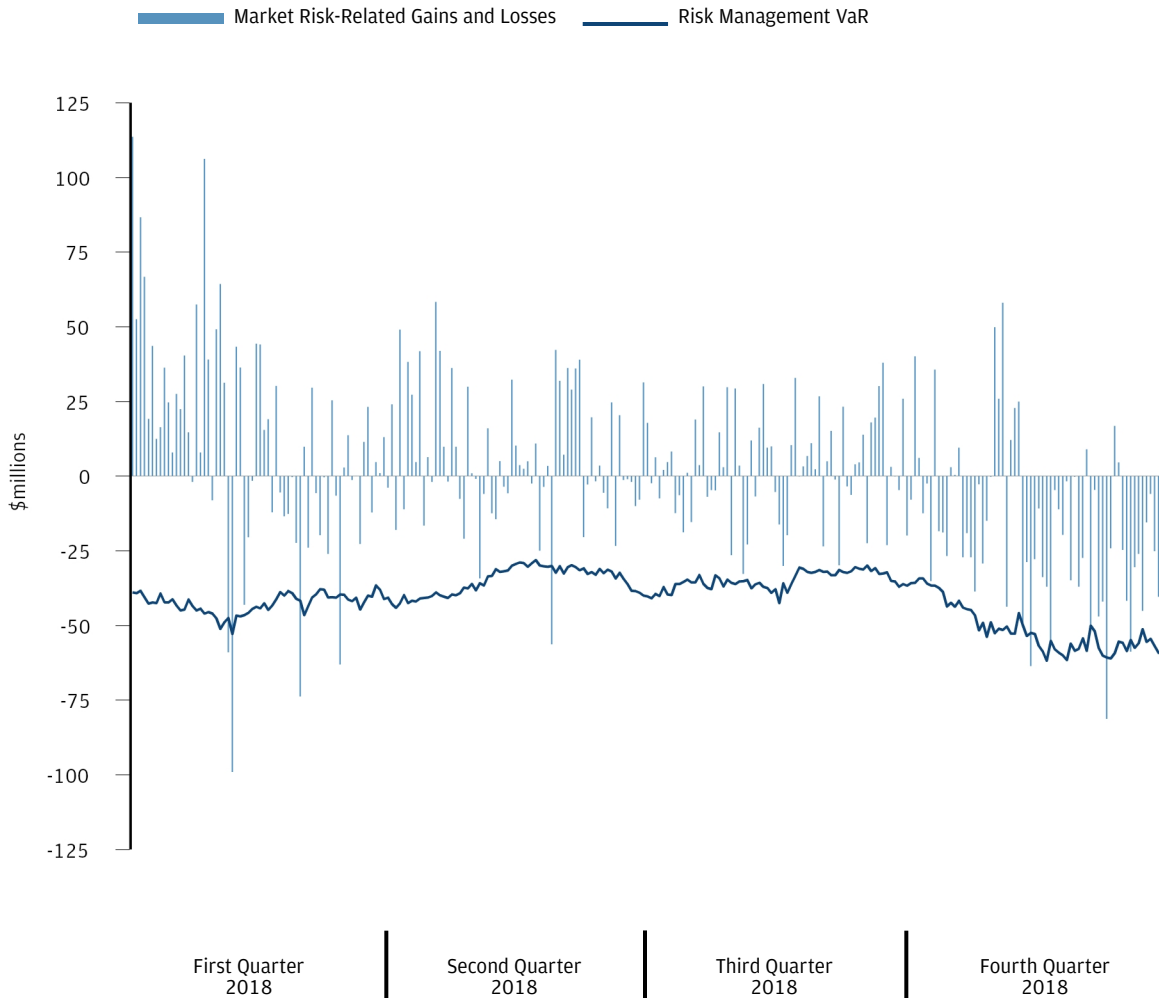
The Firm's definition of market risk-related gains and losses is consistent with the definition used by the banking regulators under Basel III. Under this definition, market risk-related gains and losses are defined as: gains and losses on the positions included in the Firm's Risk Management VaR, excluding fees, commissions, certain valuation adjustments, net interest income, and gains and losses arising from intraday trading.

Management's discussion and analysis

The following chart compares actual daily market risk-related gains and losses with the Firm's Risk Management VaR for the year ended December 31, 2018. As the chart presents market risk-related gains and losses related to those positions included in the Firm's Risk Management VaR, the results in the table below differ from the results of back-testing disclosed in the Market Risk section of the Firm's Basel III Pillar 3 Regulatory Capital Disclosures reports, which are based on Regulatory VaR applied to covered positions. The chart shows that for the year ended December 31, 2018 the Firm observed ten VaR back-testing exceptions and posted gains on 128 of the 259 days.

Daily Market Risk-Related Gains and Losses vs. Risk Management VaR (1-day, 95% Confidence level)

Year ended December 31, 2018



Other risk measures

Stress testing

Along with VaR, stress testing is an important tool used to assess risk. While VaR reflects the risk of loss due to adverse changes in markets using recent historical market behavior, stress testing reflects the risk of loss from hypothetical changes in the value of market risk sensitive positions applied simultaneously. Stress testing measures the Firm's vulnerability to losses under a range of stressed but possible economic and market scenarios. The results are used to understand the exposures responsible for those potential losses and are measured against limits.

The Firm's stress framework covers Corporate and all lines of business with market risk sensitive positions. The framework is used to calculate multiple magnitudes of potential stress for both market rallies and market sell-offs, assuming significant changes in market factors such as credit spreads, equity prices, interest rates, currency rates and commodity prices, and combines them in multiple ways to capture an array of hypothetical economic and market scenarios.

The Firm generates a number of scenarios that focus on tail events in specific asset classes and geographies, including how the event may impact multiple market factors simultaneously. Scenarios also incorporate specific idiosyncratic risks and stress basis risk between different products. The flexibility in the stress framework allows the Firm to construct new scenarios that can test the outcomes against possible future stress events. Stress testing results are reported on a regular basis to the respective LOBs, Corporate and the Firm's senior management.

Stress scenarios are governed by an overall stress framework and are subject to the standards outlined in the Firm's policies related to model risk management. Significant changes to the framework are reviewed by the relevant LOB Risk Committees on an annual basis or as changing market conditions warrant and may be redefined to reflect current or expected market conditions.

The Firm's stress testing framework is utilized in calculating the Firm's CCAR and other stress test results, which are reported to the Board of Directors. In addition, stress testing results are incorporated into the Firm's Risk Appetite framework, and are reported quarterly to the DRPC.

Profit and loss drawdowns

Profit and loss drawdowns are used to highlight trading losses above certain levels of risk tolerance. Profit and loss drawdowns are defined as the decline in net profit and loss since the year-to-date peak revenue level.

Earnings-at-risk

The VaR and sensitivity measures illustrate the economic sensitivity of the Firm's Consolidated balance sheets to changes in market variables.

The effect of interest rate exposure on the Firm's reported net income is also important as interest rate risk represents one of the Firm's significant market risks. Interest rate risk arises not only from trading activities but also from the Firm's traditional banking activities, which include extension of loans and credit facilities, taking deposits and issuing debt. The Firm evaluates its structural interest rate risk exposure through earnings-at-risk, which measures the extent to which changes in interest rates will affect the Firm's net interest income and interest rate-sensitive fees. For a summary by line of business and Corporate, identifying positions included in earnings-at-risk, refer to the table on page 125.

The CTC Risk Committee establishes the Firm's structural interest rate risk policy and related limits, which are subject to approval by the DRPC. Treasury and CIO, working in partnership with the lines of business, calculates the Firm's structural interest rate risk profile and reviews it with senior management, including the CTC Risk Committee. In addition, oversight of structural interest rate risk is managed through a dedicated risk function reporting to the CTC CRO. This risk function is responsible for providing independent oversight and governance around assumptions and establishing and monitoring limits for structural interest rate risk. The Firm manages structural interest rate risk generally through its investment securities portfolio and interest rate derivatives.

Management's discussion and analysis

Structural interest rate risk can occur due to a variety of factors, including:

- Differences in the timing among the maturity or repricing of assets, liabilities and off-balance sheet instruments
- Differences in the amounts of assets, liabilities and off-balance sheet instruments that are repricing at the same time
- Differences in the amounts by which short-term and long-term market interest rates change (for example, changes in the slope of the yield curve)
- The impact of changes in the maturity of various assets, liabilities or off-balance sheet instruments as interest rates change

The Firm manages interest rate exposure related to its assets and liabilities on a consolidated, firmwide basis. Business units transfer their interest rate risk to Treasury and CIO through funds transfer pricing, which takes into account the elements of interest rate exposure that can be risk-managed in financial markets. These elements include asset and liability balances and contractual rates of interest, contractual principal payment schedules, expected prepayment experience, interest rate reset dates and maturities, rate indices used for repricing, and any interest rate ceilings or floors for adjustable rate products. All transfer-pricing assumptions are dynamically reviewed.

The Firm generates a baseline for net interest income and certain interest rate-sensitive fees, and then conducts simulations of changes for interest rate-sensitive assets and liabilities denominated in U.S. dollars and other currencies ("non-U.S. dollar" currencies). This simulation primarily includes retained loans, deposits, deposits with banks, investment securities, long term debt and any related interest rate hedges, and excludes other positions in risk management VaR and other sensitivity-based measures as described on page 125.

Earnings-at-risk scenarios estimate the potential change in this baseline, over the following 12 months utilizing multiple assumptions. These scenarios include a parallel shift involving changes to both short-term and long-term rates by an equal amount; a steeper yield curve involving holding short-term rates constant and increasing long-term rates or decreasing short-term rates and holding long-term rates constant; and a flatter yield curve involving holding short-term rates constant and decreasing long-term rates or increasing short-term rates and holding long-term rates constant. These scenarios consider the impact on exposures as a result of changes in interest rates from baseline rates, as well as pricing sensitivities of deposits, optionality and changes in product mix. The scenarios include forecasted balance sheet changes, as well as modeled prepayment and reinvestment behavior, but do not include assumptions about actions that could be taken by the Firm in response to any such instantaneous rate changes. Mortgage prepayment assumptions are based on the interest rates used in the scenarios compared with underlying contractual rates, the time since origination, and other factors which are updated periodically based on historical experience. The pricing sensitivity of deposits in the baseline and scenarios use

assumed rates paid which may differ from actual rates paid due to timing lags and other factors. The Firm's earnings-at-risk scenarios are periodically evaluated and enhanced in response to changes in the composition of the Firm's balance sheet, changes in market conditions, improvements in the Firm's simulation and other factors.

The Firm's U.S. dollar sensitivities are presented in the table below.

December 31, (in billions)	2018	2017
Parallel shift:		
+100 bps shift in rates	\$ 0.9	\$ 1.7
-100 bps shift in rates	(2.1)	(3.6)
Steeper yield curve:		
+100 bps shift in long-term rates	0.5	0.7
-100 bps shift in short-term rates	(1.2)	(2.2)
Flatter yield curve:		
+100 bps shift in short-term rates	0.4	1.0
-100 bps shift in long-term rates	(0.9)	(1.4)

The Firm's sensitivity to rates is largely a result of assets repricing at a faster pace than deposits.

The Firm's net U.S. dollar sensitivities as of December 31, 2018 decreased when compared to December 31, 2017 primarily as a result of updating the Firm's baseline to reflect higher interest rates. As higher interest rates are now reflected in the Firm's baselines, sensitivities to changes in rates are expected to be less significant.

The Firm's non-U.S. dollar sensitivities are presented in the table below.

December 31, (in billions)	2018	2017
Parallel shift:		
+100 bps shift in rates	\$ 0.5	\$ 0.5
Flatter yield curve:		
+100 bps shift in short-term rates	0.5	0.5

The results of the non-U.S. dollar interest rate scenario involving a steeper yield curve with long-term rates rising by 100 basis points and short-term rates staying at current levels were not material to the Firm's earnings-at-risk at December 31, 2018 and 2017.

Non-U.S. dollar foreign exchange risk

Non-U.S. dollar FX risk is the risk that changes in foreign exchange rates affect the value of the Firm's assets or liabilities or future results. The Firm has structural non-U.S. dollar FX exposures arising from capital investments, forecasted expense and revenue, the investment securities

portfolio and non-U.S. dollar-denominated debt issuance. Treasury and CIO, working in partnership with the lines of business, primarily manage these risks on behalf of the Firm. Treasury and CIO may hedge certain of these risks using derivatives within risk limits governed by the CTC Risk Committee.

Other sensitivity-based measures

The Firm quantifies the market risk of certain investment and funding activities by assessing the potential impact on net revenue and OCI due to changes in relevant market variables. For additional information on the positions captured in other sensitivity-based measures, refer to the table Predominant business activities that give rise to market risk on page 125.

The table below represents the potential impact to net revenue or OCI for market risk sensitive instruments that are not included in VaR or earnings-at-risk. Where appropriate, instruments used for hedging purposes are reported along with the positions being hedged. The sensitivities disclosed in the table below may not be representative of the actual gain or loss that would have been realized at December 31, 2018 and 2017, as the movement in market parameters across maturities may vary and are not intended to imply management's expectation of future deterioration in these sensitivities.

Year ended December 31, Gain/(loss) (in millions)				
Activity	Description	Sensitivity measure	2018	2017
Investment activities^(a)				
Investment management activities	Consists of seed capital and related hedges; and fund co-investments	10% decline in market value	\$ (102)	\$ (110)
Other investments	Consists of privately held equity and other investments held at fair value	10% decline in market value	(218)	(338)
Funding activities				
Non-USD LTD cross-currency basis	Represents the basis risk on derivatives used to hedge the foreign exchange risk on the non-USD LTD ^(b)	1 basis point parallel tightening of cross currency basis	(13)	(10)
Non-USD LTD hedges foreign currency ("FX") exposure	Primarily represents the foreign exchange revaluation on the fair value of the derivative hedges ^(b)	10% depreciation of currency	17	(13)
Derivatives - funding spread risk	Impact of changes in the spread related to derivatives FVA	1 basis point parallel increase in spread	(4)	(6)
Fair value option elected liabilities - funding spread risk	Impact of changes in the spread related to fair value option elected liabilities DVA ^(b)	1 basis point parallel increase in spread	30	22
Fair value option elected liabilities - interest rate sensitivity	Interest rate sensitivity on fair value option liabilities resulting from a change in the Firm's own credit spread ^(b)	1 basis point parallel increase in spread	1	(1)

(a) Excludes equity securities without readily determinable fair values that are measured under the measurement alternative. Refer to Note 2 for additional information.

(b) Impact recognized through OCI.

COUNTRY RISK MANAGEMENT

The Firm, through its lines of business and Corporate, may be exposed to country risk resulting from financial, economic, political or other significant developments which adversely affect the value of the Firm's exposures related to a particular country or set of countries. The Country Risk Management group actively monitors the various portfolios which may be impacted by these developments and measures the extent to which the Firm's exposures are diversified given the Firm's strategy and risk tolerance relative to a country.

Organization and management

Country Risk Management is an independent risk management function that assesses, manages and monitors country risk originated across the Firm. The Firmwide Risk Executive for Country Risk reports to the Firm's CRO.

The Firm's country risk management function includes the following activities:

- Establishing policies, procedures and standards consistent with a comprehensive country risk framework
- Assigning sovereign ratings, assessing country risks and establishing risk tolerance relative to a country
- Measuring and monitoring country risk exposure and stress across the Firm
- Managing and approving country limits and reporting trends and limit breaches to senior management
- Developing surveillance tools, such as signaling models and ratings indicators, for early identification of potential country risk concerns
- Providing country risk scenario analysis

Sources and measurement

The Firm is exposed to country risk through its lending and deposits, investing, and market-making activities, whether cross-border or locally funded. Country exposure includes activity with both government and private-sector entities in a country. Under the Firm's internal country risk management approach, attribution of exposure to a specific country is based on the country where the largest proportion of the assets of the counterparty, issuer, obligor or guarantor are located or where the largest proportion of its revenue is derived, which may be different than the domicile (i.e. legal residence) or country of incorporation of the counterparty, issuer, obligor or guarantor. Country exposures are generally measured by considering the Firm's risk to an immediate default of the counterparty, issuer, obligor or guarantor, with zero recovery. Assumptions are sometimes required in determining the measurement and allocation of country exposure, particularly in the case of certain non-linear or index exposures. The use of different measurement approaches or assumptions could affect the amount of reported country exposure.

During the fourth quarter of 2018, the Firm refined its country exposure measurement approach to exclude capital invested in local entities. With this change, country exposure more directly measures the Firm's risk to an immediate default of a counterparty, issuer, obligor or guarantor. The risk associated with capital invested in local entities will continue to be examined in tailored stress scenarios, depending on the vulnerabilities being tested. For more on the Firm's country risk stress testing, refer to page 133.

Under the Firm's internal country risk measurement framework:

- Lending exposures are measured at the total committed amount (funded and unfunded), net of the allowance for credit losses and eligible cash and marketable securities collateral received
- Deposits are measured as the cash balances placed with central and commercial banks
- Securities financing exposures are measured at their receivable balance, net of eligible collateral received
- Debt and equity securities are measured at the fair value of all positions, including both long and short positions
- Counterparty exposure on derivative receivables is measured at the derivative's fair value, net of the fair value of the eligible collateral received
- Credit derivatives protection purchased and sold is reported based on the underlying reference entity and is measured at the notional amount of protection purchased or sold, net of the fair value of the recognized derivative receivable or payable. Credit derivatives protection purchased and sold in the Firm's market-making activities is measured on a net basis, as such activities often result in selling and purchasing protection related to the same underlying reference entity; this reflects the manner in which the Firm manages these exposures

Some activities may create contingent or indirect exposure related to a country (for example, providing clearing services or secondary exposure to collateral on securities financing receivables). These exposures are managed in the normal course of business through the Firm's credit, market, and operational risk governance, rather than through Country Risk Management.

The Firm's internal country risk reporting differs from the reporting provided under the FFIEC bank regulatory requirements. For further information on the FFIEC's reporting methodology, refer to Cross-border outstandings on page 306 of the 2018 Form 10-K.

Stress testing

Stress testing is an important component of the Firm's country risk management framework, which aims to estimate and limit losses arising from a country crisis by measuring the impact of adverse asset price movements to a country based on market shocks combined with counterparty specific assumptions. Country Risk Management periodically designs and runs tailored stress scenarios to test vulnerabilities to individual countries or sets of countries in response to specific or potential market events, sector performance concerns, sovereign actions and geopolitical risks. These tailored stress results are used to inform potential risk reduction across the Firm, as necessary.

Risk reporting

To enable effective risk management of country risk to the Firm, country exposure and stress are measured and reported weekly, and used by Country Risk Management to identify trends, and monitor high usages and breaches against limits.

The following table presents the Firm's top 20 exposures by country (excluding the U.S.) as of December 31, 2018, and their comparative exposures as of December 31, 2017. The selection of countries represents the Firm's largest total exposures by country, based on the Firm's internal country risk management approach, and does not represent the Firm's view of any actual or potentially adverse credit conditions. Country exposures may fluctuate from period to period due to client activity and market flows.

As discussed on page 132, during the fourth quarter of 2018 the Firm refined its country exposure measurement approach to exclude capital invested in local entities. While this change did not have a material impact to country exposure, prior period amounts have been revised within the following table to conform with the current period presentation.

Top 20 country exposures (excluding the U.S.)^(a)

December 31, (in billions)	2018			2017 ^(f)	
	Lending and deposits ^(b)	Trading and investing ^{(c)(d)}	Other ^(e)	Total exposure	Total exposure
Germany	\$ 53.7	\$ 8.1	\$ 0.3	\$ 62.1	\$ 57.4
United Kingdom	28.0	10.1	2.6	40.7	44.9
Japan	25.4	3.3	0.4	29.1	30.8
China	9.5	7.1	2.7	19.3	16.3
France	10.8	6.5	0.6	17.9	19.4
Canada	10.8	3.4	0.1	14.3	14.9
Australia	7.2	5.4	0.4	13.0	11.4
Switzerland	9.1	0.6	3.1	12.8	13.9
India	6.1	4.0	1.7	11.8	12.3
Luxembourg	10.5	0.5	–	11.0	9.5
South Korea	4.2	3.2	0.2	7.6	6.8
Brazil	4.4	2.9	–	7.3	4.6
Singapore	3.9	1.4	1.5	6.8	6.3
Italy	2.4	3.8	0.2	6.4	6.7
Netherlands	5.0	0.4	0.4	5.8	8.0
Mexico	3.7	1.8	–	5.5	5.2
Hong Kong	2.4	1.1	1.9	5.4	4.2
Saudi Arabia	4.7	0.6	–	5.3	4.5
Spain	3.8	1.3	–	5.1	6.8
Malaysia	1.8	1.1	1.4	4.3	3.0

- (a) Country exposures presented in the table reflect 87% and 86% of total firmwide non-U.S. exposure, where exposure is attributed to a specific country, for the periods ending December 31, 2018 and 2017, respectively.
- (b) Lending and deposits includes loans and accrued interest receivable (net of eligible collateral and the allowance for loan losses), deposits with banks (including central banks), acceptances, other monetary assets, issued letters of credit net of participations, and unused commitments to extend credit. Excludes intra-day and operating exposures, such as those from settlement and clearing activities.
- (c) Includes market-making inventory, AFS securities, and counterparty exposure on derivative and securities financings net of eligible collateral and hedging.
- (d) Includes single reference entity ("single-name"), index and other multiple reference entity transactions for which one or more of the underlying reference entities is in a country listed in the above table.
- (e) Predominantly includes physical commodity inventory.
- (f) The country rankings presented in the table as of December 31, 2017, are based on the country rankings of the corresponding exposures at December 31, 2018, not actual rankings of such exposures at December 31, 2017.

OPERATIONAL RISK MANAGEMENT

Operational risk is the risk associated with inadequate or failed internal processes, people and systems, or from external events and includes compliance risk, conduct risk, legal risk, and estimations and model risk. Operational risk is inherent in the Firm's activities and can manifest itself in various ways, including fraudulent acts, business interruptions, cybersecurity attacks, inappropriate employee behavior, failure to comply with applicable laws and regulations or failure of vendors to perform in accordance with their agreements. These events could result in financial losses, litigation and regulatory fines, as well as other damages to the Firm. The goal is to keep operational risk at appropriate levels in light of the Firm's financial position, the characteristics of its businesses, and the markets and regulatory environments in which it operates.

Operational Risk Management Framework

To monitor and control operational risk, the Firm has an Operational Risk Management Framework ("ORMF") which is designed to enable the Firm to maintain a sound and well-controlled operational environment. The ORMF has four main components: Governance, Operational Risk Identification and Assessment, Operational Risk Measurement, and Operational Risk Monitoring and Reporting.

Governance

The lines of business and Corporate are responsible for applying the ORMF in order to manage the operational risk that arises from their activities. The Control Management organization, which consists of control managers within each line of business and Corporate, is responsible for the day-to-day execution of the ORMF.

Line of business and Corporate control committees are responsible for reviewing data that indicates the quality and stability of processes, addressing key operational risk issues, focusing on processes with control concerns, and overseeing control remediation. These committees escalate operational risk issues to the FCC, as appropriate. For additional information on the FCC, refer to Enterprise-wide Risk Management on pages 79-140.

The Firmwide Risk Executive for Operational Risk Management ("ORM"), a direct report to the CRO, is responsible for defining the ORMF and establishing minimum standards for its execution. Operational Risk Officers report to both the line of business CROs and to the Firmwide Risk Executive for ORM, and are independent of the respective businesses or corporate functions they oversee.

The Firm's Operational Risk Management Policy is approved by the DRPC. This policy establishes the Operational Risk Management Framework for the Firm.

Operational Risk identification and assessment

The Firm utilizes a structured risk and control self-assessment process which is executed by the lines of business and Corporate in accordance with the minimum standards established by ORM, to identify, assess, mitigate and manage its operational risk. As part of this process, lines of business and Corporate identify key operational risks inherent in their activities, address gaps or deficiencies identified, and define actions to reduce residual risk. Action plans are developed for identified control issues and lines of business and Corporate are held accountable for tracking and resolving issues in a timely manner. Operational Risk Officers independently challenge the execution of the self-assessment and evaluate the appropriateness of the residual risk results.

In addition to the self-assessment process, the Firm tracks and monitors events that have led to or could lead to actual operational risk losses, including litigation-related events. Responsible lines of business and Corporate analyze their losses to evaluate the effectiveness of their control environment to assess where controls have failed, and to determine where targeted remediation efforts may be required. ORM provides oversight of these activities and may also perform independent assessments of significant operational risk events and areas of concentrated or emerging risk.

Operational Risk Measurement

In addition to the level of actual operational risk losses, operational risk measurement includes operational risk-based capital and operational risk loss projections under both baseline and stressed conditions.

The primary component of the operational risk capital estimate is the Loss Distribution Approach ("LDA") statistical model, which simulates the frequency and severity of future operational risk loss projections based on historical data. The LDA model is used to estimate an aggregate operational risk loss over a one-year time horizon, at a 99.9% confidence level. The LDA model incorporates actual internal operational risk losses in the quarter following the period in which those losses were realized, and the calculation generally continues to reflect such losses even after the issues or business activities giving rise to the losses have been remediated or reduced.

As required under the Basel III capital framework, the Firm's operational risk-based capital methodology, which uses the Advanced Measurement Approach ("AMA"), incorporates internal and external losses as well as management's view of tail risk captured through operational risk scenario analysis, and evaluation of key business environment and internal control metrics. The Firm does not reflect the impact of insurance in its AMA estimate of operational risk capital.

The Firm considers the impact of stressed economic conditions on operational risk losses and develops a forward looking view of material operational risk events that may occur in a stressed environment. The Firm's operational risk stress testing framework is utilized in calculating results for the Firm's CCAR and other stress testing processes.

For information related to operational risk RWA, CCAR or ICAAP, refer to Capital Risk Management section, pages 85-94.

Operational Risk Monitoring and reporting

ORM has established standards for consistent operational risk monitoring and reporting. Operational risk reports are produced on a firmwide basis as well as by line of business and Corporate. Reporting includes the evaluation of key risk indicators against established thresholds as well as the assessment of different types of operational risk against stated risk appetite. The standards reinforce escalation protocols to senior management and to the Board of Directors.

Subcategories and examples of operational risks

Operational risk can manifest itself in various ways. Operational risk subcategories such as Compliance risk, Conduct risk, Legal risk and Estimations and Model risk, as well as other operational risks, can lead to losses which are captured through the Firm's operational risk measurement processes. For more information on Compliance risk, Conduct risk, Legal risk and Estimations and Model risk, refer to pages 137, 138, 139 and 140, respectively. Details on other select examples of operational risks are provided below.

Cybersecurity risk

Cybersecurity risk is an important, continuous and evolving focus for the Firm. The Firm devotes significant resources to protecting and continuing to improve the security of the Firm's computer systems, software, networks and other technology assets. The Firm's security efforts are designed to protect against, among other things, cybersecurity attacks by unauthorized parties attempting to obtain access to confidential information, destroy data, disrupt or degrade service, sabotage systems or cause other damage. The Firm continues to make significant investments in enhancing its cyberdefense capabilities and to strengthen its partnerships with the appropriate government and law enforcement agencies and other businesses in order to understand the full spectrum of cybersecurity risks in the operating environment, enhance defenses and improve resiliency against cybersecurity threats. The Firm actively participates in discussions of cybersecurity risks with law enforcement, government officials, peer and industry groups, and has significantly increased efforts to educate employees and certain clients on the topic.

Third parties with which the Firm does business or that facilitate the Firm's business activities (e.g., vendors, exchanges, clearing houses, central depositories, and financial intermediaries) could also be sources of

cybersecurity risk to the Firm. Third party cybersecurity incidents such as system breakdowns or failures, misconduct by the employees of such parties, or cyberattacks could affect their ability to deliver a product or service to the Firm or result in lost or compromised information of the Firm or its clients. Clients can also be sources of cybersecurity risk to the Firm, particularly when their activities and systems are beyond the Firm's own security and control systems. As a result, the Firm engages in regular and ongoing discussions with certain vendors and clients regarding cybersecurity risks and opportunities to improve security. However, where cybersecurity incidents are due to client failure to maintain the security of their own systems and processes, clients will generally be responsible for losses incurred.

To protect the confidentiality, integrity and availability of the Firm's infrastructure, resources and information, the Firm maintains a cybersecurity program to prevent, detect, and respond to cyberattacks. The Global Chief Information Officer, Chief Technology Control Officer, and Chief Information Security Officer ("CISO") update the Audit Committee of the Board of Directors at least annually on the Firm's Information Security Program, recommended changes, cybersecurity policies and practices, ongoing efforts to improve security, as well as its efforts regarding significant cybersecurity events. In addition, the Firm has a detailed cybersecurity incident response plan ("IRP") designed to enable the Firm to respond to attempted cybersecurity incidents, coordinate such responses with law enforcement and other government agencies, and notify clients and customers. Among other key focus areas, the IRP is designed to mitigate the risk of insider trading connected to a cybersecurity incident, and includes various escalation points in this regard including Compliance and the Legal Department.

The Cybersecurity and Technology Control functions are responsible for governance and oversight of the Firm's Information Security Program. In partnership with the Firm's lines of business, the Cybersecurity and Technology Control organization identifies information security risk issues and champions programs for the technological protection of the Firm's information resources including applications, infrastructure as well as confidential and personal information related to the Firm's customers. The Cybersecurity and Technology Control organization comprises Governance and Control, Assessments, Assurance and Training, Cybersecurity Operations, business aligned control officers, Identity and Access Management, and resiliency functions that execute the Information Security Program.

The Global Cybersecurity and Technology Control governance structure is designed to identify, escalate, and mitigate information security risks. This structure uses key governance forums to disseminate information and monitor technology efforts. These forums are established at multiple levels throughout the Firm and include representatives from each line of business and Corporate.

Management's discussion and analysis

Reports containing overviews of key technology risks and efforts to enhance related controls are produced for these forums, and are reviewed by management at multiple levels including technology management, Firmwide management and the Operating Committee. The forums are used to escalate information security risks or other matters as appropriate to the FCC.

IRM provides oversight of the activities which identify, assess, manage and mitigate cybersecurity risk. As integral participants in cybersecurity governance forums, the IRM organization actively monitors and oversees the Cybersecurity and Technology Control functions.

The Firm's Security Awareness Program includes training that reinforces the Firm's Information Technology Risk and Security Management policies, standards and practices, as well as the expectation that employees comply with these policies. The Security Awareness Program engages personnel through training on how to identify potential cybersecurity risks and protect the Firm's resources and information. This training is mandatory for all employees globally on an annual basis, and it is supplemented by firmwide testing initiatives, including quarterly phishing tests. Finally, the Firm's Global Privacy Program requires all employees to take annual awareness training on data privacy. This privacy-focused training includes information about confidentiality and security, as well as responding to unauthorized access to or use of information.

Business and technology resiliency risk

Business disruptions can occur due to forces beyond the Firm's control such as severe weather, power or telecommunications loss, flooding, transit strikes, terrorist threats or infectious disease. The safety of the Firm's employees and customers is of the highest priority. The Firm's global resiliency program is intended to enable the Firm to recover its critical business functions and supporting assets (i.e., staff, technology and facilities) in the event of a business interruption. The program includes corporate governance, awareness training, and testing of recovery strategies, as well as strategic and tactical initiatives to identify, assess, and manage business interruption and public safety risks.

The strength and proficiency of the Firm's global resiliency program has played an integral role in maintaining the Firm's business operations during and after various events.

Payment fraud risk

Payment fraud risk is the risk of external and internal parties unlawfully obtaining personal monetary benefit through misdirected or otherwise improper payment. Over the past year, the risk of payment fraud remained at a heightened level across the industry. The complexities of these incidents and the strategies used by perpetrators continue to evolve. A Payments Control Program including the LOBs and Corporate develop methods for managing the risk, implementing controls and providing employee and client education and awareness training. The Firm's monitoring of customer behavior is periodically evaluated and enhanced in an effort to detect and mitigate new strategies implemented by fraud perpetrators. The Firm's consumer and wholesale businesses collaborate closely to deploy risk mitigation controls across their businesses.

Third-party outsourcing risk

To identify and manage the operational risk inherent in its outsourcing activities, the Firm has a Third-Party Oversight ("TPO") framework to assist the lines of business and Corporate in selecting, documenting, onboarding, monitoring and managing their supplier relationships. The objective of the TPO framework is to hold third parties to the same high level of operational performance as is expected of the Firm's internal operations. The Corporate Third-Party Oversight group is responsible for Firmwide TPO training, monitoring, reporting and standards.

Insurance

One of the ways in which operational risk may be mitigated is through insurance maintained by the Firm. The Firm purchases insurance from commercial insurers and utilizes a wholly-owned captive insurer, Park Assurance Company, as needed to comply with local laws and regulations (e.g., workers compensation), as well as to serve other needs (e.g., property loss and public liability). Insurance may also be required by third parties with whom the Firm does business. The insurance purchased is reviewed and approved by senior management.

COMPLIANCE RISK MANAGEMENT

Compliance risk, a subcategory of operational risk, is the risk of failure to comply with legal or regulatory obligations or codes of conduct and standards of self-regulatory organizations applicable to the business activities of the Firm.

Overview

Each line of business and Corporate hold primary ownership of and accountability for managing compliance risk. The Firm's Compliance Organization ("Compliance"), which is independent of the lines of business, works closely with senior management to provide independent review, monitoring and oversight of business operations with a focus on compliance with the legal and regulatory obligations applicable to the delivery of the Firm's products and services to clients and customers.

These compliance risks relate to a wide variety of legal and regulatory obligations, depending on the line of business and the jurisdiction, and include those related to financial products and services, relationships and interactions with clients and customers, and employee activities. For example, compliance risks include those associated with anti-money laundering compliance, trading activities, market conduct, and complying with the rules and regulations related to the offering of products and services across jurisdictional borders, among others. Compliance risk is also inherent in the Firm's fiduciary activities, including the failure to exercise the applicable standard of care (such as the duties of loyalty or care), to act in the best interest of clients and customers or to treat clients and customers fairly.

Other Functions provide oversight of significant regulatory obligations that are specific to their respective areas of responsibility.

Compliance implements various practices designed to identify and mitigate compliance risk by establishing policies and standards, testing, monitoring, training and providing guidance.

Governance and oversight

Compliance is led by the Firm's CCO who reports to the Firm's CRO.

The Firm maintains oversight and coordination of its Compliance Risk Management practices through the Firm's CCO, lines of business CCOs and regional CCOs to implement the Compliance program globally across the lines of business and regions. The Firm's CCO is a member of the FCC and the FRC. The Firm's CCO also provides regular updates to the Audit Committee and DRPC. In addition, certain Special Purpose Committees of the Board have been established to oversee the Firm's compliance with regulatory Consent Orders.

The Firm has a Code of Conduct (the "Code"). Each employee is given annual training on the Code and is required annually to affirm his or her compliance with the Code. All new hires must complete Code training shortly after their start date with the Firm. The Code sets forth the Firm's expectation that employees will conduct themselves with integrity at all times and provides the principles that govern employee conduct with clients, customers, shareholders and one another, as well as with the markets and communities in which the Firm does business. The Code requires employees to promptly report any known or suspected violation of the Code, any internal Firm policy, or any law or regulation applicable to the Firm's business. It also requires employees to report any illegal conduct, or conduct that violates the underlying principles of the Code, by any of the Firm's employees, customers, suppliers, contract workers, business partners, or agents. The Code prohibits retaliation against anyone who raises an issue or concern in good faith. Specified compliance officers are specially trained and designated as "code specialists" who act as a resource to employees on questions related to the Code. Employees can report any known or suspected violations of the Code through the Code Reporting Hotline by phone or the internet. The Hotline is anonymous, except in certain non-U.S. jurisdictions where laws prohibit anonymous reporting, and is available 24/7 globally, with translation services. It is maintained by an outside service provider. Annually, the Audit Committee receives a report on the Code of Conduct program, including an update on the employee completion rate for Code of Conduct training and affirmation.

CONDUCT RISK MANAGEMENT

Conduct risk, a subcategory of operational risk, is the risk that any action or inaction by an employee or employees could lead to unfair client or customer outcomes, impact the integrity of the markets in which the Firm operates, or compromise the Firm's reputation.

Overview

Each line of business and Corporate is accountable for identifying and managing its conduct risk to provide appropriate engagement, ownership and sustainability of a culture consistent with the Firm's How We Do Business Principles (the "Principles"). The Principles serve as a guide for how employees are expected to conduct themselves. With the Principles serving as a guide, the Firm's Code sets out the Firm's expectations for each employee and provides information and resources to help employees conduct business ethically and in compliance with the law everywhere the Firm operates. For further discussion of the Code, refer to Compliance Risk Management on page 137.

Governance and oversight

The Conduct Risk Program is governed by a Board-level approved Conduct Risk Governance Policy. The Conduct Risk Governance Policy establishes the framework for ownership, assessment, managing and escalating conduct risk in the Firm.

The CRSC provides oversight of the Firm's conduct initiatives to develop a more holistic view of conduct risks and to connect key programs across the Firm in order to identify opportunities and emerging areas of focus.

The CRSC may escalate systemic conduct risk issues to the FRC and as appropriate to the DRPC. The misconduct (actual or potential) of individuals involved in material risk and control issues are escalated to the HR Control Forum.

Certain committees of the Board oversee conduct risk issues within the scope of their responsibilities.

Conduct risk management encompasses various aspects of people management practices throughout the employee life cycle, including recruiting, onboarding, training and development, performance management, promotion and compensation processes. Each LOB, Treasury and CIO, and designated corporate function completes an assessment of conduct risk quarterly, reviews metrics and issues which may involve conduct risk, and provides business conduct training as appropriate.

LEGAL RISK MANAGEMENT

Legal risk, a subcategory of operational risk, is the risk of loss primarily caused by the actual or alleged failure to meet legal obligations that arise from the rule of law in jurisdictions in which the Firm operates, agreements with clients and customers, and products and services offered by the Firm.

Overview

The global Legal function (“Legal”) provides legal services and advice to the Firm. Legal is responsible for managing the Firm’s exposure to Legal risk by:

- managing actual and potential litigation and enforcement matters, including internal reviews and investigations related to such matters
- advising on products and services, including contract negotiation and documentation
- advising on offering and marketing documents and new business initiatives
- managing dispute resolution
- interpreting existing laws, rules and regulations, and advising on changes thereto
- advising on advocacy in connection with contemplated and proposed laws, rules and regulations, and
- providing legal advice to the LOBs and Corporate, in alignment with the lines of defense described under Enterprise-wide Risk Management.

Legal selects, engages and manages outside counsel for the Firm on all matters in which outside counsel is engaged. In addition, Legal advises the Firm’s Conflicts Office which reviews the Firm’s wholesale transactions that may have the potential to create conflicts of interest for the Firm.

Governance and oversight

The Firm’s General Counsel reports to the CEO and is a member of the Operating Committee, the Firmwide Risk Committee and the Firmwide Control Committee. The General Counsel’s leadership team includes a General Counsel for each line of business, the heads of the Litigation and Corporate & Regulatory practices, as well as the Firm’s Corporate Secretary. Each region (e.g., Latin America, Asia Pacific) has a General Counsel who is responsible for managing legal risk across all lines of business and functions in the region.

The Firm’s General Counsel and other members of Legal report on significant legal matters at each meeting of the Firm’s Board of Directors, at least quarterly to the Audit Committee, and periodically to the DRPC.

Legal serves on and advises various committees (including new business initiative and reputation risk committees) and advises the Firm’s businesses to protect the Firm’s reputation beyond any particular legal requirements.

ESTIMATIONS AND MODEL RISK MANAGEMENT

Estimations and Model risk, a subcategory of operational risk, is the potential for adverse consequences from decisions based on incorrect or misused estimation outputs.

The Firm uses models and other analytical and judgment-based estimations across various businesses and functions. The estimation methods are of varying levels of sophistication and are used for many purposes, such as the valuation of positions and measurement of risk, assessing regulatory capital requirements, conducting stress testing, and making business decisions. A dedicated independent function, Model Risk Governance and Review ("MRGR"), defines and governs the Firm's model risk management policies and certain analytical and judgment-based estimations, such as those used in risk management, budget forecasting and capital planning and analysis. MRGR reports to the Firm's CRO.

The governance of analytical and judgment-based estimations within MRGR's scope follows a consistent approach to the approach used for models, which is described in detail below.

Model risks are owned by the users of the models within the Firm based on the specific purposes of such models. Users and developers of models are responsible for developing, implementing and testing their models, as well as referring models to the Model Risk function for review and approval. Once models have been approved, model users and developers are responsible for maintaining a robust operating environment, and must monitor and evaluate the performance of the models on an ongoing basis. Model users and developers may seek to enhance models in response to changes in the portfolios and in product and market developments, as well as to capture improvements in available modeling techniques and systems capabilities.

Models are tiered based on an internal standard according to their complexity, the exposure associated with the model and the Firm's reliance on the model. This tiering is subject to the approval of the Model Risk function. In its review of a model, the Model Risk function considers whether the model is suitable for the specific purposes for which it will be used. The factors considered in reviewing a model include whether the model accurately reflects the characteristics of the product and its significant risks, the selection and reliability of model inputs, consistency with models for similar products, the appropriateness of any model-related adjustments, and sensitivity to input parameters and assumptions that cannot be observed from the market. When reviewing a model, the Model Risk function analyzes and challenges the model methodology and the reasonableness of model assumptions and may perform or require additional testing, including back-testing of model outcomes. Model reviews are approved by the appropriate level of management within the Model Risk function based on the relevant model tier.

Under the Firm's Estimations and Model Risk Management Policy, the Model Risk function reviews and approves new models, as well as material changes to existing models, prior to implementation in the operating environment. In certain circumstances, the head of the Model Risk function may grant exceptions to the Firm's policy to allow a model to be used prior to review or approval. The Model Risk function may also require the user to take appropriate actions to mitigate the model risk if it is to be used in the interim. These actions will depend on the model and may include, for example, limitation of trading activity.

For a summary of model-based valuations and other valuation techniques, refer to Critical Accounting Estimates Used by the Firm on pages 141-143 and Note 2.

CRITICAL ACCOUNTING ESTIMATES USED BY THE FIRM

JPMorgan Chase's accounting policies and use of estimates are integral to understanding its reported results. The Firm's most complex accounting estimates require management's judgment to ascertain the appropriate carrying value of assets and liabilities. The Firm has established policies and control procedures intended to ensure that estimation methods, including any judgments made as part of such methods, are well-controlled, independently reviewed and applied consistently from period to period. The methods used and judgments made reflect, among other factors, the nature of the assets or liabilities and the related business and risk management strategies, which may vary across the Firm's businesses and portfolios. In addition, the policies and procedures are intended to ensure that the process for changing methodologies occurs in an appropriate manner. The Firm believes its estimates for determining the carrying value of its assets and liabilities are appropriate. The following is a brief description of the Firm's critical accounting estimates involving significant judgments.

Allowance for credit losses

JPMorgan Chase's allowance for credit losses covers the retained consumer and wholesale loan portfolios, as well as the Firm's wholesale and certain consumer lending-related commitments. The allowance for loan losses is intended to adjust the carrying value of the Firm's loan assets to reflect probable credit losses inherent in the loan portfolio as of the balance sheet date. Similarly, the allowance for lending-related commitments is established to cover probable credit losses inherent in the lending-related commitments portfolio as of the balance sheet date.

The allowance for credit losses includes a formula-based component, an asset-specific component, and a component related to PCI loans. The determination of each of these components involves significant judgment on a number of matters. For further information on these components, areas of judgment and methodologies used in establishing the Firm's allowance for credit losses, refer to Allowance for credit losses on pages 120-122 and Note 13.

Allowance for credit losses sensitivity

The Firm's allowance for credit losses is sensitive to numerous factors, which may differ depending on the portfolio. Changes in economic conditions or in the Firm's assumptions and estimates could affect its estimate of probable credit losses inherent in the portfolio at the balance sheet date. The Firm uses its best judgment to assess these economic conditions and loss data in estimating the allowance for credit losses and these estimates are subject to periodic refinement based on changes to underlying external or Firm-specific historical data. Refer to Note 13 for further discussion.

To illustrate the potential magnitude of certain alternate judgments, the Firm estimates that changes in the following inputs would have the following effects on the Firm's modeled credit loss estimates as of December 31, 2018, without consideration of any offsetting or correlated effects of other inputs in the Firm's allowance for loan losses:

- A combined 5% decline in housing prices and a 100 basis point increase in unemployment rates from current levels could imply:
 - an increase to modeled credit loss estimates of approximately \$425 million for PCI loans.
 - an increase to modeled annual credit loss estimates of approximately \$50 million for residential real estate loans, excluding PCI loans.
- For credit card loans, a 100 basis point increase in unemployment rates from current levels could imply an increase to modeled annual credit loss estimates of approximately \$875 million.
- An increase in probability of default ("PD") factors consistent with a one-notch downgrade in the Firm's internal risk ratings for its entire wholesale loan portfolio could imply an increase in the Firm's modeled credit loss estimates of approximately \$1.6 billion.
- A 100 basis point increase in estimated loss given default ("LGD") for the Firm's entire wholesale loan portfolio could imply an increase in the Firm's modeled credit loss estimates of approximately \$175 million.

The purpose of these sensitivity analyses is to provide an indication of the isolated impacts of hypothetical alternative assumptions on modeled loss estimates. The changes in the inputs presented above are not intended to imply management's expectation of future deterioration of those risk factors. In addition, these analyses are not intended to estimate changes in the overall allowance for loan losses, which would also be influenced by the judgment management applies to the modeled loss estimates to reflect the uncertainty and imprecision of these modeled loss estimates based on then-current circumstances and conditions.

It is difficult to estimate how potential changes in specific factors might affect the overall allowance for credit losses because management considers a variety of factors and inputs in estimating the allowance for credit losses. Changes in these factors and inputs may not occur at the same rate and may not be consistent across all geographies or product types, and changes in factors may be directionally inconsistent, such that improvement in one factor may offset deterioration in other factors. In addition, it is difficult to predict how changes in specific economic conditions or assumptions could affect borrower behavior or other factors considered by management in estimating the allowance for credit losses. Given the process the Firm follows and the judgments made in evaluating the risk factors related to its loss estimates, management believes that its current estimate of the allowance for credit losses is appropriate.

Fair value

JPMorgan Chase carries a portion of its assets and liabilities at fair value. The majority of such assets and liabilities are measured at fair value on a recurring basis, including, derivatives and structured note products. Certain assets and liabilities are measured at fair value on a nonrecurring basis, including certain mortgage, home equity and other

Management's discussion and analysis

loans, where the carrying value is based on the fair value of the underlying collateral.

Assets measured at fair value

The following table includes the Firm's assets measured at fair value and the portion of such assets that are classified within level 3 of the valuation hierarchy. For further information, refer to Note 2.

December 31, 2018 (in billions, except ratios)	Total assets at fair value	Total level 3 assets
Trading debt and equity instruments	\$ 359.5	\$ 4.2
Derivative receivables ^(a)	54.2	5.8
Trading assets	413.7	10.0
AFS securities	230.4	—
Loans	3.2	0.1
MSRs	6.1	6.1
Other	27.2	1.0
Total assets measured at fair value on a recurring basis	680.6	17.2
Total assets measured at fair value on a nonrecurring basis	1.4	1.1
Total assets measured at fair value	\$ 682.0	\$ 18.3
Total Firm assets	\$ 2,622.5	
Level 3 assets as a percentage of total Firm assets ^(a)		0.7%
Level 3 assets as a percentage of total Firm assets at fair value ^(a)		2.7%

(a) For purposes of the table above, the derivative receivables total reflects the impact of netting adjustments; however, the \$5.8 billion of derivative receivables classified as level 3 does not reflect the netting adjustment as such netting is not relevant to a presentation based on the transparency of inputs to the valuation of an asset. The level 3 balances would be reduced if netting were applied, including the netting benefit associated with cash collateral.

Valuation

Details of the Firm's processes for determining fair value are set out in Note 2. Estimating fair value requires the application of judgment. The type and level of judgment required is largely dependent on the amount of observable market information available to the Firm. For instruments valued using internally developed valuation models and other valuation techniques that use significant unobservable inputs and are therefore classified within level 3 of the valuation hierarchy, judgments used to estimate fair value are more significant than those required when estimating the fair value of instruments classified within levels 1 and 2.

In arriving at an estimate of fair value for an instrument within level 3, management must first determine the appropriate valuation technique to use. Second, the lack of observability of certain significant inputs requires management to assess all relevant empirical data in deriving valuation inputs including, for example, transaction details, yield curves, interest rates, prepayment rates, default rates, volatilities, correlations, equity or debt prices, valuations of comparable instruments, foreign exchange rates and credit curves. For further discussion of the valuation of level 3 instruments, including unobservable inputs used, refer to Note 2.

For instruments classified in levels 2 and 3, management judgment must be applied to assess the appropriate level of valuation adjustments to reflect counterparty credit quality,

the Firm's creditworthiness, market funding rates, liquidity considerations, unobservable parameters, and for portfolios that meet specified criteria, the size of the net open risk position. The judgments made are typically affected by the type of product and its specific contractual terms, and the level of liquidity for the product or within the market as a whole. For a further discussion of valuation adjustments applied by the Firm, refer to Note 2.

Imprecision in estimating unobservable market inputs or other factors can affect the amount of gain or loss recorded for a particular position. Furthermore, while the Firm believes its valuation methods are appropriate and consistent with those of other market participants, the methods and assumptions used reflect management judgment and may vary across the Firm's businesses and portfolios.

The Firm uses various methodologies and assumptions in the determination of fair value. The use of methodologies or assumptions different than those used by the Firm could result in a different estimate of fair value at the reporting date. For a detailed discussion of the Firm's valuation process and hierarchy, and its determination of fair value for individual financial instruments, refer to Note 2.

Goodwill impairment

Under U.S. GAAP, goodwill must be allocated to reporting units and tested for impairment at least annually. The Firm's process and methodology used to conduct goodwill impairment testing is described in Note 15.

Management applies significant judgment when testing goodwill for impairment. The goodwill associated with each business combination is allocated to the related reporting units for goodwill impairment testing.

For the year ended December 31, 2018, the Firm reviewed current economic conditions, business performance, estimated market cost of equity, and projections of business performance for all its businesses. Based upon such reviews, the Firm concluded that the goodwill allocated to its reporting units was not impaired as of December 31, 2018. The fair values of these reporting units exceeded their carrying values by approximately 20% or higher and did not indicate a significant risk of goodwill impairment based on current projections and valuations.

The projections for all of the Firm's reporting units are consistent with management's current short-term business outlook assumptions, and in the longer term, incorporate a set of macroeconomic assumptions and the Firm's best estimates of long-term growth and returns on equity of its businesses. Where possible, the Firm uses third-party and peer data to benchmark its assumptions and estimates.

Declines in business performance, increases in credit losses, increases in capital requirements, as well as deterioration in economic or market conditions, adverse regulatory or legislative changes or increases in the estimated market cost of equity, could cause the estimated fair values of the Firm's reporting units or their associated goodwill to decline in the future, which could result in a material impairment charge to earnings in a future period related to some portion of the associated goodwill.

For additional information on goodwill, refer to Note 15.

Credit card rewards liability

JPMorgan Chase offers credit cards with various rewards programs which allow cardholders to earn rewards points based on their account activity and the terms and conditions of the rewards program. Generally, there are no limits on the points that an eligible cardholder can earn, nor do they expire, and these points can be redeemed for a variety of rewards, including cash (predominantly in the form of account credits), gift cards and travel. The Firm maintains a rewards liability which represents the estimated cost of rewards points earned and expected to be redeemed by cardholders. The rewards liability is sensitive to various assumptions, including cost per point and redemption rates for each of the various rewards programs, which are evaluated periodically. The liability is accrued as the cardholder earns the benefit and is reduced when the cardholder redeems points. This liability was \$5.8 billion and \$4.9 billion at December 31, 2018 and 2017, respectively, and is recorded in accounts payable and other liabilities on the Consolidated balance sheets.

Income taxes

JPMorgan Chase is subject to the income tax laws of the various jurisdictions in which it operates, including U.S. federal, state and local, and non-U.S. jurisdictions. These laws are often complex and may be subject to different interpretations. To determine the financial statement impact of accounting for income taxes, including the provision for income tax expense and unrecognized tax benefits, JPMorgan Chase must make assumptions and judgments about how to interpret and apply these complex tax laws to numerous transactions and business events, as well as make judgments regarding the timing of when certain items may affect taxable income in the U.S. and non-U.S. tax jurisdictions.

JPMorgan Chase's interpretations of tax laws around the world are subject to review and examination by the various taxing authorities in the jurisdictions where the Firm operates, and disputes may occur regarding its view on a tax position. These disputes over interpretations with the various taxing authorities may be settled by audit, administrative appeals or adjudication in the court systems of the tax jurisdictions in which the Firm operates. JPMorgan Chase regularly reviews whether it may be assessed additional income taxes as a result of the resolution of these matters, and the Firm records additional reserves as appropriate. In addition, the Firm may revise its estimate of income taxes due to changes in income tax laws, legal interpretations, and business strategies. It is possible that revisions in the Firm's estimate of income taxes may materially affect the Firm's results of operations in any reporting period.

The Firm's provision for income taxes is composed of current and deferred taxes. Deferred taxes arise from differences between assets and liabilities measured for financial reporting versus income tax return purposes. Deferred tax assets are recognized if, in management's judgment, their realizability is determined to be more likely than not. The Firm has also recognized deferred tax assets in connection with certain tax attributes, including NOLs. The Firm performs regular reviews to ascertain whether its deferred tax assets are realizable. These reviews include

management's estimates and assumptions regarding future taxable income, which also incorporates various tax planning strategies, including strategies that may be available to utilize NOLs before they expire. In connection with these reviews, if it is determined that a deferred tax asset is not realizable, a valuation allowance is established. The valuation allowance may be reversed in a subsequent reporting period if the Firm determines that, based on revised estimates of future taxable income or changes in tax planning strategies, it is more likely than not that all or part of the deferred tax asset will become realizable. As of December 31, 2018, management has determined it is more likely than not that the Firm will realize its deferred tax assets, net of the existing valuation allowance.

Prior to December 31, 2017, U.S. federal income taxes had not been provided on the undistributed earnings of certain non-U.S. subsidiaries, to the extent that such earnings had been reinvested abroad for an indefinite period of time. The Firm is no longer maintaining the indefinite reinvestment assertion on the undistributed earnings of those non-U.S. subsidiaries in light of the enactment of the TCJA. The U.S. federal and state and local income taxes associated with the undistributed and previously untaxed earnings of those non-U.S. subsidiaries was included in the deemed repatriation charge recorded as of December 31, 2017. The Firm will recognize any taxes it may incur on global intangible low tax income as income tax expense in the period in which the tax is incurred.

The Firm adjusts its unrecognized tax benefits as necessary when additional information becomes available. Uncertain tax positions that meet the more-likely-than-not recognition threshold are measured to determine the amount of benefit to recognize. An uncertain tax position is measured at the largest amount of benefit that management believes is more likely than not to be realized upon settlement. It is possible that the reassessment of JPMorgan Chase's unrecognized tax benefits may have a material impact on its effective income tax rate in the period in which the reassessment occurs.

The income tax expense for the current year includes a change in estimate recorded under SEC Staff Accounting Bulletin No. 118 (SAB 118) resulting from the enactment of the TCJA. The accounting under SAB 118 is complete.

For additional information on income taxes, refer to Note 24.

Litigation reserves

For a description of the significant estimates and judgments associated with establishing litigation reserves, refer to Note 29.

Management's discussion and analysis

ACCOUNTING AND REPORTING DEVELOPMENTS

Financial Accounting Standards Board ("FASB") Standards Adopted during 2018

Standard	Summary of guidance	Effects on financial statements
<p>Revenue recognition - revenue from contracts with customers</p> <p><i>Issued May 2014</i></p>	<ul style="list-style-type: none"> Requires that revenue from contracts with customers be recognized upon transfer of control of a good or service in the amount of consideration expected to be received. Changes the accounting for certain contract costs, including whether they may be offset against revenue in the Consolidated statements of income, and requires additional disclosures about revenue and contract costs. 	<ul style="list-style-type: none"> Adopted January 1, 2018. For further information, refer to Note 1.
<p>Recognition and measurement of financial assets and financial liabilities</p> <p><i>Issued January 2016</i></p>	<ul style="list-style-type: none"> Requires that certain equity instruments be measured at fair value, with changes in fair value recognized in earnings. Provides a measurement alternative for equity securities without readily determinable fair values to be measured at cost less impairment (if any), plus or minus observable price changes from an identical or similar investment of the same issuer. Any such price changes are reflected in earnings beginning in the period of adoption. 	<ul style="list-style-type: none"> Adopted January 1, 2018. For further information, refer to Note 1.
<p>Classification of certain cash receipts and cash payments in the statement of cash flows</p> <p><i>Issued August 2016</i></p>	<ul style="list-style-type: none"> Provides targeted amendments to the classification of certain cash flows, including the treatment of settlement payments for zero coupon debt instruments and distributions received from equity method investments. 	<ul style="list-style-type: none"> Adopted January 1, 2018. The adoption of the guidance had no material impact as the Firm was either in compliance with the amendments or the amounts to which it was applied were immaterial.
<p>Treatment of restricted cash on the statement of cash flows</p> <p><i>Issued November 2016</i></p>	<ul style="list-style-type: none"> Requires restricted cash to be combined with unrestricted cash when reconciling the beginning and ending cash balances on the Consolidated statements of cash flows. Requires additional disclosures to supplement the Consolidated statements of cash flows. 	<ul style="list-style-type: none"> Adopted January 1, 2018 For further information, refer to Note 1.

FASB Standards Adopted during 2018 (continued)

Standard	Summary of guidance	Effects on financial statements
<p>Definition of a business</p> <p><i>Issued January 2017</i></p>	<ul style="list-style-type: none"> Narrows the definition of a business and clarifies that, to be considered a business, substantially all of the fair value of the gross assets acquired (or disposed of) may not be concentrated in a single identifiable asset or a group of similar assets. In addition, a business must now include, at a minimum, an input and a substantive process that together significantly contribute to the ability to create outputs. 	<ul style="list-style-type: none"> Adopted January 1, 2018. The adoption of the guidance had no impact because it is applied prospectively. Subsequent to adoption, fewer transactions will be treated as acquisitions or dispositions of a business.
<p>Presentation of net periodic pension cost and net periodic postretirement benefit cost</p> <p><i>Issued March 2017</i></p>	<ul style="list-style-type: none"> Requires the service cost component of net periodic pension and postretirement benefit cost to be reported separately in the Consolidated statements of income from the other cost components. 	<ul style="list-style-type: none"> Adopted January 1, 2018. For further information, refer to Note 1.
<p>Premium amortization on purchased callable debt securities</p> <p><i>Issued March 2017</i></p>	<ul style="list-style-type: none"> Requires amortization of premiums to the earliest call date on certain debt securities. 	<ul style="list-style-type: none"> Adopted January 1, 2018. For further information, refer to Note 1.
<p>Hedge accounting</p> <p><i>Issued August 2017</i></p>	<ul style="list-style-type: none"> Aligns the accounting with the economics of the risk management activities. Expands the ability for certain hedges of interest rate risk to qualify for hedge accounting. Allows recognition of ineffectiveness in cash flow hedges and net investment hedges in OCI. Permits an election at adoption to transfer certain investment securities classified as held-to-maturity to available-for-sale. Simplifies hedge documentation requirements. 	<ul style="list-style-type: none"> Adopted January 1, 2018. For further information, refer to Note 1.
<p>Reclassification of certain tax effects from AOCI</p> <p><i>Issued February 2018</i></p>	<ul style="list-style-type: none"> Permits reclassification of the income tax effects of the TCJA on items within AOCI to retained earnings so that the tax effects of items within AOCI reflect the appropriate tax rate. 	<ul style="list-style-type: none"> Adopted January 1, 2018. For further information, refer to Note 1.

Management's discussion and analysis

FASB Standards Issued but not adopted as of December 31, 2018

Standard	Summary of guidance	Effects on financial statements
Leases <i>Issued February 2016</i>	<ul style="list-style-type: none"> Requires lessees to recognize all leases longer than twelve months on the Consolidated balance sheets as a lease liability with a corresponding right-of-use asset. Requires lessees and lessors to classify most leases using principles similar to existing lease accounting, but eliminates the "bright line" classification tests. Expands qualitative and quantitative leasing disclosures. 	<ul style="list-style-type: none"> Adopted January 1, 2019. The Firm elected the practical expedient to adopt and implement the new lease guidance as of January 1, 2019 through a cumulative-effect adjustment without revising prior comparative periods. Upon adoption, the Firm recognized lease right-of-use ("ROU") assets and lease liabilities on the Consolidated balance sheet of \$8.1 billion and \$8.2 billion, respectively. The impact to the Firm's CET1 capital ratio was a reduction of approximately 6 bps. The adoption of the new lease guidance did not have a material impact on the Firm's Consolidated statement of income. The Firm elected the available practical expedients to not reassess whether existing contracts contain a lease or whether classification or unamortized initial lease costs would be different under the new lease guidance.
Financial instruments - credit losses <i>Issued June 2016</i>	<ul style="list-style-type: none"> Replaces existing incurred loss impairment guidance and establishes a single allowance framework for financial assets carried at amortized cost, which will reflect management's estimate of credit losses over the full remaining expected life of the financial assets and will consider expected future changes in macroeconomic conditions. Eliminates existing guidance for PCI loans, and requires recognition of the nonaccretable difference as an increase to the allowance for expected credit losses on financial assets purchased with more than insignificant credit deterioration since origination, which will be offset by an increase in the recorded investment of the related loans. Amends existing impairment guidance for AFS securities to incorporate an allowance, which will allow for reversals of credit impairments in the event that the credit of an issuer improves. Requires a cumulative-effect adjustment to retained earnings as of the beginning of the reporting period of adoption. 	<ul style="list-style-type: none"> Required effective date: January 1, 2020.^(a) The Firm has established a Firmwide, cross-discipline governance structure, which provides implementation oversight. The Firm continues to test and refine its current expected credit loss models that satisfy the requirements of the new standard. This review and testing, as well as efforts to meet expanded disclosure requirements, will extend through the remainder of 2019. The Firm expects that the allowance related to the Firm's loans and commitments will increase as it will cover credit losses over the full remaining expected life of the portfolios. The Firm currently intends to estimate losses over a two-year forecast period using the weighted-average of a range of macroeconomic scenarios (established on a Firmwide basis), and then revert to longer term historical loss experience to estimate losses over more extended periods. The Firm currently expects the increase in the allowance to be in the range of \$4-6 billion, primarily driven by Card. This estimate is subject to further refinement based on continuing reviews and approvals of models, methodologies and judgments. The ultimate impact will depend upon the nature and characteristics of the Firm's portfolio at the adoption date, the macroeconomic conditions and forecasts at that date, and other management judgments. The Firm plans to adopt the new guidance on January 1, 2020.
Goodwill <i>Issued January 2017</i>	<ul style="list-style-type: none"> Requires an impairment loss to be recognized when the estimated fair value of a reporting unit falls below its carrying value. Eliminates the second condition in the current guidance that requires an impairment loss to be recognized only if the estimated implied fair value of the goodwill is below its carrying value. 	<ul style="list-style-type: none"> Required effective date: January 1, 2020.^(a) Based on current impairment test results, the Firm does not expect a material effect on the Consolidated Financial Statements. However, the impact of the new accounting guidance will depend on the performance of the reporting units and the market conditions at the time of adoption. After adoption, the guidance may result in more frequent goodwill impairment losses due to the removal of the second condition. The Firm plans to adopt the new guidance on January 1, 2020.

(a) Early adoption is permitted.

FORWARD-LOOKING STATEMENTS

From time to time, the Firm has made and will make forward-looking statements. These statements can be identified by the fact that they do not relate strictly to historical or current facts. Forward-looking statements often use words such as “anticipate,” “target,” “expect,” “estimate,” “intend,” “plan,” “goal,” “believe,” or other words of similar meaning. Forward-looking statements provide JPMorgan Chase’s current expectations or forecasts of future events, circumstances, results or aspirations. JPMorgan Chase’s disclosures in this 2018 Form 10-K contain forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. The Firm also may make forward-looking statements in its other documents filed or furnished with the SEC. In addition, the Firm’s senior management may make forward-looking statements orally to investors, analysts, representatives of the media and others.

All forward-looking statements are, by their nature, subject to risks and uncertainties, many of which are beyond the Firm’s control. JPMorgan Chase’s actual future results may differ materially from those set forth in its forward-looking statements. While there is no assurance that any list of risks and uncertainties or risk factors is complete, below are certain factors which could cause actual results to differ from those in the forward-looking statements:

- Local, regional and global business, economic and political conditions and geopolitical events;
- Changes in laws and regulatory requirements, including capital and liquidity requirements affecting the Firm’s businesses, and the ability of the Firm to address those requirements;
- Heightened regulatory and governmental oversight and scrutiny of JPMorgan Chase’s business practices, including dealings with retail customers;
- Changes in trade, monetary and fiscal policies and laws;
- Changes in income tax laws and regulations;
- Securities and capital markets behavior, including changes in market liquidity and volatility;
- Changes in investor sentiment or consumer spending or savings behavior;
- Ability of the Firm to manage effectively its capital and liquidity, including approval of its capital plans by banking regulators;
- Changes in credit ratings assigned to the Firm or its subsidiaries;
- Damage to the Firm’s reputation;
- Ability of the Firm to appropriately address social and environmental concerns that may arise from its business activities;
- Ability of the Firm to deal effectively with an economic slowdown or other economic or market disruption;
- Technology changes instituted by the Firm, its counterparties or competitors;
- The effectiveness of the Firm’s control agenda;
- Ability of the Firm to develop or discontinue products and services, and the extent to which products or services previously sold by the Firm (including but not limited to mortgages and asset-backed securities) require the Firm to incur liabilities or absorb losses not contemplated at their initiation or origination;
- Acceptance of the Firm’s new and existing products and services by the marketplace and the ability of the Firm to innovate and to increase market share;
- Ability of the Firm to attract and retain qualified employees;
- Ability of the Firm to control expenses;
- Competitive pressures;
- Changes in the credit quality of the Firm’s customers and counterparties;
- Adequacy of the Firm’s risk management framework, disclosure controls and procedures and internal control over financial reporting;
- Adverse judicial or regulatory proceedings;
- Changes in applicable accounting policies, including the introduction of new accounting standards;
- Ability of the Firm to determine accurate values of certain assets and liabilities;
- Occurrence of natural or man-made disasters or calamities or conflicts and the Firm’s ability to deal effectively with disruptions caused by the foregoing;
- Ability of the Firm to maintain the security of its financial, accounting, technology, data processing and other operational systems and facilities;
- Ability of the Firm to withstand disruptions that may be caused by any failure of its operational systems or those of third parties;
- Ability of the Firm to effectively defend itself against cyberattacks and other attempts by unauthorized parties to access information of the Firm or its customers or to disrupt the Firm’s systems; and
- The other risks and uncertainties detailed in Part I, Item 1A: Risk Factors in the Firm’s 2018 Form 10-K.

Any forward-looking statements made by or on behalf of the Firm speak only as of the date they are made, and JPMorgan Chase does not undertake to update forward-looking statements. The reader should, however, consult any further disclosures of a forward-looking nature the Firm may make in any subsequent Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, or Current Reports on Form 8-K.

Management's report on internal control over financial reporting

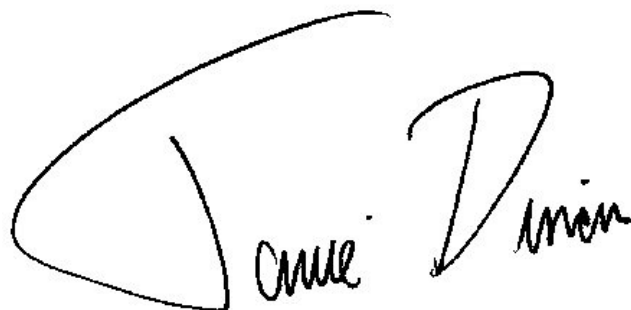
Management of JPMorgan Chase & Co. ("JPMorgan Chase" or the "Firm") is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is a process designed by, or under the supervision of, the Firm's principal executive and principal financial officers, or persons performing similar functions, and effected by JPMorgan Chase's Board of Directors, management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with accounting principles generally accepted in the United States of America.

JPMorgan Chase's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records, that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the Firm's assets; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the Firm are being made only in accordance with authorizations of JPMorgan Chase's management and directors; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the Firm's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate. Management has completed an assessment of the effectiveness of the Firm's internal control over financial reporting as of December 31, 2018. In making the assessment, management used the "Internal Control – Integrated Framework" ("COSO 2013") promulgated by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO").

Based upon the assessment performed, management concluded that as of December 31, 2018, JPMorgan Chase's internal control over financial reporting was effective based upon the COSO 2013 framework. Additionally, based upon management's assessment, the Firm determined that there were no material weaknesses in its internal control over financial reporting as of December 31, 2018.

The effectiveness of the Firm's internal control over financial reporting as of December 31, 2018, has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in their report which appears herein.

A handwritten signature in black ink, appearing to read "James Dimon". The signature is stylized with a large, sweeping initial "J" and "D".

James Dimon
Chairman and Chief Executive Officer

A handwritten signature in black ink, appearing to read "Marianne Lake". The signature is fluid and cursive.

Marianne Lake
Executive Vice President and Chief Financial Officer

February 26, 2019



To the Board of Directors and Shareholders of JPMorgan Chase & Co.:

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of JPMorgan Chase & Co. and its subsidiaries (the "Firm") as of December 31, 2018 and 2017, and the related consolidated statements of income, comprehensive income, changes in stockholders' equity and cash flows for each of the three years in the period ended December 31, 2018, including the related notes (collectively referred to as the "consolidated financial statements"). We also have audited the Firm's internal control over financial reporting as of December 31, 2018, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Firm as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2018 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Firm maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the COSO.

Basis for Opinions

The Firm's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's report on internal control over financial reporting. Our responsibility is to express opinions on the Firm's consolidated financial statements and on the Firm's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Firm in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

February 26, 2019

We have served as the Firm's auditor since 1965.

Consolidated statements of income

Year ended December 31, (in millions, except per share data)	2018	2017	2016
Revenue			
Investment banking fees	\$ 7,550	\$ 7,412	\$ 6,572
Principal transactions	12,059	11,347	11,566
Lending- and deposit-related fees	6,052	5,933	5,774
Asset management, administration and commissions	17,118	16,287	15,364
Investment securities gains/(losses)	(395)	(66)	141
Mortgage fees and related income	1,254	1,616	2,491
Card income	4,989	4,433	4,779
Other income	5,343	3,646	3,799
Noninterest revenue	53,970	50,608	50,486
Interest income	77,442	64,372	55,901
Interest expense	22,383	14,275	9,818
Net interest income	55,059	50,097	46,083
Total net revenue	109,029	100,705	96,569
Provision for credit losses	4,871	5,290	5,361
Noninterest expense			
Compensation expense	33,117	31,208	30,203
Occupancy expense	3,952	3,723	3,638
Technology, communications and equipment expense	8,802	7,715	6,853
Professional and outside services	8,502	7,890	7,526
Marketing	3,290	2,900	2,897
Other expense	5,731	6,079	5,555
Total noninterest expense	63,394	59,515	56,672
Income before income tax expense	40,764	35,900	34,536
Income tax expense	8,290	11,459	9,803
Net income	\$ 32,474	\$ 24,441	\$ 24,733
Net income applicable to common stockholders	\$ 30,709	\$ 22,567	\$ 22,834
Net income per common share data			
Basic earnings per share	\$ 9.04	\$ 6.35	\$ 6.24
Diluted earnings per share	9.00	6.31	6.19
Weighted-average basic shares	3,396.4	3,551.6	3,658.8
Weighted-average diluted shares	3,414.0	3,576.8	3,690.0

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

The Notes to Consolidated Financial Statements are an integral part of these statements.

Consolidated statements of comprehensive income

Year ended December 31, (in millions)	2018		2017		2016	
Net income	\$	32,474	\$	24,441	\$	24,733
Other comprehensive income/(loss), after-tax						
Unrealized gains/(losses) on investment securities		(1,858)		640		(1,105)
Translation adjustments, net of hedges		20		(306)		(2)
Fair value hedges		(107)		NA		NA
Cash flow hedges		(201)		176		(56)
Defined benefit pension and OPEB plans		(373)		738		(28)
DVA on fair value option elected liabilities		1,043		(192)		(330)
Total other comprehensive income/(loss), after-tax		(1,476)		1,056		(1,521)
Comprehensive income	\$	30,998	\$	25,497	\$	23,212

Effective January 1, 2018, the Firm adopted several new accounting standards. For additional information, refer to Note 1.

The Notes to Consolidated Financial Statements are an integral part of these statements.

Consolidated balance sheets

December 31, (in millions, except share data)	2018	2017
Assets		
Cash and due from banks	\$ 22,324	\$ 25,898
Deposits with banks	256,469	405,406
Federal funds sold and securities purchased under resale agreements (included 13,235 and \$14,732 at fair value)	321,588	198,422
Securities borrowed (included \$5,105 and \$3,049 at fair value)	111,995	105,112
Trading assets (included assets pledged of \$89,073 and \$109,887)	413,714	381,844
Investment securities (included \$230,394 and \$202,225 at fair value and assets pledged of \$11,432 and \$17,969)	261,828	249,958
Loans (included \$3,151 and \$2,508 at fair value)	984,554	930,697
Allowance for loan losses	(13,445)	(13,604)
Loans, net of allowance for loan losses	971,109	917,093
Accrued interest and accounts receivable	73,200	67,729
Premises and equipment	14,934	14,159
Goodwill, MSRs and other intangible assets	54,349	54,392
Other assets (included \$9,630 and \$16,128 at fair value and assets pledged of \$3,457 and \$7,980)	121,022	113,587
Total assets^(a)	\$ 2,622,532	\$ 2,533,600
Liabilities		
Deposits (included \$23,217 and \$21,321 at fair value)	\$ 1,470,666	\$ 1,443,982
Federal funds purchased and securities loaned or sold under repurchase agreements (included \$935 and \$697 at fair value)	182,320	158,916
Short-term borrowings (included \$7,130 and \$9,191 at fair value)	69,276	51,802
Trading liabilities	144,773	123,663
Accounts payable and other liabilities (included \$3,269 and \$9,208 at fair value)	196,710	189,383
Beneficial interests issued by consolidated VIEs (included \$28 and \$45 at fair value)	20,241	26,081
Long-term debt (included \$54,886 and \$47,519 at fair value)	282,031	284,080
Total liabilities^(a)	2,366,017	2,277,907
Commitments and contingencies (refer to Notes 27, 28 and 29)		
Stockholders' equity		
Preferred stock (\$1 par value; authorized 200,000,000 shares; issued 2,606,750 shares)	26,068	26,068
Common stock (\$1 par value; authorized 9,000,000,000 shares; issued 4,104,933,895 shares)	4,105	4,105
Additional paid-in capital	89,162	90,579
Retained earnings	199,202	177,676
Accumulated other comprehensive loss	(1,507)	(119)
Shares held in restricted stock units ("RSU") trust, at cost (472,953 shares)	(21)	(21)
Treasury stock, at cost (829,167,674 and 679,635,064 shares)	(60,494)	(42,595)
Total stockholders' equity	256,515	255,693
Total liabilities and stockholders' equity	\$ 2,622,532	\$ 2,533,600

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

(a) The following table presents information on assets and liabilities related to VIEs that are consolidated by the Firm at December 31, 2018 and 2017. The assets of the consolidated VIEs are used to settle the liabilities of those entities. The holders of the beneficial interests do not have recourse to the general credit of JPMorgan Chase. The assets and liabilities in the table below include third-party assets and liabilities of consolidated VIEs and exclude intercompany balances that eliminate in consolidation. For a further discussion, refer to Note 14.

December 31, (in millions)	2018	2017
Assets		
Trading assets	\$ 1,966	\$ 1,449
Loans	59,456	68,995
All other assets	1,013	2,674
Total assets	\$ 62,435	\$ 73,118
Liabilities		
Beneficial interests issued by consolidated VIEs	\$ 20,241	\$ 26,081
All other liabilities	312	349
Total liabilities	\$ 20,553	\$ 26,430

The Notes to Consolidated Financial Statements are an integral part of these statements.

Consolidated statements of changes in stockholders' equity

Year ended December 31, (in millions, except per share data)	2018	2017	2016
Preferred stock			
Balance at January 1	\$ 26,068	\$ 26,068	\$ 26,068
Issuance	1,696	1,258	–
Redemption	(1,696)	(1,258)	–
Balance at December 31	26,068	26,068	26,068
Common stock			
Balance at January 1 and December 31	4,105	4,105	4,105
Additional paid-in capital			
Balance at January 1	90,579	91,627	92,500
Shares issued and commitments to issue common stock for employee share-based compensation awards, and related tax effects	(738)	(734)	(334)
Other	(679)	(314)	(539)
Balance at December 31	89,162	90,579	91,627
Retained earnings			
Balance at January 1	177,676	162,440	146,420
Cumulative effect of change in accounting principles	(183)	–	(154)
Net income	32,474	24,441	24,733
Dividends declared:			
Preferred stock	(1,551)	(1,663)	(1,647)
Common stock (\$2.72, \$2.12 and \$1.88 per share for 2018, 2017 and 2016, respectively)	(9,214)	(7,542)	(6,912)
Balance at December 31	199,202	177,676	162,440
Accumulated other comprehensive income			
Balance at January 1	(119)	(1,175)	192
Cumulative effect of change in accounting principles	88	–	154
Other comprehensive income/(loss), after-tax	(1,476)	1,056	(1,521)
Balance at December 31	(1,507)	(119)	(1,175)
Shares held in RSU Trust, at cost			
Balance at January 1 and December 31	(21)	(21)	(21)
Treasury stock, at cost			
Balance at January 1	(42,595)	(28,854)	(21,691)
Repurchase	(19,983)	(15,410)	(9,082)
Reissuance	2,084	1,669	1,919
Balance at December 31	(60,494)	(42,595)	(28,854)
Total stockholders' equity	\$ 256,515	\$ 255,693	\$ 254,190

Effective January 1, 2018, the Firm adopted several new accounting standards. For additional information, refer to Note 1.

The Notes to Consolidated Financial Statements are an integral part of these statements.

Consolidated statements of cash flows

Year ended December 31, (in millions)	2018	2017	2016
Operating activities			
Net income	\$ 32,474	\$ 24,441	\$ 24,733
Adjustments to reconcile net income to net cash provided by/(used in) operating activities:			
Provision for credit losses	4,871	5,290	5,361
Depreciation and amortization	7,791	6,179	5,478
Deferred tax expense	1,721	2,312	4,651
Other	2,717	2,136	1,799
Originations and purchases of loans held-for-sale	(102,141)	(94,628)	(61,107)
Proceeds from sales, securitizations and paydowns of loans held-for-sale	93,453	93,270	60,196
Net change in:			
Trading assets	(38,371)	5,673	(20,007)
Securities borrowed	(6,861)	(8,653)	2,313
Accrued interest and accounts receivable	(5,849)	(15,868)	(5,815)
Other assets	(8,833)	3,982	(4,176)
Trading liabilities	18,290	(26,256)	5,198
Accounts payable and other liabilities	14,630	(16,508)	5,087
Other operating adjustments	295	7,803	(1,827)
Net cash provided by/(used in) operating activities	14,187	(10,827)	21,884
Investing activities			
Net change in:			
Federal funds sold and securities purchased under resale agreements	(123,201)	31,448	(17,468)
Held-to-maturity securities:			
Proceeds from paydowns and maturities	2,945	4,563	6,218
Purchases	(9,368)	(2,349)	(143)
Available-for-sale securities:			
Proceeds from paydowns and maturities	37,401	56,117	65,950
Proceeds from sales	46,067	90,201	48,592
Purchases	(95,091)	(105,309)	(123,959)
Proceeds from sales and securitizations of loans held-for-investment	29,826	15,791	15,429
Other changes in loans, net	(81,586)	(61,650)	(80,996)
All other investing activities, net	(4,986)	(563)	(2,825)
Net cash provided by/(used in) investing activities	(197,993)	28,249	(89,202)
Financing activities			
Net change in:			
Deposits	26,728	57,022	97,336
Federal funds purchased and securities loaned or sold under repurchase agreements	23,415	(6,739)	13,007
Short-term borrowings	18,476	16,540	(2,461)
Beneficial interests issued by consolidated VIEs	1,712	(1,377)	(5,707)
Proceeds from long-term borrowings	71,662	56,271	83,070
Payments of long-term borrowings	(76,313)	(83,079)	(68,949)
Proceeds from issuance of preferred stock	1,696	1,258	—
Redemption of preferred stock	(1,696)	(1,258)	—
Treasury stock repurchased	(19,983)	(15,410)	(9,082)
Dividends paid	(10,109)	(8,993)	(8,476)
All other financing activities, net	(1,430)	407	(467)
Net cash provided by financing activities	34,158	14,642	98,271
Effect of exchange rate changes on cash and due from banks and deposits with banks	(2,863)	8,086	(1,482)
Net increase/(decrease) in cash and due from banks and deposits with banks	(152,511)	40,150	29,471
Cash and due from banks and deposits with banks at the beginning of the period	431,304	391,154	361,683
Cash and due from banks and deposits with banks at the end of the period	\$ 278,793	\$ 431,304	\$ 391,154
Cash interest paid	\$ 21,152	\$ 14,153	\$ 9,508
Cash income taxes paid, net	3,542	4,325	2,405

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

The Notes to Consolidated Financial Statements are an integral part of these statements.

Note 1 – Basis of presentation

JPMorgan Chase & Co. (“JPMorgan Chase” or the “Firm”), a financial holding company incorporated under Delaware law in 1968, is a leading global financial services firm and one of the largest banking institutions in the U.S. with operations worldwide. The Firm is a leader in investment banking, financial services for consumers and small business, commercial banking, financial transaction processing and asset management. For a discussion of the Firm’s business segments, refer to Note 31.

The accounting and financial reporting policies of JPMorgan Chase and its subsidiaries conform to U.S. GAAP. Additionally, where applicable, the policies conform to the accounting and reporting guidelines prescribed by regulatory authorities.

Certain amounts reported in prior periods have been reclassified to conform with the current presentation.

Consolidation

The Consolidated Financial Statements include the accounts of JPMorgan Chase and other entities in which the Firm has a controlling financial interest. All material intercompany balances and transactions have been eliminated.

Assets held for clients in an agency or fiduciary capacity by the Firm are not assets of JPMorgan Chase and are not included on the Consolidated balance sheets.

The Firm determines whether it has a controlling financial interest in an entity by first evaluating whether the entity is a voting interest entity or a variable interest entity.

Voting interest entities

Voting interest entities are entities that have sufficient equity and provide the equity investors voting rights that enable them to make significant decisions relating to the entity’s operations. For these types of entities, the Firm’s determination of whether it has a controlling interest is primarily based on the amount of voting equity interests held. Entities in which the Firm has a controlling financial interest, through ownership of the majority of the entities’ voting equity interests, or through other contractual rights that give the Firm control, are consolidated by the Firm.

Investments in companies in which the Firm has significant influence over operating and financing decisions (but does not own a majority of the voting equity interests) are accounted for (i) in accordance with the equity method of accounting (which requires the Firm to recognize its proportionate share of the entity’s net earnings), or (ii) at fair value if the fair value option was elected. These investments are generally included in other assets, with income or loss included in noninterest revenue.

Certain Firm-sponsored asset management funds are structured as limited partnerships or certain limited liability companies. For many of these entities, the Firm is the general partner or managing member, but the non-affiliated partners or members have the ability to remove the Firm as the general partner or managing member without cause

(i.e., kick-out rights), based on a simple majority vote, or the non-affiliated partners or members have rights to participate in important decisions. Accordingly, the Firm does not consolidate these voting interest entities. However, in the limited cases where the non-managing partners or members do not have substantive kick-out or participating rights, the Firm evaluates the funds as VIEs and consolidates the funds if the Firm is the general partner or managing member and has a potentially significant interest.

The Firm’s investment companies and asset management funds have investments in both publicly-held and privately-held entities, including investments in buyouts, growth equity and venture opportunities. These investments are accounted for under investment company guidelines and, accordingly, irrespective of the percentage of equity ownership interests held, are carried on the Consolidated balance sheets at fair value, and are recorded in other assets, with income or loss included in noninterest revenue. If consolidated, the Firm retains such specialized investment company guidelines.

Variable interest entities

VIEs are entities that, by design, either (1) lack sufficient equity to permit the entity to finance its activities without additional subordinated financial support from other parties, or (2) have equity investors that do not have the ability to make significant decisions relating to the entity’s operations through voting rights, or do not have the obligation to absorb the expected losses, or do not have the right to receive the residual returns of the entity.

The most common type of VIE is an SPE. SPEs are commonly used in securitization transactions in order to isolate certain assets and distribute the cash flows from those assets to investors. The basic SPE structure involves a company selling assets to the SPE; the SPE funds the purchase of those assets by issuing securities to investors. The legal documents that govern the transaction specify how the cash earned on the assets must be allocated to the SPE’s investors and other parties that have rights to those cash flows. SPEs are generally structured to insulate investors from claims on the SPE’s assets by creditors of other entities, including the creditors of the seller of the assets.

The primary beneficiary of a VIE (i.e., the party that has a controlling financial interest) is required to consolidate the assets and liabilities of the VIE. The primary beneficiary is the party that has both (1) the power to direct the activities of the VIE that most significantly impact the VIE’s economic performance; and (2) through its interests in the VIE, the obligation to absorb losses or the right to receive benefits from the VIE that could potentially be significant to the VIE.

To assess whether the Firm has the power to direct the activities of a VIE that most significantly impact the VIE’s economic performance, the Firm considers all the facts and circumstances, including its role in establishing the VIE and its ongoing rights and responsibilities. This assessment

Notes to consolidated financial statements

includes, first, identifying the activities that most significantly impact the VIE's economic performance; and second, identifying which party, if any, has power over those activities. In general, the parties that make the most significant decisions affecting the VIE (such as asset managers, collateral managers, servicers, or owners of call options or liquidation rights over the VIE's assets) or have the right to unilaterally remove those decision-makers are deemed to have the power to direct the activities of a VIE.

To assess whether the Firm has the obligation to absorb losses of the VIE or the right to receive benefits from the VIE that could potentially be significant to the VIE, the Firm considers all of its economic interests, including debt and equity investments, servicing fees, and derivatives or other arrangements deemed to be variable interests in the VIE. This assessment requires that the Firm apply judgment in determining whether these interests, in the aggregate, are considered potentially significant to the VIE. Factors considered in assessing significance include: the design of the VIE, including its capitalization structure; subordination of interests; payment priority; relative share of interests held across various classes within the VIE's capital structure; and the reasons why the interests are held by the Firm.

The Firm performs on-going reassessments of: (1) whether entities previously evaluated under the majority voting-interest framework have become VIEs, based on certain events, and are therefore subject to the VIE consolidation framework; and (2) whether changes in the facts and circumstances regarding the Firm's involvement with a VIE cause the Firm's consolidation conclusion to change.

Revenue recognition

Interest income

The Firm records interest income on loans, debt securities, and other debt instruments, generally on a level-yield basis, based on the underlying contractual rate. For further discussion of interest income, refer to Note 7.

Revenue from contracts with customers

JPMorgan Chase records noninterest revenue from certain contracts with customers under ASC 606, *Revenue from Contracts with customers*, in investment banking fees, deposit-related fees, asset management administration and commissions, and components of card income. Under this guidance, revenue is recognized when the Firm's performance obligations are satisfied. For further discussion of the Firm's revenue from contracts with customers, refer to Note 6.

Principal transactions revenue

JPMorgan Chase carries a portion of its assets and liabilities at fair value. Changes in fair value are reported primarily in principal transactions revenue. For further discussion of fair value measurement, refer to Notes 2 and 3. For further discussion of principal transactions revenue, refer to Note 6.

Use of estimates in the preparation of consolidated financial statements

The preparation of the Consolidated Financial Statements requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, revenue and expense, and disclosures of contingent assets and liabilities. Actual results could be different from these estimates.

Foreign currency translation

JPMorgan Chase revalues assets, liabilities, revenue and expense denominated in non-U.S. currencies into U.S. dollars using applicable exchange rates.

Gains and losses relating to translating functional currency financial statements for U.S. reporting are included in OCI within stockholders' equity. Gains and losses relating to nonfunctional currency transactions, including non-U.S. operations where the functional currency is the U.S. dollar, are reported in the Consolidated statements of income.

Offsetting assets and liabilities

U.S. GAAP permits entities to present derivative receivables and derivative payables with the same counterparty and the related cash collateral receivables and payables on a net basis on the Consolidated balance sheets when a legally enforceable master netting agreement exists. U.S. GAAP also permits securities sold and purchased under repurchase agreements and securities borrowed or loaned under securities loan agreements to be presented net when specified conditions are met, including the existence of a legally enforceable master netting agreement. The Firm has elected to net such balances when the specified conditions are met.

The Firm uses master netting agreements to mitigate counterparty credit risk in certain transactions, including derivative contracts, resale, repurchase, securities borrowed and securities loaned agreements. A master netting agreement is a single agreement with a counterparty that permits multiple transactions governed by that agreement to be terminated or accelerated and settled through a single payment in a single currency in the event of a default (e.g., bankruptcy, failure to make a required payment or securities transfer or deliver collateral or margin when due). Upon the exercise of derivatives termination rights by the non-defaulting party (i) all transactions are terminated, (ii) all transactions are valued and the positive values of "in the money" transactions are netted against the negative values of "out of the money" transactions and (iii) the only remaining payment obligation is of one of the parties to pay the netted termination amount. Upon exercise of default rights under repurchase agreements and securities loan agreements in general (i) all transactions are terminated and accelerated, (ii) all values of securities or cash held or to be delivered are calculated, and all such sums are netted against each other and (iii) the only remaining payment obligation is of one of the parties to pay the netted termination amount.

Typical master netting agreements for these types of transactions also often contain a collateral/margin agreement that provides for a security interest in, or title transfer of, securities or cash collateral/margin to the party that has the right to demand margin (the “demanding party”). The collateral/margin agreement typically requires a party to transfer collateral/margin to the demanding party with a value equal to the amount of the margin deficit on a net basis across all transactions governed by the master netting agreement, less any threshold. The collateral/margin agreement grants to the demanding party, upon default by the counterparty, the right to set-off any amounts payable by the counterparty against any posted collateral or the cash equivalent of any posted collateral/margin. It also grants to the demanding party the right to liquidate collateral/margin and to apply the proceeds to an amount payable by the counterparty.

For further discussion of the Firm’s derivative instruments, refer to Note 5. For further discussion of the Firm’s securities financing agreements, refer to Note 11.

Statements of cash flows

For JPMorgan Chase’s Consolidated statements of cash flows, cash is defined as those amounts included in cash and due from banks and deposits with banks.

Accounting standards adopted January 1, 2018

Revenue recognition - revenue from contracts with customers

The adoption of this guidance requires gross presentation of certain costs that were previously offset against revenue. Adoption of the guidance did not result in any material changes in the timing of the Firm’s revenue recognition. This guidance was adopted retrospectively and, accordingly, prior period amounts were revised, which resulted in an increase in both noninterest revenue and noninterest expense. The Firm did not apply any practical expedients. For additional information, refer to the table on page 158 of this Note, and Note 6.

Recognition and measurement of financial assets and financial liabilities

The adoption of this guidance requires that certain equity instruments be measured at fair value, with changes in fair value recognized in earnings. The guidance also provides an alternative to measure equity securities without readily determinable fair values at cost less impairment (if any), plus or minus observable price changes from an identical or similar investment of the same issuer (the “measurement alternative”). The Firm elected the measurement alternative for its qualifying equity securities and the adoption of the guidance resulted in fair value gains of \$505 million which were recognized in other income in the first quarter of 2018. For additional information, refer to Notes 2 and 10.

Premium amortization on purchased callable debt securities

The adoption of this guidance requires that premiums be amortized to the earliest call date on certain debt securities. The adoption of this guidance resulted in a cumulative-effect adjustment to retained earnings and

AOCI. For additional information, refer to the table below, and Notes 10 and 23.

Hedge accounting

The adoption of this guidance better aligns hedge accounting with the economics of the Firm’s risk management activities. As permitted by the guidance, the Firm also elected to transfer certain investment securities from HTM to AFS. The adoption of this guidance resulted in a cumulative-effect adjustment to retained earnings and AOCI as a result of the investment securities transfer and the revised guidance for excluded components. For additional information, refer to the table below, and Notes 5, 10 and 23.

Treatment of restricted cash on the statement of cash flows

The adoption of this guidance requires restricted cash to be combined with unrestricted cash when reconciling the beginning and ending cash balances on the Consolidated statements of cash flows. To align the Consolidated balance sheets with the Consolidated statements of cash flows, the Firm reclassified restricted cash into cash and due from banks or deposits with banks. In addition, for the Firm’s Consolidated statements of cash flows, cash is defined as those amounts included in cash and due from banks and deposits with banks. This guidance was applied retrospectively and, accordingly, prior period amounts have been revised. For additional information, refer to the table below, and Note 25.

Presentation of net periodic pension cost and net periodic postretirement benefit cost

The adoption of this guidance requires the service cost component of net periodic pension cost and net periodic postretirement benefit cost to be reported separately in the Consolidated statements of income from the other cost components. This change was adopted retrospectively and, accordingly, prior period amounts were revised, which resulted in an increase in compensation expense and a reduction in other expense. For additional information, refer to the table below, and Note 8.

Reclassification of certain tax effects from AOCI

The adoption of this guidance permitted the Firm to reclassify from AOCI to retained earnings stranded tax effects due to the revaluation of deferred tax assets and liabilities as a result of changes in applicable tax rates under the TCJA. The adoption of this guidance resulted in a cumulative-effect adjustment to retained earnings and AOCI. For additional information, refer to the table below, and Note 23.

Notes to consolidated financial statements

The following tables present the prior period impact to the Consolidated statements of income and the Consolidated balance sheets from the retrospective adoption of the new accounting standards in the first quarter of 2018:

Selected Consolidated statements of income data

Year ended December 31, 2017 (in millions)	Reported	Revisions ^(a)	Revised
Revenue			
Investment banking fees	\$ 7,248	\$ 164	\$ 7,412
Asset management, administration and commissions	15,377	910	16,287
Other income	3,639	7	3,646
Total net revenue	99,624	1,081	100,705
Noninterest expense			
Compensation expense	31,009	199	31,208
Technology, communication and equipment expense	7,706	9	7,715
Professional and outside services	6,840	1,050	7,890
Other expense	6,256	(177)	6,079
Total noninterest expense	\$ 58,434	\$ 1,081	\$ 59,515

Year ended December 31, 2016 (in millions)	Reported	Revisions ^(a)	Revised
Revenue			
Investment banking fees	\$ 6,448	\$ 124	\$ 6,572
Asset management, administration and commissions	14,591	773	15,364
Other income	3,795	4	3,799
Total net revenue	95,668	901	96,569
Noninterest expense			
Compensation expense	29,979	224	30,203
Technology, communication and equipment expense	6,846	7	6,853
Professional and outside services	6,655	871	7,526
Other expense	5,756	(201)	5,555
Total noninterest expense	\$ 55,771	\$ 901	\$ 56,672

(a) Revisions relate to revenue recognition and pension cost guidance.

Selected Consolidated balance sheets data

December 31, 2017 (in millions)	Reported	Revisions ^(a)	Revised
Assets			
Cash and due from banks	\$ 25,827	\$ 71	\$ 25,898
Deposits with banks	404,294	1,112	405,406
Other assets	114,770	(1,183)	113,587
Total assets	\$2,533,600	\$ -	\$2,533,600

(a) Revisions relate to the reclassification of restricted cash.

The following table presents the adjustment to retained earnings and AOCI as a result of the adoption of new accounting standards in the first quarter of 2018:

Increase/(decrease) (in millions)	Retained earnings	AOCI
Premium amortization on purchased callable debt securities	\$ (505)	\$ 261
Hedge accounting	34	115
Reclassification of certain tax effects from AOCI	288	(288)
Total	\$ (183)	\$ 88

Significant accounting policies

The following table identifies JPMorgan Chase's other significant accounting policies and the Note and page where a detailed description of each policy can be found.

Fair value measurement	Note 2	Page 159
Fair value option	Note 3	Page 179
Derivative instruments	Note 5	Page 184
Noninterest revenue	Note 6	Page 198
Interest income and interest expense	Note 7	Page 201
Pension and other postretirement employee benefit plans	Note 8	Page 202
Employee share-based incentives	Note 9	Page 209
Investment securities	Note 10	Page 211
Securities financing activities	Note 11	Page 216
Loans	Note 12	Page 219
Allowance for credit losses	Note 13	Page 239
Variable interest entities	Note 14	Page 244
Goodwill and Mortgage servicing rights	Note 15	page 252
Premises and equipment	Note 16	page 256
Long-term debt	Note 19	page 257
Income taxes	Note 24	page 264
Off-balance sheet lending-related financial instruments, guarantees and other commitments	Note 27	page 271
Litigation	Note 29	page 278

Note 2 – Fair value measurement

JPMorgan Chase carries a portion of its assets and liabilities at fair value. These assets and liabilities are predominantly carried at fair value on a recurring basis (i.e., assets and liabilities that are measured and reported at fair value on the Firm's Consolidated balance sheets). Certain assets (e.g., held-for-sale loans), liabilities and unfunded lending-related commitments are measured at fair value on a nonrecurring basis; that is, they are not measured at fair value on an ongoing basis but are subject to fair value adjustments only in certain circumstances (for example, when there is evidence of impairment).

Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. Fair value is based on quoted market prices or inputs, where available. If prices or quotes are not available, fair value is based on valuation models and other valuation techniques that consider relevant transaction characteristics (such as maturity) and use as inputs observable or unobservable market parameters, including yield curves, interest rates, volatilities, equity or debt prices, foreign exchange rates and credit curves. Valuation adjustments may be made to ensure that financial instruments are recorded at fair value, as described below.

The level of precision in estimating unobservable market inputs or other factors can affect the amount of gain or loss recorded for a particular position. Furthermore, while the Firm believes its valuation methods are appropriate and consistent with those of other market participants, the methods and assumptions used reflect management judgment and may vary across the Firm's businesses and portfolios.

The Firm uses various methodologies and assumptions in the determination of fair value. The use of different methodologies or assumptions by other market participants compared with those used by the Firm could result in the Firm deriving a different estimate of fair value at the reporting date.

Valuation process

Risk-taking functions are responsible for providing fair value estimates for assets and liabilities carried on the Consolidated balance sheets at fair value. The Firm's VCG, which is part of the Firm's Finance function and independent of the risk-taking functions, is responsible for verifying these estimates and determining any fair value adjustments that may be required to ensure that the Firm's positions are recorded at fair value. The VGF is composed of senior finance and risk executives and is responsible for overseeing the management of risks arising from valuation activities conducted across the Firm. The Firmwide VGF is chaired by the Firmwide head of the VCG (under the direction of the Firm's Controller), and includes sub-forums covering the CIB, CCB, CB, AWM and certain corporate functions including Treasury and CIO.

Notes to consolidated financial statements

Price verification process

The VCG verifies fair value estimates provided by the risk-taking functions by leveraging independently derived prices, valuation inputs and other market data, where available. Where independent prices or inputs are not available, the VCG performs additional review to ensure the reasonableness of the estimates. The additional review may include evaluating the limited market activity including client unwinds, benchmarking valuation inputs to those used for similar instruments, decomposing the valuation of structured instruments into individual components, comparing expected to actual cash flows, reviewing profit and loss trends, and reviewing trends in collateral valuation. There are also additional levels of management review for more significant or complex positions.

The VCG determines any valuation adjustments that may be required to the estimates provided by the risk-taking functions. No adjustments to quoted prices are applied for instruments classified within level 1 of the fair value hierarchy (refer to below for further information on the fair value hierarchy). For other positions, judgment is required to assess the need for valuation adjustments to appropriately reflect liquidity considerations, unobservable parameters, and, for certain portfolios that meet specified criteria, the size of the net open risk position. The determination of such adjustments follows a consistent framework across the Firm:

- Liquidity valuation adjustments are considered where an observable external price or valuation parameter exists but is of lower reliability, potentially due to lower market activity. Liquidity valuation adjustments are applied and determined based on current market conditions. Factors that may be considered in determining the liquidity adjustment include analysis of: (1) the estimated bid-offer spread for the instrument being traded; (2) alternative pricing points for similar instruments in active markets; and (3) the range of reasonable values that the price or parameter could take.
- The Firm manages certain portfolios of financial instruments on the basis of net open risk exposure and, as permitted by U.S. GAAP, has elected to estimate the fair value of such portfolios on the basis of a transfer of the entire net open risk position in an orderly transaction. Where this is the case, valuation adjustments may be necessary to reflect the cost of exiting a larger-than-normal market-size net open risk position. Where applied, such adjustments are based on factors that a relevant market participant would consider in the transfer of the net open risk position, including the size of the adverse market move that is likely to occur during the period required to reduce the net open risk position to a normal market-size.
- Unobservable parameter valuation adjustments may be made when positions are valued using prices or input parameters to valuation models that are unobservable due to a lack of market activity or because they cannot be implied from observable market data. Such prices or parameters must be estimated and are, therefore, subject to management judgment. Unobservable

parameter valuation adjustments are applied to reflect the uncertainty inherent in the resulting valuation estimate.

- Where appropriate, the Firm also applies adjustments to its estimates of fair value in order to appropriately reflect counterparty credit quality (CVA), the Firm's own creditworthiness (DVA) and the impact of funding (FVA), using a consistent framework across the Firm. For more information on such adjustments refer to Credit and funding adjustments on page 175 of this Note.

Valuation model review and approval

If prices or quotes are not available for an instrument or a similar instrument, fair value is generally determined using valuation models that consider relevant transaction data such as maturity and use as inputs market-based or independently sourced parameters. Where this is the case the price verification process described above is applied to the inputs to those models.

Under the Firm's Estimations and Model Risk Management Policy, the Model Risk function reviews and approves new models, as well as material changes to existing models, prior to implementation in the operating environment. In certain circumstances, the head of the Model Risk function may grant exceptions to the Firm's policy to allow a model to be used prior to review or approval. The Model Risk function may also require the user to take appropriate actions to mitigate the model risk if it is to be used in the interim. These actions will depend on the model and may include, for example, limitation of trading activity.

Valuation hierarchy

A three-level valuation hierarchy has been established under U.S. GAAP for disclosure of fair value measurements. The valuation hierarchy is based on the transparency of inputs to the valuation of an asset or liability as of the measurement date. The three levels are defined as follows.

- Level 1 - inputs to the valuation methodology are quoted prices (unadjusted) for identical assets or liabilities in active markets.
- Level 2 - inputs to the valuation methodology include quoted prices for similar assets and liabilities in active markets, and inputs that are observable for the asset or liability, either directly or indirectly, for substantially the full term of the financial instrument.
- Level 3 - one or more inputs to the valuation methodology are unobservable and significant to the fair value measurement.

A financial instrument's categorization within the valuation hierarchy is based on the lowest level of input that is significant to the fair value measurement.

The following table describes the valuation methodologies generally used by the Firm to measure its significant products/instruments at fair value, including the general classification of such instruments pursuant to the valuation hierarchy.

Product/instrument	Valuation methodology	Classifications in the valuation hierarchy
Securities financing agreements	Valuations are based on discounted cash flows, which consider: <ul style="list-style-type: none"> • Derivative features: for further information refer to the discussion of derivatives below. • Market rates for the respective maturity • Collateral characteristics 	Predominantly level 2
Loans and lending-related commitments – wholesale		
Loans carried at fair value (e.g., trading loans and non-trading loans) and associated lending-related commitments	Where observable market data is available, valuations are based on: <ul style="list-style-type: none"> • Observed market prices (circumstances are infrequent) • Relevant broker quotes • Observed market prices for similar instruments Where observable market data is unavailable or limited, valuations are based on discounted cash flows, which consider the following: <ul style="list-style-type: none"> • Credit spreads derived from the cost of CDS; or benchmark credit curves developed by the Firm, by industry and credit rating • Prepayment speed • Collateral characteristics 	Level 2 or 3
Loans – consumer		
Trading loans – conforming residential mortgage loans expected to be sold (CCB, CIB)	Fair value is based on observable prices for mortgage-backed securities with similar collateral and incorporates adjustments to these prices to account for differences between the securities and the value of the underlying loans, which include credit characteristics, portfolio composition, and liquidity.	Predominantly level 2
Investment and trading securities	Quoted market prices are used where available. <p>In the absence of quoted market prices, securities are valued based on:</p> <ul style="list-style-type: none"> • Observable market prices for similar securities • Relevant broker quotes • Discounted cash flows <p>In addition, the following inputs to discounted cash flows are used for the following products:</p> <p>Mortgage- and asset-backed securities specific inputs:</p> <ul style="list-style-type: none"> • Collateral characteristics • Deal-specific payment and loss allocations • Current market assumptions related to yield, prepayment speed, conditional default rates and loss severity <p>Collateralized loan obligations (“CLOs”) specific inputs:</p> <ul style="list-style-type: none"> • Collateral characteristics • Deal-specific payment and loss allocations • Expected prepayment speed, conditional default rates, loss severity • Credit spreads • Credit rating data 	Level 1 Level 2 or 3
Physical commodities	Valued using observable market prices or data.	Level 1 and 2

Notes to consolidated financial statements

Product/instrument	Valuation methodology	Classifications in the valuation hierarchy
Derivatives	Exchange-traded derivatives that are actively traded and valued using the exchange price.	Level 1
	<p>Derivatives that are valued using models such as the Black-Scholes option pricing model, simulation models, or a combination of models that may use observable or unobservable valuation inputs as well as considering the contractual terms.</p> <p>The key valuation inputs used will depend on the type of derivative and the nature of the underlying instruments and may include equity prices, commodity prices, interest rate yield curves, foreign exchange rates, volatilities, correlations, CDS spreads and recovery rates. Additionally, the credit quality of the counterparty and of the Firm as well as market funding levels may also be considered.</p> <p>In addition, specific inputs used for derivatives that are valued based on models with significant unobservable inputs are as follows:</p> <p>Structured credit derivatives specific inputs include:</p> <ul style="list-style-type: none"> • CDS spreads and recovery rates • Credit correlation between the underlying debt instruments <p>Equity option specific inputs include:</p> <ul style="list-style-type: none"> • Equity volatilities • Equity correlation • Equity-FX correlation • Equity-IR correlation <p>Interest rate and FX exotic options specific inputs include:</p> <ul style="list-style-type: none"> • Interest rate spread volatility • Interest rate correlation • Foreign exchange correlation • Interest rate-FX correlation <p>Commodity derivatives specific inputs include:</p> <ul style="list-style-type: none"> • Commodity volatility • Forward commodity price <p>Additionally, adjustments are made to reflect counterparty credit quality (CVA) and the impact of funding (FVA). Refer to page 175 of this Note.</p>	Level 2 or 3
Mortgage servicing rights	Refer to Mortgage servicing rights in Note 15.	Level 3
Private equity direct investments	<p>Fair value is estimated using all available information; the range of potential inputs include:</p> <ul style="list-style-type: none"> • Transaction prices • Trading multiples of comparable public companies • Operating performance of the underlying portfolio company • Adjustments as required, since comparable public companies are not identical to the company being valued, and for company-specific issues and lack of liquidity. • Additional available inputs relevant to the investment. 	Level 2 or 3
Fund investments (e.g., mutual/collective investment funds, private equity funds, hedge funds, and real estate funds)	Net asset value	Level 1
	<ul style="list-style-type: none"> • NAV is supported by the ability to redeem and purchase at the NAV level. • Adjustments to the NAV as required, for restrictions on redemption (e.g., lock-up periods or withdrawal limitations) or where observable activity is limited. 	Level 2 or 3 ^(a)
Beneficial interests issued by consolidated VIEs	<p>Valued using observable market information, where available.</p> <p>In the absence of observable market information, valuations are based on the fair value of the underlying assets held by the VIE.</p>	Level 2 or 3

(a) Excludes certain investments that are measured at fair value using the net asset value per share (or its equivalent) as a practical expedient.

Product/instrument	Valuation methodology	Classification in the valuation hierarchy
Structured notes (included in deposits, short-term borrowings and long-term debt)	<ul style="list-style-type: none"> • Valuations are based on discounted cash flow analyses that consider the embedded derivative and the terms and payment structure of the note. • The embedded derivative features are considered using models such as the Black-Scholes option pricing model, simulation models, or a combination of models that may use observable or unobservable valuation inputs, depending on the embedded derivative. The specific inputs used vary according to the nature of the embedded derivative features, as described in the discussion above regarding derivatives valuation. Adjustments are then made to this base valuation to reflect the Firm's own credit risk (DVA). Refer to page 175 of this Note. 	Level 2 or 3

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The following table presents the assets and liabilities reported at fair value as of December 31, 2018 and 2017, by major product category and fair value hierarchy.

Assets and liabilities measured at fair value on a recurring basis

December 31, 2018 (in millions)	Fair value hierarchy			Derivative netting adjustments	Total fair value
	Level 1	Level 2	Level 3		
Federal funds sold and securities purchased under resale agreements	\$ —	\$ 13,235	\$ —	\$ —	\$ 13,235
Securities borrowed	—	5,105	—	—	5,105
Trading assets:					
Debt instruments:					
Mortgage-backed securities:					
U.S. government agencies ^(a)	—	76,249	549	—	76,798
Residential - nonagency	—	1,798	64	—	1,862
Commercial - nonagency	—	1,501	11	—	1,512
Total mortgage-backed securities	—	79,548	624	—	80,172
U.S. Treasury and government agencies ^(a)	51,477	7,702	—	—	59,179
Obligations of U.S. states and municipalities	—	7,121	689	—	7,810
Certificates of deposit, bankers' acceptances and commercial paper	—	1,214	—	—	1,214
Non-U.S. government debt securities	27,878	27,056	155	—	55,089
Corporate debt securities	—	18,655	334	—	18,989
Loans ^(b)	—	40,047	1,706	—	41,753
Asset-backed securities	—	2,756	127	—	2,883
Total debt instruments	79,355	184,099	3,635	—	267,089
Equity securities	71,119	482	232	—	71,833
Physical commodities ^(c)	5,182	1,855	—	—	7,037
Other	—	13,192	301	—	13,493
Total debt and equity instruments^(d)	155,656	199,628	4,168	—	359,452
Derivative receivables:					
Interest rate	682	266,380	1,642	(245,490)	23,214
Credit	—	19,235	860	(19,483)	612
Foreign exchange	771	166,238	676	(154,235)	13,450
Equity	—	46,777	2,508	(39,339)	9,946
Commodity	—	20,339	131	(13,479)	6,991
Total derivative receivables^(e)	1,453	518,969	5,817	(472,026)	54,213
Total trading assets^(f)	157,109	718,597	9,985	(472,026)	413,665
Available-for-sale securities:					
Mortgage-backed securities:					
U.S. government agencies ^(a)	—	68,646	—	—	68,646
Residential - nonagency	—	8,519	1	—	8,520
Commercial - nonagency	—	6,654	—	—	6,654
Total mortgage-backed securities	—	83,819	1	—	83,820
U.S. Treasury and government agencies	56,059	—	—	—	56,059
Obligations of U.S. states and municipalities	—	37,723	—	—	37,723
Certificates of deposit	—	75	—	—	75
Non-U.S. government debt securities	15,313	8,789	—	—	24,102
Corporate debt securities	—	1,918	—	—	1,918
Asset-backed securities:					
Collateralized loan obligations	—	19,437	—	—	19,437
Other	—	7,260	—	—	7,260
Total available-for-sale securities	71,372	159,021	1	—	230,394
Loans	—	3,029	122	—	3,151
Mortgage servicing rights	—	—	6,130	—	6,130
Other assets ^(g)	7,810	195	927	—	8,932
Total assets measured at fair value on a recurring basis	\$ 236,291	\$ 899,182	\$ 17,165	\$ (472,026)	\$ 680,612
Deposits	\$ —	\$ 19,048	\$ 4,169	\$ —	\$ 23,217
Federal funds purchased and securities loaned or sold under repurchase agreements	—	935	—	—	935
Short-term borrowings	—	5,607	1,523	—	7,130
Trading liabilities:					
Debt and equity instruments ^(d)	80,199	22,755	50	—	103,004
Derivative payables:					
Interest rate	1,526	239,576	1,680	(234,998)	7,784
Credit	—	19,309	967	(18,609)	1,667
Foreign exchange	695	163,549	973	(152,432)	12,785
Equity	—	46,462	4,733	(41,034)	10,161
Commodity	—	21,158	1,260	(13,046)	9,372
Total derivative payables^(e)	2,221	490,054	9,613	(460,119)	41,769
Total trading liabilities	82,420	512,809	9,663	(460,119)	144,773
Accounts payable and other liabilities	3,063	196	10	—	3,269
Beneficial interests issued by consolidated VIEs	—	27	1	—	28
Long-term debt	—	35,468	19,418	—	54,886
Total liabilities measured at fair value on a recurring basis	\$ 85,483	\$ 574,090	\$ 34,784	\$ (460,119)	\$ 234,238

December 31, 2017 (in millions)	Fair value hierarchy			Derivative netting adjustments	Total fair value
	Level 1	Level 2	Level 3		
Federal funds sold and securities purchased under resale agreements	\$ —	\$ 14,732	\$ —	\$ —	\$ 14,732
Securities borrowed	—	3,049	—	—	3,049
Trading assets:					
Debt instruments:					
Mortgage-backed securities:					
U.S. government agencies ^(a)	—	41,515	307	—	41,822
Residential - nonagency	—	1,835	60	—	1,895
Commercial - nonagency	—	1,645	11	—	1,656
Total mortgage-backed securities	—	44,995	378	—	45,373
U.S. Treasury and government agencies ^(a)	30,758	6,475	1	—	37,234
Obligations of U.S. states and municipalities	—	9,067	744	—	9,811
Certificates of deposit, bankers' acceptances and commercial paper	—	226	—	—	226
Non-U.S. government debt securities	28,887	28,831	78	—	57,796
Corporate debt securities	—	24,146	312	—	24,458
Loans ^(b)	—	35,242	2,719	—	37,961
Asset-backed securities	—	3,284	153	—	3,437
Total debt instruments	59,645	152,266	4,385	—	216,296
Equity securities	87,346	197	295	—	87,838
Physical commodities ^(c)	4,924	1,322	—	—	6,246
Other	—	14,197	690	—	14,887
Total debt and equity instruments^(d)	151,915	167,982	5,370	—	325,267
Derivative receivables:					
Interest rate	181	314,107	1,704	(291,319)	24,673
Credit	—	21,995	1,209	(22,335)	869
Foreign exchange	841	158,834	557	(144,081)	16,151
Equity	—	37,722	2,318	(32,158)	7,882
Commodity	—	19,875	210	(13,137)	6,948
Total derivative receivables^(e)	1,022	552,533	5,998	(503,030)	56,523
Total trading assets^(f)	152,937	720,515	11,368	(503,030)	381,790
Available-for-sale securities:					
Mortgage-backed securities:					
U.S. government agencies ^(a)	—	70,280	—	—	70,280
Residential - nonagency	—	11,366	1	—	11,367
Commercial - nonagency	—	5,025	—	—	5,025
Total mortgage-backed securities	—	86,671	1	—	86,672
U.S. Treasury and government agencies	22,745	—	—	—	22,745
Obligations of U.S. states and municipalities	—	32,338	—	—	32,338
Certificates of deposit	—	59	—	—	59
Non-U.S. government debt securities	18,140	9,154	—	—	27,294
Corporate debt securities	—	2,757	—	—	2,757
Asset-backed securities:					
Collateralized loan obligations	—	20,720	276	—	20,996
Other	—	8,817	—	—	8,817
Equity securities ^(d)	547	—	—	—	547
Total available-for-sale securities	41,432	160,516	277	—	202,225
Loans	—	2,232	276	—	2,508
Mortgage servicing rights	—	—	6,030	—	6,030
Other assets ^{(f)(g)}	13,795	343	1,265	—	15,403
Total assets measured at fair value on a recurring basis	\$ 208,164	\$ 901,387	\$ 19,216	\$ (503,030)	\$ 625,737
Deposits	\$ —	\$ 17,179	\$ 4,142	\$ —	\$ 21,321
Federal funds purchased and securities loaned or sold under repurchase agreements	—	697	—	—	697
Short-term borrowings	—	7,526	1,665	—	9,191
Trading liabilities:					
Debt and equity instruments ^(d)	64,664	21,183	39	—	85,886
Derivative payables:					
Interest rate	170	282,825	1,440	(277,306)	7,129
Credit	—	22,009	1,244	(21,954)	1,299
Foreign exchange	794	154,075	953	(143,349)	12,473
Equity	—	39,668	5,727	(36,203)	9,192
Commodity	—	21,017	884	(14,217)	7,684
Total derivative payables^(d)	964	519,594	10,248	(493,029)	37,777
Total trading liabilities	65,628	540,777	10,287	(493,029)	123,663
Accounts payable and other liabilities	9,074	121	13	—	9,208
Beneficial interests issued by consolidated VIEs	—	6	39	—	45
Long-term debt	—	31,394	16,125	—	47,519
Total liabilities measured at fair value on a recurring basis	\$ 74,702	\$ 597,700	\$ 32,271	\$ (493,029)	\$ 211,644

(a) At December 31, 2018 and 2017, included total U.S. government-sponsored enterprise obligations of \$92.3 billion and \$78.0 billion, respectively, which were predominantly mortgage-related.

(b) At December 31, 2018 and 2017, included within trading loans were \$13.2 billion and \$11.4 billion, respectively, of residential first-lien mortgages, and \$2.3 billion and \$4.2 billion, respectively, of commercial first-lien mortgages. Residential mortgage loans include conforming mortgage loans originated with the intent to sell to U.S. government agencies of \$7.6 billion and \$5.7 billion, respectively, and reverse mortgages of zero and \$836 million, respectively.

Notes to consolidated financial statements

- (c) Physical commodities inventories are generally accounted for at the lower of cost or net realizable value. "Net realizable value" is a term defined in U.S. GAAP as not exceeding fair value less costs to sell ("transaction costs"). Transaction costs for the Firm's physical commodities inventories are either not applicable or immaterial to the value of the inventory. Therefore, net realizable value approximates fair value for the Firm's physical commodities inventories. When fair value hedging has been applied (or when net realizable value is below cost), the carrying value of physical commodities approximates fair value, because under fair value hedge accounting, the cost basis is adjusted for changes in fair value. For a further discussion of the Firm's hedge accounting relationships, refer to Note 5. To provide consistent fair value disclosure information, all physical commodities inventories have been included in each period presented.
- (d) Balances reflect the reduction of securities owned (long positions) by the amount of identical securities sold but not yet purchased (short positions).
- (e) As permitted under U.S. GAAP, the Firm has elected to net derivative receivables and derivative payables and the related cash collateral received and paid when a legally enforceable master netting agreement exists. For purposes of the tables above, the Firm does not reduce derivative receivables and derivative payables balances for this netting adjustment, either within or across the levels of the fair value hierarchy, as such netting is not relevant to a presentation based on the transparency of inputs to the valuation of an asset or liability. The level 3 balances would be reduced if netting were applied, including the netting benefit associated with cash collateral.
- (f) Certain investments that are measured at fair value using the net asset value per share (or its equivalent) as a practical expedient are not required to be classified in the fair value hierarchy. At December 31, 2018 and 2017, the fair values of these investments, which include certain hedge funds, private equity funds, real estate and other funds, were \$747 million and \$779 million, respectively. Included in these balances at December 31, 2018 and 2017, were trading assets of \$49 million and \$54 million, respectively, and other assets of \$698 million and \$725 million, respectively.
- (g) Effective January 1, 2018, the Firm adopted the recognition and measurement guidance. Equity securities that were previously reported as AFS securities were reclassified to other assets upon adoption.

Level 3 valuations

The Firm has established well-structured processes for determining fair value, including for instruments where fair value is estimated using significant unobservable inputs (level 3). For further information on the Firm's valuation process and a detailed discussion of the determination of fair value for individual financial instruments, refer to pages 159-163 of this Note.

Estimating fair value requires the application of judgment. The type and level of judgment required is largely dependent on the amount of observable market information available to the Firm. For instruments valued using internally developed valuation models and other valuation techniques that use significant unobservable inputs and are therefore classified within level 3 of the fair value hierarchy, judgments used to estimate fair value are more significant than those required when estimating the fair value of instruments classified within levels 1 and 2.

In arriving at an estimate of fair value for an instrument within level 3, management must first determine the appropriate valuation model or other valuation technique to use. Second, due to the lack of observability of significant inputs, management must assess all relevant empirical data in deriving valuation inputs including transaction details, yield curves, interest rates, prepayment speed, default rates, volatilities, correlations, equity or debt prices, valuations of comparable instruments, foreign exchange rates and credit curves.

The following table presents the Firm's primary level 3 financial instruments, the valuation techniques used to measure the fair value of those financial instruments, the significant unobservable inputs, the range of values for those inputs and, for certain instruments, the weighted averages of such inputs. While the determination to classify an instrument within level 3 is based on the significance of the unobservable inputs to the overall fair value measurement, level 3 financial instruments typically include observable components (that is, components that are actively quoted and can be validated to external sources) in addition to the unobservable components. The level 1 and/or level 2 inputs are not included in the table. In addition, the Firm manages the risk of the observable components of level 3 financial instruments using securities and derivative positions that are classified within levels 1 or 2 of the fair value hierarchy.

The range of values presented in the table is representative of the highest and lowest level input used to value the significant groups of instruments within a product/instrument classification. Where provided, the weighted averages of the input values presented in the table are calculated based on the fair value of the instruments that the input is being used to value.

In the Firm's view, the input range and the weighted average value do not reflect the degree of input uncertainty or an assessment of the reasonableness of the Firm's estimates and assumptions. Rather, they reflect the characteristics of the various instruments held by the Firm and the relative distribution of instruments within the range of characteristics. For example, two option contracts may have similar levels of market risk exposure and valuation uncertainty, but may have significantly different implied volatility levels because the option contracts have different underlyings, tenors, or strike prices. The input range and weighted average values will therefore vary from period-to-period and parameter-to-parameter based on the characteristics of the instruments held by the Firm at each balance sheet date.

For the Firm's derivatives and structured notes positions classified within level 3 at December 31, 2018, interest rate correlation inputs used in estimating fair value were concentrated towards the upper end of the range; equity correlation, equity-FX and equity-IR correlation inputs were concentrated in the middle of the range; commodity correlation inputs were concentrated in the middle of the range; credit correlation inputs were concentrated towards the lower end of the range; and the interest rate-foreign exchange ("IR-FX") correlation inputs were distributed across the range. In addition, the interest rate spread volatility inputs used in estimating fair value were distributed across the range; equity volatilities and commodity volatilities were concentrated in the middle of the range; and forward commodity prices used in estimating the fair value of commodity derivatives were concentrated towards the lower end of the range. Recovery rate inputs used in estimating the fair value of credit derivatives were distributed across the range; credit spreads and conditional default rates were concentrated towards the lower end of the range; loss severity and price inputs were concentrated towards the upper end of the range.

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Level 3 inputs^(a)

December 31, 2018

Product/Instrument	Fair value (in millions)	Principal valuation technique	Unobservable inputs ^(g)	Range of input values	Weighted average
Residential mortgage-backed securities and loans ^(b)	\$ 858	Discounted cash flows	Yield	0% - 19%	6%
			Prepayment speed	0% - 24%	9%
			Conditional default rate	0% - 9%	1%
			Loss severity	0% - 100%	6%
Commercial mortgage-backed securities and loans ^(c)	419	Market comparables	Price	\$ 0 - \$103	\$90
Obligations of U.S. states and municipalities	689	Market comparables	Price	\$ 62 - \$100	\$96
Corporate debt securities	334	Market comparables	Price	\$ 0 - \$107	\$57
Loans ^(d)	234	Discounted cash flows	Yield	8%	8%
			Price	\$ 2 - \$101	\$78
Asset-backed securities	127	Market comparables	Price	\$ 1 - \$102	\$67
Net interest rate derivatives	(180)	Option pricing	Interest rate spread volatility	16bps - 38bps	
			Interest rate correlation	(45)% - 97%	
			IR-FX correlation	45% - 60%	
			Prepayment speed	4% - 30%	
Net credit derivatives	(163)	Discounted cash flows	Credit correlation	25% - 55%	
			Credit spread	10bps - 1,487bps	
			Recovery rate	20% - 70%	
			Conditional default rate	3% - 72%	
			Loss severity	100%	
Net foreign exchange derivatives	(122)	Option pricing	Price	\$ 1 - \$115	
			IR-FX correlation	(45)% - 60%	
Net equity derivatives	(2,225)	Discounted cash flows	Prepayment speed	8% - 9%	
			Option pricing	Equity volatility	14% - 57%
Net commodity derivatives	(1,129)	Option pricing	Equity correlation	20% - 98%	
			Equity-FX correlation	(75)% - 61%	
			Equity-IR correlation	20% - 60%	
			Forward commodity price	\$ 39 - \$56 per barrel	
MSRs	6,130	Discounted cash flows	Commodity volatility	5% - 68%	
			Commodity correlation	(51)% - 95%	
			Refer to Note 15		
Other assets	306	Discounted cash flows	Credit spread	55bps	55bps
			Yield	8% - 10%	8%
			Price	\$ 20 - \$108	\$40
Long-term debt, short-term borrowings, and deposits ^(e)	25,110	Option pricing	EBITDA multiple	2.9x - 8.3x	7.5x
			Interest rate spread volatility	16bps - 38bps	
			Interest rate correlation	(45)% - 97%	
			IR-FX correlation	(45)% - 60%	
			Equity correlation	20% - 98%	
Other level 3 assets and liabilities, net ^(f)	326		Equity-FX correlation	(75)% - 61%	
			Equity-IR correlation	20% - 60%	

(a) The categories presented in the table have been aggregated based upon the product type, which may differ from their classification on the Consolidated balance sheets. Furthermore, the inputs presented for each valuation technique in the table are, in some cases, not applicable to every instrument valued using the technique as the characteristics of the instruments can differ.

(b) Includes U.S. government agency securities of \$541 million, nonagency securities of \$65 million and trading loans of \$252 million.

(c) Includes U.S. government agency securities of \$8 million, nonagency securities of \$11 million, trading loans of \$278 million and non-trading loans of \$122 million.

(d) Comprises trading loans.

(e) Long-term debt, short-term borrowings and deposits include structured notes issued by the Firm that are financial instruments that typically contain embedded derivatives. The estimation of the fair value of structured notes includes the derivative features embedded within the instrument. The significant unobservable inputs are broadly consistent with those presented for derivative receivables.

(f) Includes level 3 assets and liabilities that are insignificant both individually and in aggregate.

(g) Price is a significant unobservable input for certain instruments. When quoted market prices are not readily available, reliance is generally placed on price-based internal valuation techniques. The price input is expressed assuming a par value of \$100.

Changes in and ranges of unobservable inputs

The following discussion provides a description of the impact on a fair value measurement of a change in each unobservable input in isolation, and the interrelationship between unobservable inputs, where relevant and significant. The impact of changes in inputs may not be independent, as a change in one unobservable input may give rise to a change in another unobservable input. Where relationships do exist between two unobservable inputs, those relationships are discussed below. Relationships may also exist between observable and unobservable inputs (for example, as observable interest rates rise, unobservable prepayment rates decline); such relationships have not been included in the discussion below. In addition, for each of the individual relationships described below, the inverse relationship would also generally apply.

The following discussion also provides a description of attributes of the underlying instruments and external market factors that affect the range of inputs used in the valuation of the Firm's positions.

Yield - The yield of an asset is the interest rate used to discount future cash flows in a discounted cash flow calculation. An increase in the yield, in isolation, would result in a decrease in a fair value measurement.

Credit spread - The credit spread is the amount of additional annualized return over the market interest rate that a market participant would demand for taking exposure to the credit risk of an instrument. The credit spread for an instrument forms part of the discount rate used in a discounted cash flow calculation. Generally, an increase in the credit spread would result in a decrease in a fair value measurement.

The yield and the credit spread of a particular mortgage-backed security primarily reflect the risk inherent in the instrument. The yield is also impacted by the absolute level of the coupon paid by the instrument (which may not correspond directly to the level of inherent risk). Therefore, the range of yield and credit spreads reflects the range of risk inherent in various instruments owned by the Firm. The risk inherent in mortgage-backed securities is driven by the subordination of the security being valued and the characteristics of the underlying mortgages within the collateralized pool, including borrower FICO scores, LTV ratios for residential mortgages and the nature of the property and/or any tenants for commercial mortgages. For corporate debt securities, obligations of U.S. states and municipalities and other similar instruments, credit spreads reflect the credit quality of the obligor and the tenor of the obligation.

Prepayment speed - The prepayment speed is a measure of the voluntary unscheduled principal repayments of a prepayable obligation in a collateralized pool. Prepayment speeds generally decline as borrower delinquencies rise. An increase in prepayment speeds, in isolation, would result in a decrease in a fair value measurement of assets valued at a premium to par and an increase in a fair value measurement of assets valued at a discount to par.

Prepayment speeds may vary from collateral pool to collateral pool, and are driven by the type and location of the

underlying borrower, and the remaining tenor of the obligation as well as the level and type (e.g., fixed or floating) of interest rate being paid by the borrower. Typically collateral pools with higher borrower credit quality have a higher prepayment rate than those with lower borrower credit quality, all other factors being equal.

Conditional default rate - The conditional default rate is a measure of the reduction in the outstanding collateral balance underlying a collateralized obligation as a result of defaults. While there is typically no direct relationship between conditional default rates and prepayment speeds, collateralized obligations for which the underlying collateral has high prepayment speeds will tend to have lower conditional default rates. An increase in conditional default rates would generally be accompanied by an increase in loss severity and an increase in credit spreads. An increase in the conditional default rate, in isolation, would result in a decrease in a fair value measurement. Conditional default rates reflect the quality of the collateral underlying a securitization and the structure of the securitization itself. Based on the types of securities owned in the Firm's market-making portfolios, conditional default rates are most typically at the lower end of the range presented.

Loss severity - The loss severity (the inverse concept is the recovery rate) is the expected amount of future realized losses resulting from the ultimate liquidation of a particular loan, expressed as the net amount of loss relative to the outstanding loan balance. An increase in loss severity is generally accompanied by an increase in conditional default rates. An increase in the loss severity, in isolation, would result in a decrease in a fair value measurement.

The loss severity applied in valuing a mortgage-backed security investment depends on factors relating to the underlying mortgages, including the LTV ratio, the nature of the lender's lien on the property and other instrument-specific factors.

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Correlation - Correlation is a measure of the relationship between the movements of two variables (e.g., how the change in one variable influences the change in the other). Correlation is a pricing input for a derivative product where the payoff is driven by one or more underlying risks. Correlation inputs are related to the type of derivative (e.g., interest rate, credit, equity, foreign exchange and commodity) due to the nature of the underlying risks. When parameters are positively correlated, an increase in one parameter will result in an increase in the other parameter. When parameters are negatively correlated, an increase in one parameter will result in a decrease in the other parameter. An increase in correlation can result in an increase or a decrease in a fair value measurement. Given a short correlation position, an increase in correlation, in isolation, would generally result in a decrease in a fair value measurement.

The level of correlation used in the valuation of derivatives with multiple underlying risks depends on a number of factors including the nature of those risks. For example, the correlation between two credit risk exposures would be different than that between two interest rate risk exposures. Similarly, the tenor of the transaction may also impact the correlation input, as the relationship between the underlying risks may be different over different time periods. Furthermore, correlation levels are very much dependent on market conditions and could have a relatively wide range of levels within or across asset classes over time, particularly in volatile market conditions.

Volatility - Volatility is a measure of the variability in possible returns for an instrument, parameter or market index given how much the particular instrument, parameter or index changes in value over time. Volatility is a pricing input for options, including equity options, commodity options, and interest rate options. Generally, the higher the volatility of the underlying, the riskier the instrument. Given a long position in an option, an increase in volatility, in isolation, would generally result in an increase in a fair value measurement.

The level of volatility used in the valuation of a particular option-based derivative depends on a number of factors, including the nature of the risk underlying the option (e.g., the volatility of a particular equity security may be significantly different from that of a particular commodity index), the tenor of the derivative as well as the strike price of the option.

EBITDA multiple - EBITDA multiples refer to the input (often derived from the value of a comparable company) that is multiplied by the historic and/or expected earnings before interest, taxes, depreciation and amortization ("EBITDA") of a company in order to estimate the company's value. An increase in the EBITDA multiple, in isolation, net of adjustments, would result in an increase in a fair value measurement.

Changes in level 3 recurring fair value measurements

The following tables include a rollforward of the Consolidated balance sheets amounts (including changes in fair value) for financial instruments classified by the Firm within level 3 of the fair value hierarchy for the years ended December 31, 2018, 2017 and 2016. When a determination is made to classify a financial instrument within level 3, the determination is based on the significance of the unobservable inputs to the overall fair value measurement. However, level 3 financial instruments typically include, in addition to the unobservable or level 3 components, observable components (that is, components that are actively quoted and can be validated to external sources); accordingly, the gains and losses in the table below include changes in fair value due in part to observable factors that are part of the valuation methodology. Also, the Firm risk-manages the observable components of level 3 financial instruments using securities and derivative positions that are classified within level 1 or 2 of the fair value hierarchy; as these level 1 and level 2 risk management instruments are not included below, the gains or losses in the following tables do not reflect the effect of the Firm's risk management activities related to such level 3 instruments.

Year ended December 31, 2018 (in millions)	Fair value measurements using significant unobservable inputs							Fair value at Dec. 31, 2018	Change in unrealized gains/(losses) related to financial instruments held at Dec. 31, 2018	
	Fair value at January 1, 2018	Total realized/ unrealized gains/ (losses)	Purchases ^(f)	Sales	Settlements ^(g)	Transfers into level 3 ^(h)	Transfers (out of) level 3 ^(h)			
Assets:^(a)										
Trading assets:										
Debt instruments:										
Mortgage-backed securities:										
U.S. government agencies	\$ 307	\$ (23)	\$ 478	\$ (164)	\$ (73)	\$ 94	\$ (70)	\$ 549	\$ (21)	
Residential - nonagency	60	(2)	78	(50)	(7)	59	(74)	64	1	
Commercial - nonagency	11	2	18	(18)	(17)	36	(21)	11	(2)	
Total mortgage-backed securities	378	(23)	574	(232)	(97)	189	(165)	624	(22)	
U.S. Treasury and government agencies	1	—	—	—	—	—	(1)	—	—	
Obligations of U.S. states and municipalities	744	(17)	112	(70)	(80)	—	—	689	(17)	
Non-U.S. government debt securities	78	(22)	459	(277)	(12)	23	(94)	155	(9)	
Corporate debt securities	312	(18)	364	(309)	(48)	262	(229)	334	(1)	
Loans	2,719	26	1,364	(1,793)	(658)	813	(765)	1,706	(1)	
Asset-backed securities	153	28	98	(41)	(55)	45	(101)	127	22	
Total debt instruments	4,385	(26)	2,971	(2,722)	(950)	1,332	(1,355)	3,635	(28)	
Equity securities	295	(40)	118	(120)	(1)	107	(127)	232	9	
Other	690	(285)	55	(40)	(118)	3	(4)	301	(301)	
Total trading assets - debt and equity instruments	5,370	(351) ^(c)	3,144	(2,882)	(1,069)	1,442	(1,486)	4,168	(320) ^(c)	
Net derivative receivables: ^(b)										
Interest rate	264	150	107	(133)	(430)	(15)	19	(38)	187	
Credit	(35)	(40)	5	(7)	(57)	4	23	(107)	(28)	
Foreign exchange	(396)	103	52	(20)	30	(108)	42	(297)	(63)	
Equity	(3,409)	198	1,676	(2,208)	1,805	(617)	330	(2,225)	561	
Commodity	(674)	(73)	1	(72)	(301)	7	(17)	(1,129)	146	
Total net derivative receivables	(4,250)	338 ^(c)	1,841	(2,440)	1,047	(729)	397	(3,796)	803 ^(c)	
Available-for-sale securities:										
Mortgage-backed securities	1	—	—	—	—	—	—	1	—	
Asset-backed securities	276	1	—	—	(277)	—	—	—	—	
Total available-for-sale securities	277	1 ^(d)	—	—	(277)	—	—	1	—	
Loans	276	(7)	123	—	(196)	—	(74)	122	(7)	
Mortgage servicing rights	6,030	230	1,246	(636)	(740)	—	—	6,130	230	
Other assets	1,265	(328)	61	(37)	(37)	4	(1)	927	(340)	

Year ended December 31, 2018 (in millions)	Fair value measurements using significant unobservable inputs							Fair value at Dec. 31, 2018	Change in unrealized (gains)/losses related to financial instruments held at Dec. 31, 2018	
	Fair value at January 1, 2018	Total realized/ unrealized (gains)/ losses	Purchases	Sales	Issuances	Settlements ^(g)	Transfers into level 3 ^(h)			Transfers (out of) level 3 ^(h)
Liabilities:^(a)										
Deposits	\$ 4,142	\$ (136)	\$ —	\$ —	\$ 1,437	\$ (736)	\$ 2	\$ (540)	\$ 4,169	\$ (204)
Federal funds purchased and securities loaned or sold under repurchase agreements	—	—	—	—	—	—	—	—	—	—
Short-term borrowings	1,665	(329)	—	—	3,455	(3,388)	272	(152)	1,523	(131)
Trading liabilities - debt and equity instruments	39	19	(99)	114	—	(1)	14	(36)	50	16
Accounts payable and other liabilities	13	—	(12)	5	—	—	4	—	10	—
Beneficial interests issued by consolidated VIEs	39	—	—	1	—	(39)	—	—	1	—
Long-term debt	16,125	(1,169)	—	—	11,919	(7,769)	1,143	(831)	19,418	(1,385)

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Year ended December 31, 2017 (in millions)	Fair value measurements using significant unobservable inputs								Change in unrealized gains/(losses) related to financial instruments held at Dec. 31, 2017	
	Fair value at January 1, 2017	Total realized/ unrealized gains/ (losses)	Purchases ^(f)	Sales	Settlements ^(g)	Transfers into level 3 ^(h)	Transfers (out of) level 3 ^(h)	Fair value at Dec. 31, 2017		
Assets:^(a)										
Trading assets:										
Debt instruments:										
Mortgage-backed securities:										
U.S. government agencies	\$ 392	\$ (11)	\$ 161	\$ (171)	\$ (70)	\$ 49	\$ (43)	\$ 307	\$ (20)	
Residential - nonagency	83	19	53	(30)	(64)	132	(133)	60	11	
Commercial - nonagency	17	9	27	(44)	(13)	64	(49)	11	1	
Total mortgage-backed securities	492	17	241	(245)	(147)	245	(225)	378	(8)	
U.S. Treasury and government agencies	–	–	–	–	–	1	–	1	–	
Obligations of U.S. states and municipalities	649	18	152	(70)	(5)	–	–	744	15	
Non-U.S. government debt securities	46	–	559	(518)	–	62	(71)	78	–	
Corporate debt securities	576	11	872	(612)	(497)	157	(195)	312	18	
Loans	4,837	333	2,389	(2,832)	(1,323)	806	(1,491)	2,719	43	
Asset-backed securities	302	32	354	(356)	(56)	75	(198)	153	–	
Total debt instruments	6,902	411	4,567	(4,633)	(2,028)	1,346	(2,180)	4,385	68	
Equity securities	231	39	176	(148)	(4)	59	(58)	295	21	
Other	761	100	30	(46)	(162)	17	(10)	690	39	
Total trading assets - debt and equity instruments	7,894	550 ^(c)	4,773	(4,827)	(2,194)	1,422	(2,248)	5,370	128 ^(c)	
Net derivative receivables: ^(b)										
Interest rate	1,263	72	60	(82)	(1,040)	(8)	(1)	264	(473)	
Credit	98	(164)	1	(6)	–	77	(41)	(35)	32	
Foreign exchange	(1,384)	43	13	(10)	854	(61)	149	(396)	42	
Equity	(2,252)	(417)	1,116	(551)	(245)	(1,482)	422	(3,409)	(161)	
Commodity	(85)	(149)	–	–	(433)	(6)	(1)	(674)	(718)	
Total net derivative receivables	(2,360)	(615) ^(c)	1,190	(649)	(864)	(1,480)	528	(4,250)	(1,278) ^(c)	
Available-for-sale securities:										
Mortgage-backed securities	1	–	–	–	–	–	–	1	–	
Asset-backed securities	663	15	–	(50)	(352)	–	–	276	14	
Total available-for-sale securities	664	15 ^(d)	–	(50)	(352)	–	–	277	14 ^(d)	
Loans	570	35 ^(c)	–	(26)	(303)	–	–	276	3 ^(c)	
Mortgage servicing rights	6,096	(232) ^(e)	1,103	(140)	(797)	–	–	6,030	(232) ^(e)	
Other assets	2,223	244 ^(c)	66	(177)	(870)	–	(221)	1,265	74 ^(c)	

Year ended December 31, 2017 (in millions)	Fair value measurements using significant unobservable inputs								Change in unrealized (gains)/losses related to financial instruments held at Dec. 31, 2017	
	Fair value at January 1, 2017	Total realized/ unrealized (gains)/ losses	Purchases	Sales	Issuances	Settlements ^(g)	Transfers into level 3 ^(h)	Transfers (out of) level 3 ^(h)		Fair value at Dec. 31, 2017
Liabilities:^(a)										
Deposits	\$ 2,117	\$ 152 ^{(c)(f)}	\$ –	\$ –	\$ 3,027	\$ (291)	\$ 11	\$ (874)	\$ 4,142	\$ 198 ^{(c)(f)}
Federal funds purchased and securities loaned or sold under repurchase agreements	–	–	–	–	–	–	–	–	–	–
Short-term borrowings	1,134	42 ^{(c)(f)}	–	–	3,289	(2,748)	150	(202)	1,665	7 ^{(c)(f)}
Trading liabilities - debt and equity instruments	43	(3) ^(c)	(46)	48	–	3	3	(9)	39	–
Accounts payable and other liabilities	13	(2)	(1)	–	–	3	–	–	13	(2)
Beneficial interests issued by consolidated VIEs	48	2 ^(c)	(122)	39	–	(6)	78	–	39	–
Long-term debt	12,850	1,067 ^{(c)(f)}	–	–	12,458	(10,985)	1,660	(925)	16,125	552 ^{(c)(f)}

Year ended December 31, 2016 (in millions)	Fair value measurements using significant unobservable inputs							Fair value at Dec. 31, 2016	Change in unrealized gains/(losses) related to financial instruments held at Dec. 31, 2016	
	Fair value at January 1, 2016	Total realized/ unrealized gains/ (losses)	Purchases ^(f)	Sales	Settlements ^(g)	Transfers into level 3 ^(h)	Transfers (out of) level 3 ^(h)			
Assets:^(a)										
Trading assets:										
Debt instruments:										
Mortgage-backed securities:										
U.S. government agencies	\$ 715	\$ (20)	\$ 135	\$ (295)	\$ (115)	\$ 111	\$ (139)	\$ 392	\$ (36)	
Residential - nonagency	194	4	252	(319)	(20)	67	(95)	83	5	
Commercial - nonagency	115	(11)	69	(29)	(3)	173	(297)	17	3	
Total mortgage-backed securities	1,024	(27)	456	(643)	(138)	351	(531)	492	(28)	
Obligations of U.S. states and municipalities	651	19	149	(132)	(38)	—	—	649	—	
Non-U.S. government debt securities	74	(4)	91	(97)	(7)	19	(30)	46	(7)	
Corporate debt securities	736	2	445	(359)	(189)	148	(207)	576	(22)	
Loans	6,604	(343)	2,228	(2,598)	(1,311)	1,044	(787)	4,837	(169)	
Asset-backed securities	1,832	39	655	(712)	(968)	288	(832)	302	19	
Total debt instruments	10,921	(314)	4,024	(4,541)	(2,651)	1,850	(2,387)	6,902	(207)	
Equity securities	265	—	90	(108)	(40)	29	(5)	231	7	
Physical commodities	—	—	—	—	—	—	—	—	—	
Other	744	79	649	(287)	(360)	26	(90)	761	28	
Total trading assets - debt and equity instruments	11,930	(235) ^(c)	4,763	(4,936)	(3,051)	1,905	(2,482)	7,894	(172) ^(c)	
Net derivative receivables: ^(b)										
Interest rate	876	756	193	(57)	(713)	(14)	222	1,263	(144)	
Credit	549	(742)	10	(2)	211	36	36	98	(622)	
Foreign exchange	(725)	67	64	(124)	(649)	(48)	31	(1,384)	(350)	
Equity	(1,514)	(145)	277	(852)	213	94	(325)	(2,252)	(86)	
Commodity	(935)	194	1	10	645	8	(8)	(85)	(36)	
Total net derivative receivables	(1,749)	130 ^(c)	545	(1,025)	(293)	76	(44)	(2,360)	(1,238) ^(c)	
Available-for-sale securities:										
Mortgage-backed securities	1	—	—	—	—	—	—	1	—	
Asset-backed securities	823	1	—	—	(119)	—	(42)	663	1	
Total available-for-sale securities	824	1 ^(d)	—	—	(119)	—	(42)	664	1 ^(d)	
Loans	1,518	(49) ^(c)	259	(7)	(838)	—	(313)	570	—	
Mortgage servicing rights	6,608	(163) ^(e)	679	(109)	(919)	—	—	6,096	(163) ^(e)	
Other assets	2,401	130 ^(c)	487	(496)	(299)	—	—	2,223	48 ^(c)	

Year ended December 31, 2016 (in millions)	Fair value measurements using significant unobservable inputs							Fair value at Dec. 31, 2016	Change in unrealized (gains)/losses related to financial instruments held at Dec. 31, 2016	
	Fair value at January 1, 2016	Total realized/ unrealized (gains)/ losses	Purchases	Sales	Issuances	Settlements ^(g)	Transfers into level 3 ^(h)			Transfers (out of) level 3 ^(h)
Liabilities:^(a)										
Deposits	\$ 2,950	\$ (56) ^(c)	\$ —	\$ —	\$ 1,375	\$ (1,283)	\$ —	\$ (869)	\$ 2,117	\$ 23 ^(c)
Federal funds purchased and securities loaned or sold under repurchase agreements	—	—	—	—	—	(2)	6	(4)	—	—
Short-term borrowings	639	(230) ^(c)	—	—	1,876	(1,210)	114	(55)	1,134	(70) ^(c)
Trading liabilities - debt and equity instruments	63	(12) ^(c)	(15)	23	—	(22)	13	(7)	43	(18) ^(c)
Accounts payable and other liabilities	19	—	—	—	—	(6)	—	—	13	—
Beneficial interests issued by consolidated VIEs	549	(31) ^(c)	—	—	143	(613)	—	—	48	6 ^(c)
Long-term debt	11,447	147 ^(c)	—	—	8,140	(5,810)	315	(1,389)	12,850	639 ^(c)

Notes to consolidated financial statements

- (a) Level 3 assets as a percentage of total Firm assets accounted for at fair value (including assets measured at fair value on a nonrecurring basis) were 3%, 3% and 4% at December 31, 2018, 2017 and 2016 respectively. Level 3 liabilities as a percentage of total Firm liabilities accounted for at fair value (including liabilities measured at fair value on a nonrecurring basis) were 15%, 15% and 12% at December 31, 2018, 2017 and 2016, respectively.
- (b) All level 3 derivatives are presented on a net basis, irrespective of underlying counterparty.
- (c) Predominantly reported in principal transactions revenue, except for changes in fair value for CCB mortgage loans, and lending-related commitments originated with the intent to sell, and mortgage loan purchase commitments, which are reported in mortgage fees and related income.
- (d) Realized gains/(losses) on AFS securities, as well as other-than-temporary impairment ("OTTI") losses that are recorded in earnings, are reported in investment securities gains/(losses). Unrealized gains/(losses) are reported in OCI. Realized gains/(losses) and foreign exchange hedge accounting adjustments recorded in income on AFS securities were \$1 million, zero and zero for the years ended December 31, 2018, 2017 and 2016, respectively. Unrealized gains/(losses) recorded on AFS securities in OCI were zero, \$15 million and \$1 million for the years ended December 31, 2018, 2017 and 2016, respectively.
- (e) Changes in fair value for MSRs are reported in mortgage fees and related income.
- (f) Loan originations are included in purchases.
- (g) Includes financial assets and liabilities that have matured, been partially or fully repaid, impacts of modifications, deconsolidations associated with beneficial interests in VIEs and other items.
- (h) All transfers into and/or out of level 3 are based on changes in the observability and/or significance of the valuation inputs and are assumed to occur at the beginning of the quarterly reporting period in which they occur.
- (i) Realized (gains)/losses due to DVA for fair value option elected liabilities are reported in principal transactions revenue, and they were not material for the years ended December 31, 2018 and 2017, respectively. Unrealized (gains)/losses are reported in OCI, and they were \$(277) million and \$(48) million for the years ended December 31, 2018 and 2017, respectively.

Level 3 analysis

Consolidated balance sheets changes

Level 3 assets (including assets measured at fair value on a nonrecurring basis) were 0.7% of total Firm assets at December 31, 2018. The following describes significant changes to level 3 assets since December 31, 2017, for those items measured at fair value on a recurring basis. For further information on changes impacting items measured at fair value on a nonrecurring basis, refer to Assets and liabilities measured at fair value on a nonrecurring basis on page 176.

For the year ended December 31, 2018

Level 3 assets were \$17.2 billion at December 31, 2018, reflecting a decrease of \$2.1 billion from December 31, 2017, largely due to:

- \$1.2 billion decrease in trading assets – debt and equity instruments predominantly driven by a decrease of \$1.0 billion in trading loans primarily due to settlements and net sales.

Transfers between levels for instruments carried at fair value on a recurring basis

During the year ended December 31, 2018, transfers from level 3 into level 2 included the following:

- \$1.5 billion of total debt and equity instruments, the majority of which were trading loans, driven by an increase in observability.
- \$1.2 billion of gross equity derivative receivables and \$1.5 billion of gross equity derivative payables as a result of an increase in observability and a decrease in the significance of unobservable inputs.

During the year ended December 31, 2018, transfers from level 2 into level 3 included the following:

- \$1.4 billion of total debt and equity instruments, the majority of which were trading loans, driven by a decrease in observability.
- \$1.0 billion of gross equity derivative receivables and \$1.6 billion of gross equity derivative payables as a result of a decrease in observability and an increase in the significance of unobservable inputs.
- \$1.1 billion of long-term debt driven by a decrease in observability and an increase in the significance of unobservable inputs for certain structured notes.

During the year ended December 31, 2017, transfers from level 3 into level 2 included the following:

- \$1.5 billion of trading loans driven by an increase in observability.

- \$1.2 billion of gross equity derivative payables as a result of an increase in observability and a decrease in the significance of unobservable inputs.

During the year ended December 31, 2017, transfers from level 2 into level 3 included the following:

- \$1.0 billion of gross equity derivative receivables and \$2.5 billion of gross equity derivative payables as a result of a decrease in observability and an increase in the significance of unobservable inputs.
- \$1.7 billion of long-term debt driven by a decrease in observability and an increase in the significance of unobservable inputs for certain structured notes.

During the year ended December 31, 2016, transfers from level 3 into level 2 included the following:

- \$1.4 billion of long-term debt driven by an increase in observability and a reduction in the significance of unobservable inputs for certain structured notes.

During the year ended December 31, 2016, transfers from level 2 into level 3 included the following:

- \$1.1 billion of gross equity derivative receivables and \$1.0 billion of gross equity derivative payables as a result of an increase in observability and an increase in the significance of unobservable inputs.
- \$1.0 billion of trading loans driven by a decrease in observability.

All transfers are based on changes in the observability and/or significance of the valuation inputs and are assumed to occur at the beginning of the quarterly reporting period in which they occur.

Gains and losses

The following describes significant components of total realized/unrealized gains/(losses) for instruments measured at fair value on a recurring basis for the years ended December 31, 2018, 2017 and 2016. For further information on these instruments, refer to Changes in level 3 recurring fair value measurements rollforward tables on pages 170-174.

2018

- \$1.6 billion of net gains on liabilities largely driven by market movements in long-term debt.

2017

- \$1.3 billion of net losses on liabilities predominantly driven by market movements in long-term debt.

2016

- There were no individually significant movements for the year ended December 31, 2016.

Credit and funding adjustments – derivatives

Derivatives are generally valued using models that use as their basis observable market parameters. These market parameters generally do not consider factors such as counterparty nonperformance risk, the Firm's own credit quality, and funding costs. Therefore, it is generally necessary to make adjustments to the base estimate of fair value to reflect these factors.

CVA represents the adjustment, relative to the relevant benchmark interest rate, necessary to reflect counterparty nonperformance risk. The Firm estimates CVA using a scenario analysis to estimate the expected positive credit exposure across all of the Firm's existing positions with each counterparty, and then estimates losses based on the probability of default and estimated recovery rate as a result of a counterparty credit event considering contractual factors designed to mitigate the Firm's credit exposure, such as collateral and legal rights of offset. The key inputs to this methodology are (i) the probability of a default event occurring for each counterparty, as derived from observed or estimated CDS spreads; and (ii) estimated recovery rates implied by CDS spreads, adjusted to consider the differences in recovery rates as a derivative creditor relative to those reflected in CDS spreads, which generally reflect senior unsecured creditor risk.

FVA represents the adjustment to reflect the impact of funding and is recognized where there is evidence that a market participant in the principal market would incorporate it in a transfer of the instrument. The Firm's FVA framework, applied to uncollateralized (including partially collateralized) over-the-counter ("OTC") derivatives incorporates key inputs such as: (i) the expected funding requirements arising from the Firm's positions with

each counterparty and collateral arrangements; and (ii) the estimated market funding cost in the principal market which, for derivative liabilities, considers the Firm's credit risk (DVA). For collateralized derivatives, the fair value is estimated by discounting expected future cash flows at the relevant overnight indexed swap rate given the underlying collateral agreement with the counterparty, and therefore a separate FVA is not necessary.

The following table provides the impact of credit and funding adjustments on principal transactions revenue in the respective periods, excluding the effect of any associated hedging activities. The FVA presented below includes the impact of the Firm's own credit quality on the inception value of liabilities as well as the impact of changes in the Firm's own credit quality over time.

Year ended December 31, (in millions)	2018	2017	2016
Credit and funding adjustments:			
Derivatives CVA	\$ 193	\$ 802	\$ (84)
Derivatives FVA	(74)	(295)	7

Valuation adjustments on fair value option elected liabilities

The valuation of the Firm's liabilities for which the fair value option has been elected requires consideration of the Firm's own credit risk. DVA on fair value option elected liabilities reflects changes (subsequent to the issuance of the liability) in the Firm's probability of default and LGD, which are estimated based on changes in the Firm's credit spread observed in the bond market. Realized (gains)/losses due to DVA for fair value option elected liabilities are reported in principal transactions revenue. Unrealized (gains)/losses are reported in OCI. Refer to page 174 in this Note and Note 23 for further information.

Notes to consolidated financial statements

Assets and liabilities measured at fair value on a nonrecurring basis

The following tables present the assets held as of December 31, 2018 and 2017, respectively, for which a nonrecurring fair value adjustment was recorded during the years ended December 31, 2018 and 2017, respectively, by major product category and fair value hierarchy.

December 31, 2018 (in millions)	Fair value hierarchy			Total fair value
	Level 1	Level 2	Level 3	
Loans	\$ –	\$ 273	\$ 264 ^(b)	\$ 537
Other assets ^(a)	–	8	815	823
Total assets measured at fair value on a nonrecurring basis	\$ –	\$ 281	\$ 1,079	\$ 1,360

December 31, 2017 (in millions)	Fair value hierarchy			Total fair value
	Level 1	Level 2	Level 3	
Loans	\$ –	\$ 238	\$ 596	\$ 834
Other assets	–	283	183	466
Total assets measured at fair value on a nonrecurring basis	\$ –	\$ 521	\$ 779	\$ 1,300

- (a) Primarily includes equity securities without readily determinable fair values that were adjusted based on observable price changes in orderly transactions from an identical or similar investment of the same issuer (measurement alternative) as a result of the adoption of the recognition and measurement guidance. Of the \$815 million in level 3 assets measured at fair value on a nonrecurring basis as of December 31, 2018, \$667 million related to such equity securities. These equity securities are classified as level 3 due to the infrequency of the observable prices and/or the restrictions on the shares.
- (b) Of the \$264 million in level 3 assets measured at fair value on a nonrecurring basis as of December 31, 2018, \$225 million related to residential real estate loans carried at the net realizable value of the underlying collateral (e.g., collateral-dependent loans and other loans charged off in accordance with regulatory guidance). These amounts are classified as level 3 as they are valued using information from broker's price opinions, appraisals and automated valuation models and discounted based upon the Firm's experience with actual liquidation values. These discounts ranged from 13% to 54% with a weighted average of 25%.

There were no material liabilities measured at fair value on a nonrecurring basis at December 31, 2018 and 2017.

Nonrecurring fair value changes

The following table presents the total change in value of assets and liabilities for which a fair value adjustment has been recognized for the years ended December 31, 2018, 2017 and 2016, related to financial instruments held at those dates.

December 31, (in millions)	2018	2017	2016
Loans	\$ (68)	\$ (159)	\$ (209)
Other assets	132 ^(a)	(148)	37
Accounts payable and other liabilities	–	(1)	–
Total nonrecurring fair value gains/(losses)	\$ 64	\$ (308)	\$ (172)

- (a) Included \$149 million for the year ended 2018 of net gains as a result of the measurement alternative.

For further information about the measurement of impaired collateral-dependent loans, and other loans where the carrying value is based on the fair value of the underlying collateral (e.g., residential mortgage loans charged off in accordance with regulatory guidance), refer to Note 12.

Equity securities without readily determinable fair values

As a result of the adoption of the recognition and measurement guidance and the election of the measurement alternative in the first quarter of 2018, the Firm measures certain equity securities without readily determinable fair values at cost less impairment (if any), plus or minus observable price changes from an identical or similar investment of the same issuer, with such changes recognized in other income.

In its determination of the new carrying values upon observable price changes, the Firm may adjust the prices if deemed necessary to arrive at the Firm's estimated fair values. Such adjustments may include adjustments to reflect the different rights and obligations of similar securities, and other adjustments that are consistent with the Firm's valuation techniques for private equity direct investments.

The following table presents the carrying value of equity securities without readily determinable fair values held as of December 31, 2018, that are measured under the measurement alternative and the related adjustments recorded during the periods presented for those securities with observable price changes. These securities are included in the nonrecurring fair value tables when applicable price changes are observable.

(in millions)	As of or for the	
	Year ended December 31, 2018	
Other assets		
Carrying value	\$	1,510
Upward carrying value changes		309
Downward carrying value changes/impairment		(160)

Included in other assets above is the Firm's interest in approximately 40 million Visa Class B shares, recorded at a nominal carrying value. These shares are subject to certain transfer restrictions currently and will be convertible into Visa Class A shares upon final resolution of certain litigation matters involving Visa. The conversion rate of Visa Class B shares into Visa Class A shares is 1.6298 at December 31, 2018, and may be adjusted by Visa depending on developments related to the litigation matters.

Additional disclosures about the fair value of financial instruments that are not carried on the Consolidated balance sheets at fair value

U.S. GAAP requires disclosure of the estimated fair value of certain financial instruments. Financial instruments within the scope of these disclosure requirements are included in the following table. However, certain financial instruments and all nonfinancial instruments are excluded from the scope of these disclosure requirements. Accordingly, the fair value disclosures provided in the following table include only a partial estimate of the fair value of JPMorgan Chase's assets and liabilities. For example, the Firm has developed long-term relationships with its customers through its deposit base and credit card accounts, commonly referred to as core deposit intangibles and credit card relationships. In the opinion of management, these items, in the aggregate, add significant value to JPMorgan Chase, but their fair value is not disclosed in this Note.

Financial instruments for which carrying value approximates fair value

Certain financial instruments that are not carried at fair value on the Consolidated balance sheets are carried at amounts that approximate fair value, due to their short-term nature and generally negligible credit risk. These instruments include cash and due from banks, deposits with banks, federal funds sold, securities purchased under resale agreements and securities borrowed, short-term receivables and accrued interest receivable, short-term borrowings, federal funds purchased, securities loaned and sold under repurchase agreements, accounts payable, and accrued liabilities. In addition, U.S. GAAP requires that the fair value of deposit liabilities with no stated maturity (i.e., demand, savings and certain money market deposits) be equal to their carrying value; recognition of the inherent funding value of these instruments is not permitted.

Notes to consolidated financial statements

The following table presents by fair value hierarchy classification the carrying values and estimated fair values at December 31, 2018 and 2017, of financial assets and liabilities, excluding financial instruments that are carried at fair value on a recurring basis, and their classification within the fair value hierarchy.

(in billions)	December 31, 2018					December 31, 2017				
	Estimated fair value hierarchy					Estimated fair value hierarchy				
	Carrying value	Level 1	Level 2	Level 3	Total estimated fair value	Carrying value	Level 1	Level 2	Level 3	Total estimated fair value
Financial assets										
Cash and due from banks	\$ 22.3	\$ 22.3	\$ –	\$ –	\$ 22.3	\$ 25.9	\$ 25.9	\$ –	\$ –	\$ 25.9
Deposits with banks	256.5	256.5	–	–	256.5	405.4	401.8	3.6	–	405.4
Accrued interest and accounts receivable	72.0	–	71.9	0.1	72.0	67.0	–	67.0	–	67.0
Federal funds sold and securities purchased under resale agreements	308.4	–	308.4	–	308.4	183.7	–	183.7	–	183.7
Securities borrowed	106.9	–	106.9	–	106.9	102.1	–	102.1	–	102.1
Investment securities, held-to-maturity	31.4	–	31.5	–	31.5	47.7	–	48.7	–	48.7
Loans, net of allowance for loan losses ^(a)	968.0	–	241.5	728.5	970.0	914.6	–	213.2	707.1	920.3
Other ^(b)	60.5	–	59.6	1.0	60.6	53.9	–	52.1	9.2	61.3
Financial liabilities										
Deposits	\$ 1,447.4	\$ –	\$ 1,447.5	\$ –	\$ 1,447.5	\$ 1,422.7	\$ –	\$ 1,422.7	\$ –	\$ 1,422.7
Federal funds purchased and securities loaned or sold under repurchase agreements	181.4	–	181.4	–	181.4	158.2	–	158.2	–	158.2
Short-term borrowings	62.1	–	62.1	–	62.1	42.6	–	42.4	0.2	42.6
Accounts payable and other liabilities	160.6	0.2	157.0	3.0	160.2	152.0	–	148.9	2.9	151.8
Beneficial interests issued by consolidated VIEs	20.2	–	20.2	–	20.2	26.0	–	26.0	–	26.0
Long-term debt and junior subordinated deferrable interest debentures	227.1	–	224.6	3.3	227.9	236.6	–	240.3	3.2	243.5

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

- (a) Fair value is typically estimated using a discounted cash flow model that incorporates the characteristics of the underlying loans (including principal, contractual interest rate and contractual fees) and other key inputs, including expected lifetime credit losses, interest rates, prepayment rates, and primary origination or secondary market spreads. For certain loans, the fair value is measured based on the value of the underlying collateral. The difference between the estimated fair value and carrying value of a financial asset or liability is the result of the different methodologies used to determine fair value as compared with carrying value. For example, credit losses are estimated for a financial asset's remaining life in a fair value calculation but are estimated for a loss emergence period in the allowance for loan loss calculation; future loan income (interest and fees) is incorporated in a fair value calculation but is generally not considered in the allowance for loan losses.
- (b) The prior period amounts have been revised to conform with the current period presentation.

The majority of the Firm's lending-related commitments are not carried at fair value on a recurring basis on the Consolidated balance sheets. The carrying value of the wholesale allowance for lending-related commitments and the estimated fair value of these wholesale lending-related commitments were as follows for the periods indicated.

(in billions)	December 31, 2018					December 31, 2017				
	Estimated fair value hierarchy					Estimated fair value hierarchy				
	Carrying value ^(a)	Level 1	Level 2	Level 3	Total estimated fair value	Carrying value ^(a)	Level 1	Level 2	Level 3	Total estimated fair value
Wholesale lending-related commitments	\$ 1.0	\$ –	\$ –	\$ 2.1	\$ 2.1	\$ 1.1	\$ –	\$ –	\$ 1.6	\$ 1.6

- (a) Excludes the current carrying values of the guarantee liability and the offsetting asset, each of which is recognized at fair value at the inception of the guarantees.

The Firm does not estimate the fair value of consumer lending-related commitments. In many cases, the Firm can reduce or cancel these commitments by providing the borrower notice or, in some cases as permitted by law, without notice. For a further discussion of the valuation of lending-related commitments, refer to page 161 of this Note.

Note 3 – Fair value option

The fair value option provides an option to elect fair value as an alternative measurement for selected financial assets, financial liabilities, unrecognized firm commitments, and written loan commitments.

The Firm has elected to measure certain instruments at fair value for several reasons including to mitigate income statement volatility caused by the differences between the measurement basis of elected instruments (e.g., certain instruments elected were previously accounted for on an accrual basis) and the associated risk management arrangements that are accounted for on a fair value basis, as well as to better reflect those instruments that are managed on a fair value basis.

The Firm's election of fair value includes the following instruments:

- Loans purchased or originated as part of securitization warehousing activity, subject to bifurcation accounting, or managed on a fair value basis, including lending-related commitments
- Certain securities financing agreements, such as those with an embedded derivative and/or a maturity of greater than one year
- Owned beneficial interests in securitized financial assets that contain embedded credit derivatives, which would otherwise be required to be separately accounted for as a derivative instrument
- Structured notes, which are predominantly financial instruments that contain embedded derivatives, that are issued as part of CIB's client-driven activities
- Certain long-term beneficial interests issued by CIB's consolidated securitization trusts where the underlying assets are carried at fair value

Notes to consolidated financial statements

Changes in fair value under the fair value option election

The following table presents the changes in fair value included in the Consolidated statements of income for the years ended December 31, 2018, 2017 and 2016, for items for which the fair value option was elected. The profit and loss information presented below only includes the financial instruments that were elected to be measured at fair value; related risk management instruments, which are required to be measured at fair value, are not included in the table.

December 31, (in millions)	2018			2017			2016		
	Principal transactions	All other income	Total changes in fair value recorded ^(e)	Principal transactions	All other income	Total changes in fair value recorded ^(e)	Principal transactions	All other income	Total changes in fair value recorded ^(e)
Federal funds sold and securities purchased under resale agreements	\$ (35)	\$ —	\$ (35)	\$ (97)	\$ —	\$ (97)	\$ (76)	\$ —	\$ (76)
Securities borrowed	22	—	22	50	—	50	1	—	1
Trading assets:									
Debt and equity instruments, excluding loans	(1,680)	1 ^(c)	(1,679)	1,943	2 ^(c)	1,945	120	(1) ^(c)	119
Loans reported as trading assets:									
Changes in instrument-specific credit risk	414	1 ^(c)	415	330	14 ^(c)	344	461	43 ^(c)	504
Other changes in fair value	160	185 ^(c)	345	217	747 ^(c)	964	79	684 ^(c)	763
Loans:									
Changes in instrument-specific credit risk	(1)	—	(1)	(1)	—	(1)	13	—	13
Other changes in fair value	(1)	—	(1)	(12)	3 ^(c)	(9)	(7)	—	(7)
Other assets	5	(45) ^(d)	(40)	11	(55) ^(d)	(44)	20	62 ^(d)	82
Deposits ^(a)	181	—	181	(533)	—	(533)	(134)	—	(134)
Federal funds purchased and securities loaned or sold under repurchase agreements	11	—	11	11	—	11	19	—	19
Short-term borrowings ^(a)	862	—	862	(747)	—	(747)	(236)	—	(236)
Trading liabilities	1	—	1	(1)	—	(1)	6	—	6
Beneficial interests issued by consolidated VIEs	—	—	—	—	—	—	23	—	23
Long-term debt ^{(a)(b)}	2,695	—	2,695	(2,022)	—	(2,022)	(773)	—	(773)

(a) Unrealized gains/(losses) due to instrument-specific credit risk (DVA) for liabilities for which the fair value option has been elected is recorded in OCI, while realized gains/(losses) are recorded in principal transactions revenue. Realized gains/(losses) due to instrument-specific credit risk recorded in principal transactions revenue were not material for the years ended December 31, 2018, 2017 and 2016.

(b) Long-term debt measured at fair value predominantly relates to structured notes. Although the risk associated with the structured notes is actively managed, the gains/(losses) reported in this table do not include the income statement impact of the risk management instruments used to manage such risk.

(c) Reported in mortgage fees and related income.

(d) Reported in other income.

(e) Changes in fair value exclude contractual interest, which is included in interest income and interest expense for all instruments other than hybrid financial instruments. For further information regarding interest income and interest expense, refer to Note 7.

Determination of instrument-specific credit risk for items for which a fair value election was made

The following describes how the gains and losses that are attributable to changes in instrument-specific credit risk, were determined.

- Loans and lending-related commitments: For floating-rate instruments, all changes in value are attributed to instrument-specific credit risk. For fixed-rate instruments, an allocation of the changes in value for the period is made between those changes in value that are interest rate-related and changes in value that are credit-related. Allocations are generally based on an analysis of borrower-specific credit spread and recovery information, where available, or benchmarking to similar entities or industries.

- Long-term debt: Changes in value attributable to instrument-specific credit risk were derived principally from observable changes in the Firm's credit spread as observed in the bond market.
- Securities financing agreements: Generally, for these types of agreements, there is a requirement that collateral be maintained with a market value equal to or in excess of the principal amount loaned; as a result, there would be no adjustment or an immaterial adjustment for instrument-specific credit risk related to these agreements.

Difference between aggregate fair value and aggregate remaining contractual principal balance outstanding

The following table reflects the difference between the aggregate fair value and the aggregate remaining contractual principal balance outstanding as of December 31, 2018 and 2017, for loans, long-term debt and long-term beneficial interests for which the fair value option has been elected.

December 31, (in millions)	2018			2017		
	Contractual principal outstanding	Fair value	Fair value over/ (under) contractual principal outstanding	Contractual principal outstanding	Fair value	Fair value over/ (under) contractual principal outstanding
Loans^(a)						
Nonaccrual loans						
Loans reported as trading assets	\$ 4,240	\$ 1,350	\$ (2,890)	\$ 4,219	\$ 1,371	\$ (2,848)
Loans	39	—	(39)	39	—	(39)
Subtotal	4,279	1,350	(2,929)	4,258	1,371	(2,887)
All other performing loans						
Loans reported as trading assets	42,215	40,403	(1,812)	38,157	36,590	(1,567)
Loans	3,186	3,151	(35)	2,539	2,508	(31)
Total loans	\$ 49,680	\$ 44,904	\$ (4,776)	\$ 44,954	\$ 40,469	\$ (4,485)
Long-term debt						
Principal-protected debt	\$ 32,674 ^(c)	\$ 28,718	\$ (3,956)	\$ 26,297 ^(c)	\$ 23,848	\$ (2,449)
Nonprincipal-protected debt ^(b)	NA	26,168	NA	NA	23,671	NA
Total long-term debt	NA	\$ 54,886	NA	NA	\$ 47,519	NA
Long-term beneficial interests						
Nonprincipal-protected debt ^(b)	NA	\$ 28	NA	NA	\$ 45	NA
Total long-term beneficial interests	NA	\$ 28	NA	NA	\$ 45	NA

(a) There were no performing loans that were ninety days or more past due as of December 31, 2018 and 2017.

(b) Remaining contractual principal is not applicable to nonprincipal-protected structured notes and long-term beneficial interests. Unlike principal-protected structured notes and long-term beneficial interests, for which the Firm is obligated to return a stated amount of principal at maturity, nonprincipal-protected structured notes and long-term beneficial interests do not obligate the Firm to return a stated amount of principal at maturity, but for structured notes to return an amount based on the performance of an underlying variable or derivative feature embedded in the note. However, investors are exposed to the credit risk of the Firm as issuer for both nonprincipal-protected and principal-protected notes.

(c) Where the Firm issues principal-protected zero-coupon or discount notes, the balance reflects the contractual principal payment at maturity or, if applicable, the contractual principal payment at the Firm's next call date.

At December 31, 2018 and 2017, the contractual amount of lending-related commitments for which the fair value option was elected was \$6.9 billion and \$7.4 billion, respectively, with a corresponding fair value of \$(82) million and \$(76) million, respectively. For further information regarding off-balance sheet lending-related financial instruments, refer to Note 27.

Structured note products by balance sheet classification and risk component

The following table presents the fair value of structured notes, by balance sheet classification and the primary risk type.

(in millions)	December 31, 2018				December 31, 2017			
	Long-term debt	Short-term borrowings	Deposits	Total	Long-term debt	Short-term borrowings	Deposits	Total
Risk exposure								
Interest rate	\$ 24,137	\$ 62	\$ 12,372	\$ 36,571	\$ 22,056	\$ 69	\$ 8,058	\$ 30,183
Credit	4,009	995	—	5,004	4,329	1,312	—	5,641
Foreign exchange	3,169	157	38	3,364	2,841	147	38	3,026
Equity	21,382	5,422	7,368	34,172	17,581	7,106	6,548	31,235
Commodity	372	34	1,207	1,613	230	15	4,468	4,713
Total structured notes	\$ 53,069	\$ 6,670	\$ 20,985	\$ 80,724	\$ 47,037	\$ 8,649	\$ 19,112	\$ 74,798

Note 4 – Credit risk concentrations

Concentrations of credit risk arise when a number of clients, counterparties or customers are engaged in similar business activities or activities in the same geographic region, or when they have similar economic features that would cause their ability to meet contractual obligations to be similarly affected by changes in economic conditions.

JPMorgan Chase regularly monitors various segments of its credit portfolios to assess potential credit risk concentrations and to obtain additional collateral when deemed necessary and permitted under the Firm's agreements. Senior management is significantly involved in the credit approval and review process, and risk levels are adjusted as needed to reflect the Firm's risk appetite.

In the Firm's consumer portfolio, concentrations are managed primarily by product and by U.S. geographic region, with a key focus on trends and concentrations at the portfolio level, where potential credit risk concentrations can be remedied through changes in underwriting policies and portfolio guidelines. For additional information on the geographic composition of the Firm's consumer loan portfolios, refer to Note 12. In the wholesale portfolio, credit risk concentrations are evaluated primarily by industry and monitored regularly on both an aggregate portfolio level and on an individual client or counterparty basis.

The Firm's wholesale exposure is managed through loan syndications and participations, loan sales, securitizations, credit derivatives, master netting agreements, collateral and other risk-reduction techniques. For additional information on loans, refer to Note 12.

The Firm does not believe that its exposure to any particular loan product or industry segment (e.g., real estate), or its exposure to residential real estate loans with high LTV ratios, results in a significant concentration of credit risk.

Terms of loan products and collateral coverage are included in the Firm's assessment when extending credit and establishing its allowance for loan losses.

The table below presents both on-balance sheet and off-balance sheet consumer and wholesale-related credit exposure by the Firm's three credit portfolio segments as of December 31, 2018 and 2017.

As a result of continued growth and the relative size of the portfolio, exposure to "Individuals," which was previously disclosed in "All Other," is now separately disclosed in the table below as "Individuals and Individual Entities." This category predominantly consists of Wealth Management clients within AWM and includes exposure to personal investment companies and personal and testamentary trusts. Predominantly all of this exposure is secured, largely by cash and marketable securities. In the table below, prior period amounts have been revised to conform with the current period presentation.

December 31, (in millions)	2018				2017			
	Credit exposure ^(g)	On-balance sheet		Off-balance sheet ^(h)	Credit exposure ^(g)	On-balance sheet		Off-balance sheet ^(h)
		Loans	Derivatives			Loans	Derivatives	
Consumer, excluding credit card	\$ 419,798	\$ 373,732	\$ –	\$ 46,066	\$ 421,234	\$ 372,681	\$ –	\$ 48,553
Receivables from customers ^(a)	154	–	–	–	133	–	–	–
Total Consumer, excluding credit card	419,952	373,732	–	46,066	421,367	372,681	–	48,553
Credit card	762,011	156,632	–	605,379	722,342	149,511	–	572,831
Total consumer-related	1,181,963	530,364	–	651,445	1,143,709	522,192	–	621,384
Wholesale-related^(b)								
Real Estate	143,316	115,737	164	27,415	139,409	113,648	153	25,608
Individuals and Individual Entities ^(c)	97,077	86,586	1,017	9,474	87,371	77,768	1,252	8,351
Consumer & Retail	94,815	36,921	1,093	56,801	87,679	31,044	1,114	55,521
Technology, Media & Telecommunications	72,646	16,980	2,667	52,999	59,274	13,665	2,265	43,344
Industrials	58,528	19,126	958	38,444	55,272	18,161	1,163	35,948
Banks & Finance Cos	49,920	28,825	5,903	15,192	49,037	25,879	6,816	16,342
Healthcare	48,142	16,347	1,874	29,921	55,997	16,273	2,191	37,533
Asset Managers	42,807	16,806	9,033	16,968	32,531	11,480	7,998	13,053
Oil & Gas	42,600	13,008	559	29,033	41,317	12,621	1,727	26,969
Utilities	28,172	5,591	1,740	20,841	29,317	6,187	2,084	21,046
State & Municipal Govt ^(d)	27,351	10,319	2,000	15,032	28,633	12,134	2,888	13,611
Central Govt	18,456	3,867	12,869	1,720	19,182	3,375	13,937	1,870
Automotive	17,339	5,170	399	11,770	14,820	4,903	342	9,575
Chemicals & Plastics	16,035	4,902	181	10,952	15,945	5,654	208	10,083
Transportation	15,660	6,391	1,102	8,167	15,797	6,733	977	8,087
Metals & Mining	15,359	5,370	488	9,501	14,171	4,728	702	8,741
Insurance	12,639	1,356	2,569	8,714	14,089	1,411	2,804	9,874
Financial Markets Infrastructure	7,484	18	5,941	1,525	5,036	351	3,499	1,186
Securities Firms	4,558	645	2,029	1,884	4,113	952	1,692	1,469
All other ^(e)	68,284	45,197	1,627	21,460	60,529	35,931	2,711	21,887
Subtotal	881,188	439,162	54,213	387,813	829,519	402,898	56,523	370,098
Loans held-for-sale and loans at fair value	15,028	15,028	–	–	5,607	5,607	–	–
Receivables from customers and other ^(a)	30,063	–	–	–	26,139	–	–	–
Total wholesale-related	926,279	454,190	54,213	387,813	861,265	408,505	56,523	370,098
Total exposure^{(f)(g)}	\$2,108,242	\$ 984,554	\$ 54,213	\$1,039,258	\$2,004,974	\$ 930,697	\$ 56,523	\$ 991,482

(a) Receivables from customers primarily represent held-for-investment margin loans to brokerage customers (Prime Services in CIB, AWM and CCB) that are collateralized through assets maintained in the clients' brokerage accounts, as such no allowance is held against these receivables. These receivables are reported within accrued interest and accounts receivable on the Firm's Consolidated balance sheets.

(b) The industry rankings presented in the table as of December 31, 2017, are based on the industry rankings of the corresponding exposures at December 31, 2018, not actual rankings of such exposures at December 31, 2017.

(c) Individuals and Individual Entities predominantly consists of Wealth Management clients within AWM and includes exposure to personal investment companies and personal and testamentary trusts.

(d) In addition to the credit risk exposure to states and municipal governments (both U.S. and non-U.S.) at December 31, 2018 and 2017, noted above, the Firm held: \$7.8 billion and \$9.8 billion, respectively, of trading securities; \$37.7 billion and \$32.3 billion, respectively, of AFS securities; and \$4.8 billion and \$14.4 billion, respectively, of held-to-maturity ("HTM") securities, issued by U.S. state and municipal governments. For further information, refer to Note 2 and Note 10.

(e) All other includes: SPEs and Private education and civic organizations, representing approximately 92% and 8%, respectively, at December 31, 2018 and 90% and 10%, respectively, at December 31, 2017. For more information on exposures to SPEs, refer to Note 14.

(f) Excludes cash placed with banks of \$268.1 billion and \$421.0 billion, at December 31, 2018 and 2017, respectively, which is predominantly placed with various central banks, primarily Federal Reserve Banks.

(g) Credit exposure is net of risk participations and excludes the benefit of credit derivatives used in credit portfolio management activities held against derivative receivables or loans and liquid securities and other cash collateral held against derivative receivables.

(h) Represents lending-related financial instruments.

Note 5 – Derivative instruments

Derivative contracts derive their value from underlying asset prices, indices, reference rates, other inputs or a combination of these factors and may expose counterparties to risks and rewards of an underlying asset or liability without having to initially invest in, own or exchange the asset or liability. JPMorgan Chase makes markets in derivatives for clients and also uses derivatives to hedge or manage its own risk exposures. Predominantly all of the Firm's derivatives are entered into for market-making or risk management purposes.

Market-making derivatives

The majority of the Firm's derivatives are entered into for market-making purposes. Clients use derivatives to mitigate or modify interest rate, credit, foreign exchange, equity and commodity risks. The Firm actively manages the risks from its exposure to these derivatives by entering into other derivative contracts or by purchasing or selling other financial instruments that partially or fully offset the exposure from client derivatives.

Risk management derivatives

The Firm manages certain market and credit risk exposures using derivative instruments, including derivatives in hedge accounting relationships and other derivatives that are used to manage risks associated with specified assets and liabilities.

The Firm generally uses interest rate contracts to manage the risk associated with changes in interest rates. Fixed-rate assets and liabilities appreciate or depreciate in market value as interest rates change. Similarly, interest income and expense increases or decreases as a result of variable-rate assets and liabilities resetting to current market rates, and as a result of the repayment and subsequent origination or issuance of fixed-rate assets and liabilities at current market rates. Gains and losses on the derivative instruments related to these assets and liabilities are expected to substantially offset this variability.

Foreign currency forward contracts are used to manage the foreign exchange risk associated with certain foreign currency-denominated (i.e., non-U.S. dollar) assets and liabilities and forecasted transactions, as well as the Firm's net investments in certain non-U.S. subsidiaries or branches whose functional currencies are not the U.S. dollar. As a result of fluctuations in foreign currencies, the U.S. dollar-equivalent values of the foreign currency-denominated assets and liabilities or the forecasted revenues or expenses increase or decrease. Gains or losses on the derivative instruments related to these foreign currency-denominated assets or liabilities, or forecasted transactions, are expected to substantially offset this variability.

Commodities contracts are used to manage the price risk of certain commodities inventories. Gains or losses on these derivative instruments are expected to substantially offset the depreciation or appreciation of the related inventory.

Credit derivatives are used to manage the counterparty credit risk associated with loans and lending-related commitments. Credit derivatives compensate the purchaser when the entity referenced in the contract experiences a credit event, such as bankruptcy or a failure to pay an obligation when due. Credit derivatives primarily consist of CDS. For a further discussion of credit derivatives, refer to the discussion in the Credit derivatives section on pages 195-197 of this Note.

For more information about risk management derivatives, refer to the risk management derivatives gains and losses table on page 195 of this Note, and the hedge accounting gains and losses tables on pages 192-195 of this Note.

Derivative counterparties and settlement types

The Firm enters into OTC derivatives, which are negotiated and settled bilaterally with the derivative counterparty. The Firm also enters into, as principal, certain ETD such as futures and options, and OTC-cleared derivative contracts with CCPs. ETD contracts are generally standardized contracts traded on an exchange and cleared by the CCP, which is the Firm's counterparty from the inception of the transactions. OTC-cleared derivatives are traded on a bilateral basis and then novated to the CCP for clearing.

Derivative clearing services

The Firm provides clearing services for clients in which the Firm acts as a clearing member at certain derivative exchanges and clearing houses. The Firm does not reflect the clients' derivative contracts in its Consolidated Financial Statements. For further information on the Firm's clearing services, refer to Note 27.

Accounting for derivatives

All free-standing derivatives that the Firm executes for its own account are required to be recorded on the Consolidated balance sheets at fair value.

As permitted under U.S. GAAP, the Firm nets derivative assets and liabilities, and the related cash collateral receivables and payables, when a legally enforceable master netting agreement exists between the Firm and the derivative counterparty. For further discussion of the offsetting of assets and liabilities, refer to Note 1. The accounting for changes in value of a derivative depends on whether or not the transaction has been designated and qualifies for hedge accounting. Derivatives that are not designated as hedges are reported and measured at fair value through earnings. The tabular disclosures on pages 188-195 of this Note provide additional information on the amount of, and reporting for, derivative assets, liabilities, gains and losses. For further discussion of derivatives embedded in structured notes, refer to Notes 2 and 3.

Derivatives designated as hedges

The Firm adopted new hedge accounting guidance in the first quarter of 2018, which required prospective amendments to the disclosures, as reflected in this Note. For additional information on the impact upon adoption of the new guidance, refer to Notes 1 and 23.

The Firm applies hedge accounting to certain derivatives executed for risk management purposes – generally interest rate, foreign exchange and commodity derivatives. However, JPMorgan Chase does not seek to apply hedge accounting to all of the derivatives involved in the Firm's risk management activities. For example, the Firm does not apply hedge accounting to purchased CDS used to manage the credit risk of loans and lending-related commitments, because of the difficulties in qualifying such contracts as hedges. For the same reason, the Firm does not apply hedge accounting to certain interest rate, foreign exchange, and commodity derivatives used for risk management purposes.

To qualify for hedge accounting, a derivative must be highly effective at reducing the risk associated with the exposure being hedged. In addition, for a derivative to be designated as a hedge, the risk management objective and strategy must be documented. Hedge documentation must identify the derivative hedging instrument, the asset or liability or forecasted transaction and type of risk to be hedged, and how the effectiveness of the derivative is assessed prospectively and retrospectively. To assess effectiveness, the Firm uses statistical methods such as regression analysis, nonstatistical methods such as dollar-value comparisons of the change in the fair value of the derivative to the change in the fair value or cash flows of the hedged item, and qualitative comparisons of critical terms and the evaluation of any changes in those terms. The extent to which a derivative has been, and is expected to continue to be, highly effective at offsetting changes in the fair value or cash flows of the hedged item must be assessed and documented at least quarterly. If it is determined that a derivative is not highly effective at hedging the designated exposure, hedge accounting is discontinued.

There are three types of hedge accounting designations: fair value hedges, cash flow hedges and net investment hedges. JPMorgan Chase uses fair value hedges primarily to hedge fixed-rate long-term debt, AFS securities and certain commodities inventories. For qualifying fair value hedges, the changes in the fair value of the derivative, and in the value of the hedged item for the risk being hedged, are recognized in earnings. Certain amounts excluded from the assessment of effectiveness are recorded in OCI and recognized in earnings over the life of the derivative. If the hedge relationship is terminated, then the adjustment to the hedged item continues to be reported as part of the basis of the hedged item, and for benchmark interest rate hedges, is amortized to earnings as a yield adjustment. Derivative amounts affecting earnings are recognized consistent with the classification of the hedged item – primarily net interest income and principal transactions revenue.

JPMorgan Chase uses cash flow hedges primarily to hedge the exposure to variability in forecasted cash flows from floating-rate assets and liabilities and foreign currency-denominated revenue and expense. For qualifying cash flow hedges, changes in the fair value of the derivative are recorded in OCI and recognized in earnings as the hedged item affects earnings. Derivative amounts affecting earnings are recognized consistent with the classification of the hedged item – primarily interest income, interest expense, noninterest revenue and compensation expense. If the hedge relationship is terminated, then the change in value of the derivative recorded in AOCI is recognized in earnings when the cash flows that were hedged affect earnings. For hedge relationships that are discontinued because a forecasted transaction is not expected to occur according to the original hedge forecast, any related derivative values recorded in AOCI are immediately recognized in earnings.

JPMorgan Chase uses net investment hedges to protect the value of the Firm's net investments in certain non-U.S. subsidiaries or branches whose functional currencies are not the U.S. dollar. For qualifying net investment hedges, changes in the fair value of the derivatives due to changes in spot foreign exchange rates are recorded in OCI as translation adjustments. Amounts excluded from the assessment of effectiveness are recorded directly in earnings.

Notes to consolidated financial statements

The following table outlines the Firm's primary uses of derivatives and the related hedge accounting designation or disclosure category.

Type of Derivative	Use of Derivative	Designation and disclosure	Affected segment or unit	Page reference
Manage specifically identified risk exposures in qualifying hedge accounting relationships:				
• Interest rate	Hedge fixed rate assets and liabilities	Fair value hedge	Corporate	192
• Interest rate	Hedge floating-rate assets and liabilities	Cash flow hedge	Corporate	194
• Foreign exchange	Hedge foreign currency-denominated assets and liabilities	Fair value hedge	Corporate	192
• Foreign exchange	Hedge foreign currency-denominated forecasted revenue and expense	Cash flow hedge	Corporate	194
• Foreign exchange	Hedge the value of the Firm's investments in non-U.S. dollar functional currency entities	Net investment hedge	Corporate	195
• Commodity	Hedge commodity inventory	Fair value hedge	CIB	192
Manage specifically identified risk exposures not designated in qualifying hedge accounting relationships:				
• Interest rate	Manage the risk of the mortgage pipeline, warehouse loans and MSR's	Specified risk management	CCB	195
• Credit	Manage the credit risk of wholesale lending exposures	Specified risk management	CIB	195
• Interest rate and foreign exchange	Manage the risk of certain other specified assets and liabilities	Specified risk management	Corporate	195
Market-making derivatives and other activities:				
• Various	Market-making and related risk management	Market-making and other	CIB	195
• Various	Other derivatives	Market-making and other	CIB, Corporate	195

Notional amount of derivative contracts

The following table summarizes the notional amount of derivative contracts outstanding as of December 31, 2018 and 2017.

December 31, (in billions)	Notional amounts ^(b)	
	2018	2017
Interest rate contracts		
Swaps	\$ 21,763	\$ 21,043
Futures and forwards	3,562	4,904
Written options	3,997	3,576
Purchased options	4,322	3,987
Total interest rate contracts	33,644	33,510
Credit derivatives^(a)	1,501	1,522
Foreign exchange contracts		
Cross-currency swaps	3,548	3,953
Spot, futures and forwards	5,871	5,923
Written options	835	786
Purchased options	830	776
Total foreign exchange contracts	11,084	11,438
Equity contracts		
Swaps	346	367
Futures and forwards	101	90
Written options	528	531
Purchased options	490	453
Total equity contracts	1,465	1,441
Commodity contracts		
Swaps	134	133 ^(c)
Spot, futures and forwards	156	168
Written options	135	98
Purchased options	120	93
Total commodity contracts	545	492 ^(c)
Total derivative notional amounts	\$ 48,239	\$ 48,403 ^(c)

(a) For more information on volumes and types of credit derivative contracts, refer to the Credit derivatives discussion on pages 195-197.

(b) Represents the sum of gross long and gross short third-party notional derivative contracts.

(c) The prior period amounts have been revised to conform with the current period presentation.

While the notional amounts disclosed above give an indication of the volume of the Firm's derivatives activity, the notional amounts significantly exceed, in the Firm's view, the possible losses that could arise from such transactions. For most derivative contracts, the notional amount is not exchanged; it is used simply as a reference to calculate payments.

Notes to consolidated financial statements

Impact of derivatives on the Consolidated balance sheets

The following table summarizes information on derivative receivables and payables (before and after netting adjustments) that are reflected on the Firm's Consolidated balance sheets as of December 31, 2018 and 2017, by accounting designation (e.g., whether the derivatives were designated in qualifying hedge accounting relationships or not) and contract type.

Free-standing derivative receivables and payables^(a)

December 31, 2018 (in millions)	Gross derivative receivables			Net derivative receivables ^(b)	Gross derivative payables			Net derivative payables ^(b)
	Not designated as hedges	Designated as hedges	Total derivative receivables		Not designated as hedges	Designated as hedges	Total derivative payables	
Trading assets and liabilities								
Interest rate	\$ 267,871	\$ 833	\$ 268,704	\$ 23,214	\$ 242,782	\$ –	\$ 242,782	\$ 7,784
Credit	20,095	–	20,095	612	20,276	–	20,276	1,667
Foreign exchange	167,057	628	167,685	13,450	164,392	825	165,217	12,785
Equity	49,285	–	49,285	9,946	51,195	–	51,195	10,161
Commodity	20,223	247	20,470	6,991	22,297	121	22,418	9,372
Total fair value of trading assets and liabilities	\$ 524,531	\$ 1,708	\$ 526,239	\$ 54,213	\$ 500,942	\$ 946	\$ 501,888	\$ 41,769

December 31, 2017 (in millions)	Gross derivative receivables			Net derivative receivables ^(b)	Gross derivative payables			Net derivative payables ^(b)
	Not designated as hedges	Designated as hedges	Total derivative receivables		Not designated as hedges	Designated as hedges	Total derivative payables	
Trading assets and liabilities								
Interest rate	\$ 314,962 ^(c)	\$ 1,030 ^(c)	\$ 315,992	\$ 24,673	\$ 284,433 ^(c)	\$ 3 ^(c)	\$ 284,436	\$ 7,129
Credit	23,205	–	23,205	869	23,252	–	23,252	1,299
Foreign exchange	159,740	491	160,231	16,151	154,601	1,221	155,822	12,473
Equity	40,040	–	40,040	7,882	45,395	–	45,395	9,192
Commodity	20,066	19	20,085	6,948	21,498	403	21,901	7,684
Total fair value of trading assets and liabilities	\$ 558,013 ^(c)	\$ 1,540 ^(c)	\$ 559,553	\$ 56,523	\$ 529,179 ^(c)	\$ 1,627 ^(c)	\$ 530,806	\$ 37,777

(a) Balances exclude structured notes for which the fair value option has been elected. Refer to Note 3 for further information.

(b) As permitted under U.S. GAAP, the Firm has elected to net derivative receivables and derivative payables and the related cash collateral receivables and payables when a legally enforceable master netting agreement exists.

(c) The prior period amounts have been revised to conform with the current period presentation.

Derivatives netting

The following tables present, as of December 31, 2018 and 2017, gross and net derivative receivables and payables by contract and settlement type. Derivative receivables and payables, as well as the related cash collateral from the same counterparty, have been netted on the Consolidated balance sheets where the Firm has obtained an appropriate legal opinion with respect to the master netting agreement. Where such a legal opinion has not been either sought or obtained, amounts are not eligible for netting on the Consolidated balance sheets, and those derivative receivables and payables are shown separately in the tables below.

In addition to the cash collateral received and transferred that is presented on a net basis with derivative receivables and payables, the Firm receives and transfers additional collateral (financial instruments and cash). These amounts mitigate counterparty credit risk associated with the Firm's derivative instruments, but are not eligible for net presentation:

- collateral that consists of non-cash financial instruments (generally U.S. government and agency securities and other G7 government securities) and cash collateral held at third party custodians, which are shown separately as "Collateral not nettable on the Consolidated balance sheets" in the tables below, up to the fair value exposure amount.
- the amount of collateral held or transferred that exceeds the fair value exposure at the individual counterparty level, as of the date presented, which is excluded from the tables below; and
- collateral held or transferred that relates to derivative receivables or payables where an appropriate legal opinion has not been either sought or obtained with respect to the master netting agreement, which is excluded from the tables below.

December 31, (in millions)	2018			2017		
	Gross derivative receivables	Amounts netted on the Consolidated balance sheets	Net derivative receivables	Gross derivative receivables	Amounts netted on the Consolidated balance sheets	Net derivative receivables
U.S. GAAP nettable derivative receivables						
Interest rate contracts:						
OTC	\$ 258,227	\$ (239,498)	\$ 18,729	\$ 305,569	\$ (284,917)	\$ 20,652
OTC-cleared	6,404	(5,856)	548	6,531	(6,318)	213
Exchange-traded ^(a)	322	(136)	186	185	(84)	101
Total interest rate contracts	264,953	(245,490)	19,463	312,285	(291,319)	20,966
Credit contracts:						
OTC	12,648	(12,261)	387	15,390	(15,165)	225
OTC-cleared	7,267	(7,222)	45	7,225	(7,170)	55
Total credit contracts	19,915	(19,483)	432	22,615	(22,335)	280
Foreign exchange contracts:						
OTC	163,862	(153,988)	9,874	155,289	(142,420)	12,869
OTC-cleared	235	(226)	9	1,696	(1,654)	42
Exchange-traded ^(a)	32	(21)	11	141	(7)	134
Total foreign exchange contracts	164,129	(154,235)	9,894	157,126	(144,081)	13,045
Equity contracts:						
OTC	26,178	(23,879)	2,299	22,024	(19,917)	2,107
Exchange-traded ^(a)	18,876	(15,460)	3,416	14,188	(12,241)	1,947
Total equity contracts	45,054	(39,339)	5,715	36,212	(32,158)	4,054
Commodity contracts:						
OTC	7,448	(5,261)	2,187	7,204 ^(e)	(4,436)	2,768 ^(e)
Exchange-traded ^(a)	8,815	(8,218)	597	8,854	(8,701)	153
Total commodity contracts	16,263	(13,479)	2,784	16,058 ^(e)	(13,137)	2,921 ^(e)
Derivative receivables with appropriate legal opinion	510,314	(472,026)	38,288 ^(d)	544,296 ^(e)	(503,030)	41,266 ^{(d)(e)}
Derivative receivables where an appropriate legal opinion has not been either sought or obtained	15,925		15,925	15,257 ^(e)		15,257 ^(e)
Total derivative receivables recognized on the Consolidated balance sheets	\$ 526,239		\$ 54,213	\$ 559,553		\$ 56,523
Collateral not nettable on the Consolidated balance sheets^{(b)(c)}			(13,046)			(13,363)
Net amounts			\$ 41,167			\$ 43,160

Notes to consolidated financial statements

December 31, (in millions)	2018			2017		
	Gross derivative payables	Amounts netted on the Consolidated balance sheets	Net derivative payables	Gross derivative payables	Amounts netted on the Consolidated balance sheets	Net derivative payables
U.S. GAAP nettable derivative payables						
Interest rate contracts:						
OTC	\$ 233,404	\$ (228,369)	\$ 5,035	\$ 276,960	\$ (271,294)	\$ 5,666
OTC-cleared	7,163	(6,494)	669	6,004	(5,928)	76
Exchange-traded ^(a)	210	(135)	75	127	(84)	43
Total interest rate contracts	240,777	(234,998)	5,779	283,091	(277,306)	5,785
Credit contracts:						
OTC	13,412	(11,895)	1,517	16,194	(15,170)	1,024
OTC-cleared	6,716	(6,714)	2	6,801	(6,784)	17
Total credit contracts	20,128	(18,609)	1,519	22,995	(21,954)	1,041
Foreign exchange contracts:						
OTC	160,930	(152,161)	8,769	150,966	(141,789)	9,177
OTC-cleared	274	(268)	6	1,555	(1,553)	2
Exchange-traded ^(a)	16	(3)	13	98	(7)	91
Total foreign exchange contracts	161,220	(152,432)	8,788	152,619	(143,349)	9,270
Equity contracts:						
OTC	29,437	(25,544)	3,893	28,193	(23,969)	4,224
Exchange-traded ^(a)	16,285	(15,490)	795	12,720	(12,234)	486
Total equity contracts	45,722	(41,034)	4,688	40,913	(36,203)	4,710
Commodity contracts:						
OTC	8,930	(4,838)	4,092	7,697 ^(e)	(5,508)	2,189 ^(e)
Exchange-traded ^(a)	8,259	(8,208)	51	8,870	(8,709)	161
Total commodity contracts	17,189	(13,046)	4,143	16,567^(e)	(14,217)	2,350^(e)
Derivative payables with appropriate legal opinion	485,036	(460,119)	24,917^(d)	516,185^(e)	(493,029)	23,156^{(d)(e)}
Derivative payables where an appropriate legal opinion has not been either sought or obtained	16,852		16,852	14,621^(e)		14,621^(e)
Total derivative payables recognized on the Consolidated balance sheets	\$ 501,888		\$ 41,769	\$ 530,806		\$ 37,777
Collateral not nettable on the Consolidated balance sheets^{(b)(c)}			(4,449)			(4,180)
Net amounts			\$ 37,320			\$ 33,597

(a) Exchange-traded derivative balances that relate to futures contracts are settled daily.

(b) Represents liquid security collateral as well as cash collateral held at third-party custodians related to derivative instruments where an appropriate legal opinion has been obtained. For some counterparties, the collateral amounts of financial instruments may exceed the derivative receivables and derivative payables balances. Where this is the case, the total amount reported is limited to the net derivative receivables and net derivative payables balances with that counterparty.

(c) Derivative collateral relates only to OTC and OTC-cleared derivative instruments.

(d) Net derivatives receivable included cash collateral netted of \$55.2 billion and \$55.5 billion at December 31, 2018 and 2017, respectively. Net derivatives payable included cash collateral netted of \$43.3 billion and \$45.5 billion at December 31, 2018 and 2017, respectively. Derivative cash collateral relates to OTC and OTC-cleared derivative instruments.

(e) The prior period amounts have been revised to conform with the current period presentation.

Liquidity risk and credit-related contingent features

In addition to the specific market risks introduced by each derivative contract type, derivatives expose JPMorgan Chase to credit risk – the risk that derivative counterparties may fail to meet their payment obligations under the derivative contracts and the collateral, if any, held by the Firm proves to be of insufficient value to cover the payment obligation. It is the policy of JPMorgan Chase to actively pursue, where possible, the use of legally enforceable master netting arrangements and collateral agreements to mitigate derivative counterparty credit risk. The amount of derivative receivables reported on the Consolidated balance sheets is the fair value of the derivative contracts after giving effect to legally enforceable master netting agreements and cash collateral held by the Firm.

While derivative receivables expose the Firm to credit risk, derivative payables expose the Firm to liquidity risk, as the derivative contracts typically require the Firm to post cash or securities collateral with counterparties as the fair value

of the contracts moves in the counterparties' favor or upon specified downgrades in the Firm's and its subsidiaries' respective credit ratings. Certain derivative contracts also provide for termination of the contract, generally upon a downgrade of either the Firm or the counterparty, at the fair value of the derivative contracts. The following table shows the aggregate fair value of net derivative payables related to OTC and OTC-cleared derivatives that contain contingent collateral or termination features that may be triggered upon a ratings downgrade, and the associated collateral the Firm has posted in the normal course of business, at December 31, 2018 and 2017.

OTC and OTC-cleared derivative payables containing downgrade triggers

December 31, (in millions)	2018	2017
Aggregate fair value of net derivative payables	\$ 9,396	\$ 11,916
Collateral posted	8,907	9,973

The following table shows the impact of a single-notch and two-notch downgrade of the long-term issuer ratings of JPMorgan Chase & Co. and its subsidiaries, predominantly JPMorgan Chase Bank, National Association ("JPMorgan Chase Bank, N.A."), at December 31, 2018 and 2017, related to OTC and OTC-cleared derivative contracts with contingent collateral or termination features that may be triggered upon a ratings downgrade. Derivatives contracts generally require additional collateral to be posted or terminations to be triggered when the predefined threshold rating is breached. A downgrade by a single rating agency that does not result in a rating lower than a preexisting corresponding rating provided by another major rating agency will generally not result in additional collateral (except in certain instances in which additional initial margin may be required upon a ratings downgrade), nor in termination payments requirements. The liquidity impact in the table is calculated based upon a downgrade below the lowest current rating of the rating agencies referred to in the derivative contract.

Liquidity impact of downgrade triggers on OTC and OTC-cleared derivatives

December 31, (in millions)	2018		2017	
	Single-notch downgrade	Two-notch downgrade	Single-notch downgrade	Two-notch downgrade
Amount of additional collateral to be posted upon downgrade ^(a)	\$ 76	\$ 947	\$ 79	\$ 1,989
Amount required to settle contracts with termination triggers upon downgrade ^(b)	172	764	320	650

(a) Includes the additional collateral to be posted for initial margin.

(b) Amounts represent fair values of derivative payables, and do not reflect collateral posted.

Derivatives executed in contemplation of a sale of the underlying financial asset

In certain instances the Firm enters into transactions in which it transfers financial assets but maintains the economic exposure to the transferred assets by entering into a derivative with the same counterparty in contemplation of the initial transfer. The Firm generally accounts for such transfers as collateralized financing transactions as described in Note 11, but in limited circumstances they may qualify to be accounted for as a sale and a derivative under U.S. GAAP. The amount of such transfers accounted for as a sale where the associated derivative was outstanding at December 31, 2018 was not material, and there were no such transfers at December 31, 2017.

Notes to consolidated financial statements

Impact of derivatives on the Consolidated statements of income

The following tables provide information related to gains and losses recorded on derivatives based on their hedge accounting designation or purpose.

Fair value hedge gains and losses

The following tables present derivative instruments, by contract type, used in fair value hedge accounting relationships, as well as pre-tax gains/(losses) recorded on such derivatives and the related hedged items for the years ended December 31, 2018, 2017 and 2016, respectively. The Firm includes gains/(losses) on the hedging derivative in the same line item in the Consolidated statements of income as the related hedged item.

Year ended December 31, 2018 (in millions)	Gains/(losses) recorded in income			Income statement impact of excluded components ^(f)		OCI impact Derivatives - Gains/(losses) recorded in OCI ^(g)
	Derivatives	Hedged items	Income statement impact	Amortization approach	Changes in fair value	
Contract type						
Interest rate ^{(a)(b)}	\$ (1,145)	\$ 1,782	\$ 637	\$ —	\$ 623	\$ —
Foreign exchange ^(c)	1,092	(616)	476	(566)	476	(140)
Commodity ^(d)	789	(754)	35	—	26	—
Total	\$ 736	\$ 412	\$ 1,148	\$ (566)	\$ 1,125	\$ (140)

Year ended December 31, 2017 (in millions)	Gains/(losses) recorded in income			Income statement impact due to:	
	Derivatives	Hedged items	Income statement impact	Hedge ineffectiveness ^(e)	Excluded components ^(f)
Contract type					
Interest rate ^{(a)(b)}	\$ (481)	\$ 1,359	\$ 878	\$ (18)	\$ 896
Foreign exchange ^(c)	(3,509)	3,507	(2)	—	(2)
Commodity ^(d)	(1,275)	1,348	73	29	44
Total	\$ (5,265)	\$ 6,214	\$ 949	\$ 11	\$ 938

Year ended December 31, 2016 (in millions)	Gains/(losses) recorded in income			Income statement impact due to:	
	Derivatives	Hedged items	Income statement impact	Hedge ineffectiveness ^(e)	Excluded components ^(f)
Contract type					
Interest rate ^{(a)(b)}	\$ (482)	\$ 1,338	\$ 856	\$ 6	\$ 850
Foreign exchange ^(c)	2,435	(2,261)	174	—	174
Commodity ^(d)	(536)	586	50	(9)	59
Total	\$ 1,417	\$ (337)	\$ 1,080	\$ (3)	\$ 1,083

- (a) Primarily consists of hedges of the benchmark (e.g., London Interbank Offered Rate (“LIBOR”)) interest rate risk of fixed-rate long-term debt and AFS securities. Gains and losses were recorded in net interest income.
- (b) Excludes the amortization expense associated with the inception hedge accounting adjustment applied to the hedged item. This expense is recorded in net interest income and substantially offsets the income statement impact of the excluded components. Also excludes the accrual of interest on interest rate swaps and the related hedged items.
- (c) Primarily consists of hedges of the foreign currency risk of long-term debt and AFS securities for changes in spot foreign currency rates. Gains and losses related to the derivatives and the hedged items due to changes in foreign currency rates and the income statement impact of excluded components were recorded primarily in principal transactions revenue and net interest income.
- (d) Consists of overall fair value hedges of physical commodities inventories that are generally carried at the lower of cost or net realizable value (net realizable value approximates fair value). Gains and losses were recorded in principal transactions revenue.
- (e) Hedge ineffectiveness is the amount by which the gain or loss on the designated derivative instrument does not exactly offset the gain or loss on the hedged item attributable to the hedged risk.
- (f) The assessment of hedge effectiveness excludes certain components of the changes in fair values of the derivatives and hedged items such as forward points on foreign exchange forward contracts, time values and cross-currency basis spreads. Under the new hedge accounting guidance, the initial amount of the excluded components may be amortized into income over the life of the derivative, or changes in fair value may be recognized in current period earnings.
- (g) Represents the change in value of amounts excluded from the assessment of effectiveness under the amortization approach, predominantly cross-currency basis spreads. The amount excluded at inception of the hedge is recognized in earnings over the life of the derivative.

As of December 31, 2018, the following amounts were recorded on the Consolidated balance sheets related to certain cumulative fair value hedge basis adjustments that are expected to reverse through the income statement in future periods as an adjustment to yield.

December 31, 2018 (in millions)	Carrying amount of the hedged items ^{(a)(b)}	Cumulative amount of fair value hedging adjustments included in the carrying amount of hedged items:		
		Active hedging relationships	Discontinued hedging relationships ^(d)	Total
Assets				
Investment securities - AFS	\$ 55,313 ^(c)	\$ (1,105)	\$ 381	\$ (724)
Liabilities				
Long-term debt	\$ 139,915	\$ 141	\$ 8	\$ 149
Beneficial interests issued by consolidated VIEs	6,987	–	(33)	(33)

(a) Excludes physical commodities with a carrying value of \$6.8 billion to which the Firm applies fair value hedge accounting. As a result of the application of hedge accounting, these inventories are carried at fair value, thus recognizing unrealized gains and losses in current periods. Given the Firm exits these positions at fair value, there is no incremental impact to net income in future periods.

(b) Excludes hedged items where only foreign currency risk is the designated hedged risk, as basis adjustments related to foreign currency hedges will not reverse through the income statement in future periods. The carrying amount excluded for available-for-sale securities is \$14.6 billion and for long-term debt is \$7.3 billion.

(c) Carrying amount represents the amortized cost.

(d) Represents hedged items no longer designated in qualifying fair value hedging relationships for which an associated basis adjustment exists at the balance sheet date.

Notes to consolidated financial statements

Cash flow hedge gains and losses

The following tables present derivative instruments, by contract type, used in cash flow hedge accounting relationships, and the pre-tax gains/(losses) recorded on such derivatives, for the years ended December 31, 2018, 2017 and 2016, respectively. The Firm includes the gain/(loss) on the hedging derivative in the same line item in the Consolidated statements of income as the change in cash flows on the related hedged item.

Year ended December 31, 2018 (in millions)	Derivatives gains/(losses) recorded in income and other comprehensive income/(loss)		
	Amounts reclassified from AOCI to income	Amounts recorded in OCI	Total change in OCI for period
Contract type			
Interest rate ^(a)	\$ 44	\$ (44)	\$ (88)
Foreign exchange ^(b)	(26)	(201)	(175)
Total	\$ 18	\$ (245)	\$ (263)

Year ended December 31, 2017 (in millions)	Derivatives gains/(losses) recorded in income and other comprehensive income/(loss)		
	Amounts reclassified from AOCI to income	Amounts recorded in OCI ^(c)	Total change in OCI for period
Contract type			
Interest rate ^(a)	\$ (17)	\$ 12	\$ 29
Foreign exchange ^(b)	(117)	135	252
Total	\$ (134)	\$ 147	\$ 281

Year ended December 31, 2016 (in millions)	Derivatives gains/(losses) recorded in income and other comprehensive income/(loss)		
	Amounts reclassified from AOCI to income	Amounts recorded in OCI ^(c)	Total change in OCI for period
Contract type			
Interest rate ^(a)	\$ (74)	\$ (55)	\$ 19
Foreign exchange ^(b)	(286)	(395)	(109)
Total	\$ (360)	\$ (450)	\$ (90)

- (a) Primarily consists of benchmark interest rate hedges of LIBOR-indexed floating-rate assets and floating-rate liabilities. Gains and losses were recorded in net interest income.
- (b) Primarily consists of hedges of the foreign currency risk of non-U.S. dollar-denominated revenue and expense. The income statement classification of gains and losses follows the hedged item - primarily noninterest revenue and compensation expense.
- (c) Represents the effective portion of changes in value of the related hedging derivative. Hedge ineffectiveness is the amount by which the cumulative gain or loss on the designated derivative instrument exceeds the present value of the cumulative expected change in cash flows on the hedged item attributable to the hedged risk. The Firm did not recognize any ineffectiveness on cash flow hedges during 2017 and 2016.

The Firm did not experience any forecasted transactions that failed to occur for the years ended 2018, 2017 and 2016.

Over the next 12 months, the Firm expects that approximately \$(74) million (after-tax) of net losses recorded in AOCI at December 31, 2018, related to cash flow hedges will be recognized in income. For cash flow hedges that have been terminated, the maximum length of time over which the derivative results recorded in AOCI will be recognized in earnings is approximately six years, corresponding to the timing of the originally hedged forecasted cash flows. For open cash flow hedges, the maximum length of time over which forecasted transactions are hedged is approximately six years. The Firm's longer-dated forecasted transactions relate to core lending and borrowing activities.

Net investment hedge gains and losses

The following table presents hedging instruments, by contract type, that were used in net investment hedge accounting relationships, and the pre-tax gains/(losses) recorded on such instruments for the years ended December 31, 2018, 2017 and 2016.

Year ended December 31, (in millions)	2018		2017		2016	
	Amounts recorded in income ^{(a)(b)}	Amounts recorded in OCI	Amounts recorded in income ^{(a)(b)(c)}	Amounts recorded in OCI ^(d)	Amounts recorded in income ^{(a)(b)(c)}	Amounts recorded in OCI ^(d)
Foreign exchange derivatives	\$11	\$1,219	\$(152)	\$(1,244)	\$(280)	\$262

- (a) Certain components of hedging derivatives are permitted to be excluded from the assessment of hedge effectiveness, such as forward points on foreign exchange forward contracts. The Firm elects to record changes in fair value of these amounts directly in other income.
- (b) Excludes amounts reclassified from AOCI to income on the sale or liquidation of hedged entities. For additional information, refer to Note 23.
- (c) The prior period amounts have been revised to conform with the current period presentation.
- (d) Represents the effective portion of changes in value of the related hedging derivative. The Firm did not recognize any ineffectiveness on net investment hedges directly in income during 2017 and 2016.

Gains and losses on derivatives used for specified risk management purposes

The following table presents pre-tax gains/(losses) recorded on a limited number of derivatives, not designated in hedge accounting relationships, that are used to manage risks associated with certain specified assets and liabilities, including certain risks arising from the mortgage pipeline, warehouse loans, MSRs, wholesale lending exposures, and foreign currency denominated assets and liabilities.

Year ended December 31, (in millions)	Derivatives gains/(losses) recorded in income		
	2018	2017	2016
Contract type			
Interest rate ^(a)	\$ 79	\$ 331	\$ 1,174
Credit ^(b)	(21)	(74)	(282)
Foreign exchange ^(c)	117	(107) ^(d)	(20) ^(d)
Total	\$ 175	\$ 150^(d)	\$ 872^(d)

- (a) Primarily represents interest rate derivatives used to hedge the interest rate risk inherent in the mortgage pipeline, warehouse loans and MSRs, as well as written commitments to originate warehouse loans. Gains and losses were recorded predominantly in mortgage fees and related income.
- (b) Relates to credit derivatives used to mitigate credit risk associated with lending exposures in the Firm's wholesale businesses. These derivatives do not include credit derivatives used to mitigate counterparty credit risk arising from derivative receivables, which is included in gains and losses on derivatives related to market-making activities and other derivatives. Gains and losses were recorded in principal transactions revenue.
- (c) Primarily relates to derivatives used to mitigate foreign exchange risk of specified foreign currency-denominated assets and liabilities. Gains and losses were recorded in principal transactions revenue.
- (d) The prior period amounts have been revised to conform with the current period presentation.

Gains and losses on derivatives related to market-making activities and other derivatives

The Firm makes markets in derivatives in order to meet the needs of customers and uses derivatives to manage certain risks associated with net open risk positions from its market-making activities, including the counterparty credit risk arising from derivative receivables. All derivatives not included in the hedge accounting or specified risk management categories above are included in this category. Gains and losses on these derivatives are primarily recorded in principal transactions revenue. Refer to Note 6 for information on principal transactions revenue.

Credit derivatives

Credit derivatives are financial instruments whose value is derived from the credit risk associated with the debt of a third-party issuer (the reference entity) and which allow one party (the protection purchaser) to transfer that risk to another party (the protection seller). Credit derivatives expose the protection purchaser to the creditworthiness of the protection seller, as the protection seller is required to make payments under the contract when the reference entity experiences a credit event, such as a bankruptcy, a failure to pay its obligation or a restructuring. The seller of credit protection receives a premium for providing protection but has the risk that the underlying instrument referenced in the contract will be subject to a credit event.

The Firm is both a purchaser and seller of protection in the credit derivatives market and uses these derivatives for two primary purposes. First, in its capacity as a market-maker, the Firm actively manages a portfolio of credit derivatives by purchasing and selling credit protection, predominantly on corporate debt obligations, to meet the needs of customers. Second, as an end-user, the Firm uses credit derivatives to manage credit risk associated with lending exposures (loans and unfunded commitments) and derivatives counterparty exposures in the Firm's wholesale businesses, and to manage the credit risk arising from certain financial instruments in the Firm's market-making businesses. Following is a summary of various types of credit derivatives.

Notes to consolidated financial statements

Credit default swaps

Credit derivatives may reference the credit of either a single reference entity (“single-name”) or a broad-based index. The Firm purchases and sells protection on both single-name and index-reference obligations. Single-name CDS and index CDS contracts are either OTC or OTC-cleared derivative contracts. Single-name CDS are used to manage the default risk of a single reference entity, while index CDS contracts are used to manage the credit risk associated with the broader credit markets or credit market segments. Like the S&P 500 and other market indices, a CDS index consists of a portfolio of CDS across many reference entities. New series of CDS indices are periodically established with a new underlying portfolio of reference entities to reflect changes in the credit markets. If one of the reference entities in the index experiences a credit event, then the reference entity that defaulted is removed from the index. CDS can also be referenced against specific portfolios of reference names or against customized exposure levels based on specific client demands: for example, to provide protection against the first \$1 million of realized credit losses in a \$10 million portfolio of exposure. Such structures are commonly known as tranche CDS.

For both single-name CDS contracts and index CDS contracts, upon the occurrence of a credit event, under the terms of a CDS contract neither party to the CDS contract has recourse to the reference entity. The protection purchaser has recourse to the protection seller for the difference between the face value of the CDS contract and the fair value of the reference obligation at settlement of the credit derivative contract, also known as the recovery value. The protection purchaser does not need to hold the debt instrument of the underlying reference entity in order to receive amounts due under the CDS contract when a credit event occurs.

Credit-related notes

A credit-related note is a funded credit derivative where the issuer of the credit-related note purchases from the note investor credit protection on a reference entity or an index. Under the contract, the investor pays the issuer the par value of the note at the inception of the transaction, and in return, the issuer pays periodic payments to the investor, based on the credit risk of the referenced entity. The issuer also repays the investor the par value of the note at maturity unless the reference entity (or one of the entities that makes up a reference index) experiences a specified credit event. If a credit event occurs, the issuer is not obligated to repay the par value of the note, but rather, the issuer pays the investor the difference between the par value of the note and the fair value of the defaulted reference obligation at the time of settlement. Neither party to the credit-related note has recourse to the defaulting reference entity.

The following tables present a summary of the notional amounts of credit derivatives and credit-related notes the Firm sold and purchased as of December 31, 2018 and 2017. Upon a credit event, the Firm as a seller of protection would typically pay out only a percentage of the full notional amount of net protection sold, as the amount actually required to be paid on the contracts takes into account the recovery value of the reference obligation at the time of settlement. The Firm manages the credit risk on contracts to sell protection by purchasing protection with identical or similar underlying reference entities. Other purchased protection referenced in the following tables includes credit derivatives bought on related, but not identical, reference positions (including indices, portfolio coverage and other reference points) as well as protection purchased through credit-related notes.

The Firm does not use notional amounts of credit derivatives as the primary measure of risk management for such derivatives, because the notional amount does not take into account the probability of the occurrence of a credit event, the recovery value of the reference obligation, or related cash instruments and economic hedges, each of which reduces, in the Firm's view, the risks associated with such derivatives.

Total credit derivatives and credit-related notes

December 31, 2018 (in millions)	Maximum payout/Notional amount			
	Protection sold	Protection purchased with identical underlyings ^(b)	Net protection (sold)/purchased ^(c)	Other protection purchased ^(d)
Credit derivatives				
Credit default swaps	\$ (697,220)	\$ 707,282	\$ 10,062	\$ 4,053
Other credit derivatives ^(a)	(41,244)	42,484	1,240	8,488
Total credit derivatives	(738,464)	749,766	11,302	12,541
Credit-related notes	–	–	–	8,425
Total	\$ (738,464)	\$ 749,766	\$ 11,302	\$ 20,966

December 31, 2017 (in millions)	Maximum payout/Notional amount			
	Protection sold	Protection purchased with identical underlyings ^(b)	Net protection (sold)/purchased ^(c)	Other protection purchased ^(d)
Credit derivatives				
Credit default swaps	\$ (690,224)	\$ 702,098	\$ 11,874	\$ 5,045
Other credit derivatives ^(a)	(54,157)	59,158	5,001	11,747
Total credit derivatives	(744,381)	761,256	16,875	16,792
Credit-related notes	(18)	–	(18)	7,915
Total	\$ (744,399)	\$ 761,256	\$ 16,857	\$ 24,707

(a) Other credit derivatives largely consists of credit swap options.

(b) Represents the total notional amount of protection purchased where the underlying reference instrument is identical to the reference instrument on protection sold; the notional amount of protection purchased for each individual identical underlying reference instrument may be greater or lower than the notional amount of protection sold.

(c) Does not take into account the fair value of the reference obligation at the time of settlement, which would generally reduce the amount the seller of protection pays to the buyer of protection in determining settlement value.

(d) Represents protection purchased by the Firm on referenced instruments (single-name, portfolio or index) where the Firm has not sold any protection on the identical reference instrument.

The following tables summarize the notional amounts by the ratings, maturity profile, and total fair value, of credit derivatives and credit-related notes as of December 31, 2018 and 2017, where JPMorgan Chase is the seller of protection. The maturity profile is based on the remaining contractual maturity of the credit derivative contracts. The ratings profile is based on the rating of the reference entity on which the credit derivative contract is based. The ratings and maturity profile of credit derivatives and credit-related notes where JPMorgan Chase is the purchaser of protection are comparable to the profile reflected below.

Protection sold – credit derivatives and credit-related notes ratings^(a)/maturity profile

December 31, 2018 (in millions)	<1 year	1-5 years	>5 years	Total notional amount	Fair value of receivables ^(b)	Fair value of payables ^(b)	Net fair value
Risk rating of reference entity							
Investment-grade	\$ (115,443)	\$ (402,325)	\$ (43,611)	\$ (561,379)	\$ 5,720	\$ (2,791)	\$ 2,929
Noninvestment-grade	(45,897)	(119,348)	(11,840)	(177,085)	4,719	(5,660)	(941)
Total	\$ (161,340)	\$ (521,673)	\$ (55,451)	\$ (738,464)	\$ 10,439	\$ (8,451)	\$ 1,988
December 31, 2017 (in millions)	<1 year	1-5 years	>5 years	Total notional amount	Fair value of receivables^(b)	Fair value of payables^(b)	Net fair value
Risk rating of reference entity							
Investment-grade	\$ (159,286)	\$ (319,726)	\$ (39,429)	\$ (518,441)	\$ 8,516	\$ (1,134)	\$ 7,382
Noninvestment-grade	(73,394)	(134,125)	(18,439)	(225,958)	7,407	(5,313)	2,094
Total	\$ (232,680)	\$ (453,851)	\$ (57,868)	\$ (744,399)	\$ 15,923	\$ (6,447)	\$ 9,476

(a) The ratings scale is primarily based on external credit ratings defined by S&P and Moody's.

(b) Amounts are shown on a gross basis, before the benefit of legally enforceable master netting agreements and cash collateral received by the Firm.

Note 6 – Noninterest revenue and noninterest expense

The Firm records noninterest revenue from certain contracts with customers under ASC 606, *Revenue from Contracts with Customers*, in investment banking fees, deposit-related fees, asset management, administration, and commissions, and components of card income. Contracts in the scope of ASC 606 are often terminable on demand and the Firm has no remaining obligation to deliver future services. For arrangements with a fixed term, the Firm may commit to deliver services in the future. Revenue associated with these remaining performance obligations typically depends on the occurrence of future events or underlying asset values, and is not recognized until the outcome of those events or values are known.

The adoption of the revenue recognition guidance in the first quarter of 2018, required gross presentation of certain costs previously offset against revenue, predominantly associated with certain distribution costs (previously offset against asset management, administration and commissions), with the remainder associated with certain underwriting costs (previously offset against investment banking fees). Adoption of the guidance did not result in any material changes in the timing of revenue recognition. This guidance was adopted retrospectively and, accordingly, prior period amounts were revised, which resulted in an increase in both noninterest revenue and noninterest expense. The Firm did not apply any practical expedients. For additional information, refer to Note 1.

Investment banking fees

This revenue category includes debt and equity underwriting and advisory fees. As an underwriter, the Firm helps clients raise capital via public offering and private placement of various types of debt and equity instruments. Underwriting fees are primarily based on the issuance price and quantity of the underlying instruments, and are recognized as revenue typically upon execution of the client’s transaction. The Firm also manages and syndicates loan arrangements. Credit arrangement and syndication fees, included within debt underwriting fees, are recorded as revenue after satisfying certain retention, timing and yield criteria.

The Firm also provides advisory services, by assisting its clients with mergers and acquisitions, divestitures, restructuring and other complex transactions. Advisory fees are recognized as revenue typically upon execution of the client’s transaction.

Year ended December 31, (in millions)	2018	2017	2016
Underwriting			
Equity	\$ 1,684	\$ 1,466	\$ 1,200
Debt	3,347	3,802	3,277
Total underwriting	5,031	5,268	4,477
Advisory	2,519	2,144	2,095
Total investment banking fees	\$ 7,550	\$ 7,412	\$ 6,572

Investment banking fees are earned primarily by CIB. Refer to Note 31 for segment results.

Principal transactions

Principal transactions revenue is driven by many factors, including the bid-offer spread, which is the difference between the price at which the Firm is willing to buy a financial or other instrument and the price at which the Firm is willing to sell that instrument. It also consists of the realized (as a result of the sale of instruments, closing out or termination of transactions, or interim cash payments) and unrealized (as a result of changes in valuation) gains and losses on financial and other instruments (including those accounted for under the fair value option) primarily used in client-driven market-making activities and on private equity investments. In connection with its client-driven market-making activities, the Firm transacts in debt and equity instruments, derivatives and commodities (including physical commodities inventories and financial instruments that reference commodities).

Principal transactions revenue also includes certain realized and unrealized gains and losses related to hedge accounting and specified risk-management activities, including: (a) certain derivatives designated in qualifying hedge accounting relationships (primarily fair value hedges of commodity and foreign exchange risk), (b) certain derivatives used for specific risk management purposes, primarily to mitigate credit risk and foreign exchange risk, and (c) other derivatives. For further information on the income statement classification of gains and losses from derivatives activities, refer to Note 5.

In the financial commodity markets, the Firm transacts in OTC derivatives (e.g., swaps, forwards, options) and ETD that reference a wide range of underlying commodities. In the physical commodity markets, the Firm primarily purchases and sells precious and base metals and may hold other commodities inventories under financing and other arrangements with clients.

The following table presents all realized and unrealized gains and losses recorded in principal transactions revenue. This table excludes interest income and interest expense on trading assets and liabilities, which are an integral part of the overall performance of the Firm’s client-driven market-making activities. Refer to Note 7 for further information on interest income and interest expense. Trading revenue is presented primarily by instrument type. The Firm’s client-driven market-making businesses generally utilize a variety of instrument types in connection with their market-making and related risk-management activities; accordingly, the trading revenue presented in the table below is not representative of the total revenue of any individual line of business.

Year ended December 31, (in millions)	2018	2017	2016
Trading revenue by instrument type			
Interest rate	\$ 1,961	\$ 2,479	\$ 2,325
Credit	1,395	1,329	2,096
Foreign exchange	3,222	2,746	2,827
Equity	4,924	3,873	2,994
Commodity	906	661	1,067
Total trading revenue	12,408	11,088	11,309
Private equity gains	(349)	259	257
Principal transactions	\$ 12,059	\$ 11,347	\$ 11,566

Principal transactions revenue is earned primarily by CIB. Refer to Note 31 for segment results.

Lending- and deposit-related fees

Lending-related fees include fees earned from loan commitments, standby letters of credit, financial guarantees, and other loan-servicing activities. Deposit-related fees include fees earned in lieu of compensating balances, and fees earned from performing cash management activities and other deposit account services. Lending- and deposit-related fees in this revenue category are recognized over the period in which the related service is provided.

Year ended December 31, (in millions)	2018	2017	2016
Lending-related fees	\$ 1,117	\$ 1,110	\$ 1,114
Deposit-related fees	4,935	4,823	4,660
Total lending- and deposit-related fees	\$ 6,052	\$ 5,933	\$ 5,774

Lending- and deposit-related fees are earned by CCB, CIB, CB, and AWM. Refer to Note 31 for segment results.

Asset management, administration and commissions

This revenue category includes fees from investment management and related services, custody, brokerage services and other products. The Firm manages assets on behalf of its clients, including investors in Firm-sponsored funds and owners of separately managed investment accounts. Management fees are typically based on the value of assets under management and are collected and recognized at the end of each period over which the management services are provided and the value of the managed assets is known. The Firm also receives performance-based management fees, which are earned based on exceeding certain benchmarks or other performance targets and are accrued and recognized when the probability of reversal is remote, typically at the end of the related billing period. The Firm has contractual arrangements with third parties to provide distribution and other services in connection with its asset management activities. Amounts paid to third-party service providers are recorded in professional and outside services expense.

Year ended December 31, (in millions)	2018	2017	2016
Asset management fees			
Investment management fees ^(a)	\$ 10,768	\$ 10,434	\$ 9,636
All other asset management fees ^(b)	270	296	338
Total asset management fees	11,038	10,730	9,974
Total administration fees ^(c)	2,179	2,029	1,915
Commissions and other fees			
Brokerage commissions ^(d)	2,505	2,239	2,151
All other commissions and fees	1,396	1,289	1,324
Total commissions and fees	3,901	3,528	3,475
Total asset management, administration and commissions	\$ 17,118	\$ 16,287	\$ 15,364

- Represents fees earned from managing assets on behalf of the Firm's clients, including investors in Firm-sponsored funds and owners of separately managed investment accounts.
- The Firm receives other asset management fees for services that are ancillary to investment management services, including commissions earned on sales or distribution of mutual funds to clients. These fees are recorded as revenue at the time the service is rendered or, in the case of certain distribution fees based on the underlying fund's asset value and/or investor redemption, recorded over time as the investor remains in the fund or upon investor redemption.
- The Firm receives administrative fees predominantly from custody, securities lending, fund services and securities clearance services it provides. These fees are recorded as revenue over the period in which the related service is provided.
- The Firm acts as a broker, by facilitating its clients' purchases and sales of securities and other financial instruments. Brokerage commissions are collected and recognized as revenue upon occurrence of the client transaction. The Firm reports certain costs paid to third-party clearing houses and exchanges net against commission revenue.

Asset management, administration and commissions are earned primarily by AWM, CIB, CCB, and CB. Refer to Note 31 for segment results.

Mortgage fees and related income

This revenue category primarily reflects CCB's Home Lending net production and net mortgage servicing revenue.

Net production revenue includes fees and income recognized as earned on mortgage loans originated with the intent to sell; the impact of risk management activities associated with the mortgage pipeline and warehouse loans; and changes in the fair value of any residual interests held from mortgage securitizations. Net production revenue also includes gains and losses on sales of mortgage loans, lower of cost or fair value adjustments on mortgage loans held-for-sale, changes in fair value on mortgage loans originated with the intent to sell and measured at fair value under the fair value option, as well as losses recognized as incurred related to the repurchase of previously sold loans.

Net mortgage servicing revenue includes operating revenue earned from servicing third-party mortgage loans which is recognized over the period in which the service is provided, changes in the fair value of MSRs and the impact of risk management activities associated with MSRs.

For further discussion of risk management activities and MSRs, refer to Note 15.

Net interest income from mortgage loans is recorded in interest income.

Notes to consolidated financial statements

Card income

This revenue category includes interchange income from credit and debit cards and fees earned from processing card transactions for merchants, both of which are recognized when purchases are made by a cardholder. Card income also includes account origination costs and annual fees, which are deferred and recognized on a straight-line basis over a 12-month period.

Certain Chase credit card products offer the cardholder the ability to earn points based on account activity, which the cardholder can choose to redeem for cash and non-cash rewards. The cost to the Firm related to these proprietary rewards programs varies based on multiple factors including the terms and conditions of the rewards programs, cardholder activity, cardholder reward redemption rates and cardholder reward selections. The Firm maintains a liability for its obligations under its rewards programs and reports the current-period cost as a reduction of card income.

Credit card revenue sharing agreements

The Firm has contractual agreements with numerous co-brand partners that grant the Firm exclusive rights to issue co-branded credit card products and market them to the customers of such partners. These partners endorse the co-brand credit card programs and provide their customer or member lists to the Firm. The partners may also conduct marketing activities and provide rewards redeemable under their own loyalty programs that the Firm will grant to co-brand credit cardholders based on account activity. The terms of these agreements generally range from five to ten years.

The Firm typically makes payments to the co-brand credit card partners based on the cost of partners' marketing activities and loyalty program rewards provided to credit cardholders, new account originations and sales volumes. Payments to partners based on marketing efforts undertaken by the partners are expensed by the Firm as incurred and reported as marketing expense. Payments for partner loyalty program rewards are reported as a reduction of card income when incurred. Payments to partners based on new credit card account originations are accounted for as direct loan origination costs and are deferred and recognized as a reduction of card income on a straight-line basis over a 12-month period. Payments to partners based on sales volumes are reported as a reduction of card income when the related interchange income is earned.

The following table presents the components of card income:

Year ended December 31, (in millions)	2018	2017	2016
Interchange and merchant processing income	\$ 18,808	\$ 17,080	\$ 15,367
Reward costs and partner payments	(13,074) ^(b)	(10,820)	(9,480)
Other card income ^(a)	(745)	(1,827)	(1,108)
Total card income	\$ 4,989	\$ 4,433	\$ 4,779

(a) Predominantly represents annual fees and new account origination costs, which are deferred and recognized on a straight-line basis over a 12-month period and are outside the scope of the revenue recognition guidance, ASC 606, *Revenue from Contracts with Customers*.

(b) Includes an adjustment to the credit card rewards liability of approximately \$330 million, recorded in the second quarter of 2018.

Card income is earned primarily by CCB and CB. Refer to Note 31 for segment results.

Other income

Other income on the Firm's Consolidated statements of income included the following:

Year ended December 31, (in millions)	2018	2017	2016
Operating lease income	\$ 4,540	\$ 3,613	\$ 2,724

Operating lease income is recognized on a straight-line basis over the lease term.

Noninterest expense

Other expense

Other expense on the Firm's Consolidated statements of income included the following:

Year ended December 31, (in millions)	2018	2017	2016
Legal expense/(benefit)	\$ 72	\$ (35)	\$ (317)
FDIC-related expense	1,239	1,492	1,296

Note 7 – Interest income and Interest expense

Interest income and interest expense are recorded in the Consolidated statements of income and classified based on the nature of the underlying asset or liability.

The following table presents the components of interest income and interest expense:

Year ended December 31, (in millions)	2018	2017	2016
Interest income			
Loans ^(a)	\$ 47,620	\$ 41,008	\$ 36,634
Taxable securities	5,653	5,535	5,538
Non-taxable securities ^(b)	1,595	1,847	1,766
Total investment securities	7,248	7,382	7,304
Trading assets	8,703	7,610	7,292
Federal funds sold and securities purchased under resale agreements	3,819	2,327	2,265
Securities borrowed ^(c)	728	(37)	(332)
Deposits with banks	5,907	4,238	1,879
All other interest-earning assets ^(d)	3,417	1,844	859
Total interest income	\$ 77,442	\$ 64,372	\$ 55,901
Interest expense			
Interest bearing deposits	\$ 5,973	\$ 2,857	\$ 1,356
Federal funds purchased and securities loaned or sold under repurchase agreements	3,066	1,611	1,089
Short-term borrowings ^(e)	1,144	481	203
Trading liabilities - debt and all other interest-bearing liabilities ^(f)	3,729	2,070	1,102
Long-term debt	7,978	6,753	5,564
Beneficial interest issued by consolidated VIEs	493	503	504
Total interest expense	\$ 22,383	\$ 14,275	\$ 9,818
Net interest income	\$ 55,059	\$ 50,097	\$ 46,083
Provision for credit losses	4,871	5,290	5,361
Net interest income after provision for credit losses	\$ 50,188	\$ 44,807	\$ 40,722

- (a) Includes the amortization/accretion of unearned income (e.g., purchase premiums/discounts, net deferred fees/costs, etc.).
- (b) Represents securities that are tax-exempt for U.S. federal income tax purposes.
- (c) Negative interest income is related to client-driven demand for certain securities combined with the impact of low interest rates. This is matched book activity and the negative interest expense on the corresponding securities loaned is recognized in interest expense.
- (d) Includes held-for-investment margin loans, which are classified in accrued interest and accounts receivable, and all other interest-earning assets, which are classified in other assets on the Consolidated balance sheets.
- (e) Includes commercial paper.
- (f) Other interest-bearing liabilities include brokerage customer payables.

Interest income and interest expense includes the current-period interest accruals for financial instruments measured at fair value, except for derivatives and financial instruments containing embedded derivatives that would be separately accounted for in accordance with U.S. GAAP, absent the fair value option election; for those instruments, all changes in fair value including any interest elements, are reported in principal transactions revenue. For financial instruments that are not measured at fair value, the related interest is included within interest income or interest expense, as applicable. For further information on accounting for interest income and interest expense related to loans, investment securities, securities financing (i.e. securities purchased or sold under resale or repurchase agreements; securities borrowed; and securities loaned) and long-term debt, refer to Notes 12, 10, 11 and 19, respectively.

Note 8 – Pension and other postretirement employee benefit plans

The Firm has various defined benefit pension plans and OPEB plans that provide benefits to its employees in the U.S. and certain non-U.S. locations. The Firm also provides a qualified defined contribution plan in the U.S. and maintains other similar arrangements in certain non-U.S. locations.

The principal defined benefit pension plan in the U.S. is a qualified noncontributory plan that provides benefits to substantially all U.S. employees. In connection with changes to the U.S. Retirement Savings Program during the fourth quarter of 2018, the Firm announced that it will freeze the U.S. defined benefit pension plan. Commencing on January 1, 2020 (and January 1, 2019 for new hires), pay credits will be directed to the U.S. defined contribution plan. Interest credits will continue to accrue. As a result, a curtailment was triggered and a remeasurement of the U.S. defined benefit pension obligation and plan assets occurred as of November 30, 2018. The plan design change resulted in an increase to pension expense of \$21 million representing the immediate recognition of the prior service cost, but did not have a material impact on the U.S. defined benefit pension plan or the Firm's Consolidated Financial Statements.

The Firm also has defined benefit pension plans that are offered in certain non-U.S. locations based on factors such as eligible compensation, age and/or years of service. It is the Firm's policy to fund the pension plans in amounts sufficient to meet the requirements under applicable laws. The Firm does not anticipate at this time any contribution to the U.S. defined benefit pension plan in 2019. The 2019 contributions to the non-U.S. defined benefit pension plans are expected to be \$45 million of which \$30 million are contractually required.

The Firm also has a number of nonqualified noncontributory defined benefit pension plans that are unfunded. These plans provide supplemental defined pension benefits to certain employees.

The Firm offers postretirement medical and life insurance benefits to certain U.S. retirees and postretirement medical benefits to qualifying U.S. and U.K. employees.

The Firm defrays the cost of its U.S. OPEB obligation through corporate-owned life insurance ("COLI") purchased on the lives of eligible employees and retirees. While the Firm owns the COLI policies, COLI proceeds (death benefits, withdrawals and other distributions) may be used only to reimburse the Firm for its net postretirement benefit claim payments and related administrative expense. The Firm has generally funded its postretirement benefit obligations through contributions to the relevant trust on a pay-as-you-go basis. On December 21, 2017, the Firm contributed \$600 million of cash to the trust as a prefunding of a portion of its postretirement benefit obligations. The U.K. OPEB plan is unfunded.

Pension and OPEB accounting generally requires that the difference between plan assets at fair value and the benefit obligation be measured and recorded on the balance sheet. Plans that are overfunded (excess of plan assets over benefit obligation) are recorded in other assets and plans that are underfunded (excess benefit obligation over plan assets) are recorded within other liabilities. Gains or losses resulting from changes in the benefit obligation and the value of plan assets are recorded in other comprehensive income ("OCI") and recognized as part of the net periodic benefit cost over subsequent periods as discussed in the Gains and losses section of this Note. Additionally, income statement items related to pension and OPEB plans (other than benefits earned during the period) are aggregated and reported net within other expense.

The following table presents the changes in benefit obligations, plan assets, the net funded status, and the pretax pension and OPEB amounts recorded in AOCI on the Consolidated balance sheets for the Firm's defined benefit pension and OPEB plans, and the weighted-average actuarial annualized assumptions for the projected and accumulated postretirement benefit obligations.

As of or for the year ended December 31, (in millions)	Defined benefit pension plans		OPEB plans ^(h)	
	2018	2017	2018	2017
Change in benefit obligation				
Benefit obligation, beginning of year	\$ (16,700)	\$ (15,594)	\$ (684)	\$ (708)
Benefits earned during the year	(354)	(330)	—	—
Interest cost on benefit obligations	(556)	(598)	(24)	(28)
Plan amendments	(29)	—	—	—
Plan curtailment	123	—	—	—
Employee contributions	(7)	(7)	(15)	(16)
Net gain/(loss)	938 ^(g)	(721) ^(g)	40	(4)
Benefits paid	873	841	69	76
Plan settlements	15	30	—	—
Expected Medicare Part D subsidy receipts	NA	NA	—	(1)
Foreign exchange impact and other	185	(321)	2	(3)
Benefit obligation, end of year^(a)	\$ (15,512)	\$ (16,700)	\$ (612)	\$ (684)
Change in plan assets				
Fair value of plan assets, beginning of year	\$ 19,603	\$ 17,703	\$ 2,757	\$ 1,956
Actual return on plan assets	(548)	2,356	(28)	233
Firm contributions	75	78	2	602
Employee contributions	7	7	15	—
Benefits paid	(873)	(841)	(113)	(34)
Plan settlements	(15)	(30)	—	—
Foreign exchange impact and other	(197)	330	—	—
Fair value of plan assets, end of year^{(a)(b)(c)}	\$ 18,052	\$ 19,603	\$ 2,633	\$ 2,757
Net funded status^{(d)(e)}	\$ 2,540	\$ 2,903	\$ 2,021	\$ 2,073
Accumulated benefit obligation, end of year	\$ (15,494)	\$ (16,530)	NA	NA
Pretax pension and OPEB amounts recorded in AOCI				
Net gain/(loss)	\$ (3,134)	\$ (2,800)	\$ 184	\$ 271
Prior service credit/(cost)	(23)	6	—	—
Accumulated other comprehensive income/(loss), pretax, end of year	\$ (3,157)	\$ (2,794)	\$ 184	\$ 271
Weighted-average actuarial assumptions used to determine benefit obligations				
Discount Rate ^(f)	0.60 - 4.30 %	0.60 - 3.70 %	4.20%	3.70%
Rate of compensation increase ^(f)	2.25 - 3.00	2.25 - 3.00	NA	NA
Interest crediting rate ^(f)	1.81 - 4.90%	1.81 - 4.90%	NA	NA
Health care cost trend rate:				
Assumed for next year	NA	NA	5.00	5.00
Ultimate	NA	NA	5.00	5.00
Year when rate will reach ultimate	NA	NA	2019	2018

- (a) At December 31, 2018 and 2017, included non-U.S. benefit obligations of \$(3.3) billion and \$(3.8) billion, and plan assets of \$3.5 billion and \$3.9 billion, respectively, predominantly in the U.K.
- (b) At both December 31, 2018 and 2017, approximately \$302 million of U.S. defined benefit pension plan assets included participation rights under participating annuity contracts.
- (c) At December 31, 2018 and 2017, defined benefit pension plan amounts that were not measured at fair value included \$340 million and \$377 million, respectively, of accrued receivables, and \$503 million and \$587 million, respectively, of accrued liabilities, for U.S. plans.
- (d) Represents plans with an aggregate overfunded balance of \$5.1 billion and \$5.6 billion at December 31, 2018 and 2017, respectively, and plans with an aggregate underfunded balance of \$547 million and \$612 million at December 31, 2018 and 2017, respectively.
- (e) For pension plans with a projected benefit obligation exceeding plan assets, the projected benefit obligation and fair value of plan assets was \$1.3 billion and \$762 million at December 31, 2018, respectively and \$1.4 billion and \$811 million at December 31, 2017, respectively. For pension plans with an accumulated benefit obligation exceeding plan assets, the accumulated benefit obligation and fair value of plan assets was \$1.3 billion and \$762 million at December 31, 2018, respectively, and \$1.4 billion and \$811 million at December 31, 2017, respectively. For OPEB plans with a projected benefit obligation exceeding plan assets, the projected benefit obligation was \$26 million and \$32 million at December 31, 2018 and December 31, 2017, respectively, they had no plan assets.
- (f) For the U.S. defined benefit pension plans, the discount rate assumption is 4.30% and 3.70% for 2018 and 2017, respectively, and the rate of compensation increase and the interest crediting rate are 2.30% and 4.90%, respectively, for both 2018 and 2017.
- (g) At December 31, 2018 and 2017, the gain/(loss) was primarily attributable to the change in the discount rate.
- (h) Includes an unfunded postretirement benefit obligation of \$26 million and \$32 million at December 31, 2018 and 2017, respectively, for the U.K. plan.

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Gains and losses

For the Firm's defined benefit pension plans, fair value is used to determine the expected return on plan assets. Amortization of net gains and losses is included in annual net periodic benefit cost if, as of the beginning of the year, the net gain or loss exceeds 10% of the greater of the PBO or the fair value of the plan assets. Any excess is amortized over the average future service period of defined benefit pension plan participants, which for the U.S. defined benefit pension plan is currently eight years and for the non-U.S. defined benefit pension plans is the period appropriate for the affected plan. In addition, prior service costs are amortized over the average remaining service period of active employees expected to receive benefits under the plan when the prior service cost is first recognized. Due to the curtailment of the principal U.S. defined benefit pension plan in 2018, all related prior service cost was recognized in the annual net periodic benefit cost.

For the Firm's OPEB plans, a calculated value that recognizes changes in fair value over a five-year period is used to determine the expected return on plan assets. This value is referred to as the market-related value of assets. Amortization of net gains and losses, adjusted for gains and losses not yet recognized, is included in annual net periodic benefit cost if, as of the beginning of the year, the net gain or loss exceeds 10% of the greater of the accumulated postretirement benefit obligation or the market-related value of assets. Any excess net gain or loss is amortized over the average expected lifetime of retired participants, which is currently eleven years; however, prior service costs resulting from plan changes are amortized over the average years of service remaining to full eligibility age, which is currently one year.

The following table presents the components of net periodic benefit costs reported in the Consolidated statements of income for the Firm's U.S. and non-U.S. defined benefit pension, defined contribution and OPEB plans, and in other comprehensive income for the defined benefit pension and OPEB plans, and the weighted-average annualized actuarial assumptions for the net periodic benefit cost.

Year ended December 31, (in millions)	Pension plans			OPEB plans		
	2018	2017	2016	2018	2017	2016
Components of net periodic benefit cost						
Benefits earned during the year	\$ 354	\$ 330	\$ 332	\$ —	\$ —	\$ —
Interest cost on benefit obligations	556	598	629	24	28	31
Expected return on plan assets	(981)	(968)	(1,030)	(103)	(97)	(105)
Amortization:						
Net (gain)/loss	103	250	257	—	—	—
Prior service cost/(credit)	(23)	(36)	(36)	—	—	—
Curtailement (gain)/loss	21	—	—	—	—	—
Settlement (gain)/loss	2	2	4	—	—	—
Net periodic defined benefit cost^(a)	\$ 32	\$ 176	\$ 156	\$ (79)	\$ (69)	\$ (74)
Other defined benefit pension plans ^(b)	20	24	25	NA	NA	NA
Total defined benefit plans	\$ 52	\$ 200	\$ 181	\$ (79)	\$ (69)	\$ (74)
Total defined contribution plans	872	814	789	NA	NA	NA
Total pension and OPEB cost included in noninterest expense	\$ 924	\$ 1,014	\$ 970	\$ (79)	\$ (69)	\$ (74)
Changes in plan assets and benefit obligations recognized in other comprehensive income						
Prior service (credit)/cost arising during the year	29	—	—	—	—	—
Net (gain)/loss arising during the year	467	(669)	395	91	(133)	(29)
Amortization of net loss	(103)	(250)	(257)	—	—	—
Amortization of prior service (cost)/credit	23	36	36	—	—	—
Curtailement gain/(loss)	(21)	—	—	—	—	—
Settlement gain/(loss)	(2)	(2)	(4)	—	—	—
Foreign exchange impact and other	(30)	54	(77)	(4)	—	—
Total recognized in other comprehensive income	\$ 363	\$ (831)	\$ 93	\$ 87	\$ (133)	\$ (29)
Total recognized in net periodic benefit cost and other comprehensive income	\$ 395	\$ (655)	\$ 249	\$ 8	\$ (202)	\$ (103)
Weighted-average assumptions used to determine net periodic benefit costs						
Discount rate ^(c)	0.60 - 4.50 %	0.60 - 4.30 %	0.90 - 4.50%	3.70%	4.20%	4.40%
Expected long-term rate of return on plan assets ^(c)	0.70 - 5.50	0.70 - 6.00	0.80 - 6.50	4.00	5.00	5.75
Rate of compensation increase ^(c)	2.25 - 3.00	2.25 - 3.00	2.25 - 4.30	NA	NA	NA
Interest crediting rate ^(c)	1.81 - 4.90%	1.81 - 4.90%	1.56 - 4.90%	NA	NA	NA
Health care cost trend rate						
Assumed for next year	NA	NA	NA	5.00	5.00	5.50
Ultimate	NA	NA	NA	5.00	5.00	5.00
Year when rate will reach ultimate	NA	NA	NA	2018	2017	2017

(a) Effective January 1, 2018, benefits earned during the year are reported in compensation expense; all other components of net periodic defined benefit costs are reported within other expense in the Consolidated statements of income.

(b) Includes various defined benefit pension plans which are individually immaterial.

(c) The rate assumptions for the U.S. defined benefit pension plans are at the upper end of the range, except for the rate of compensation increase, which is 2.30% for both 2018 and 2017, and 3.50% for 2016.

Plan assumptions

The Firm's expected long-term rate of return for defined benefit pension and OPEB plan assets is a blended weighted average, by asset allocation of the projected long-term returns for the various asset classes, taking into consideration local market conditions and the specific allocation of plan assets. Returns on asset classes are developed using a forward-looking approach and are not strictly based on historical returns. Consideration is also given to current market conditions and the short-term portfolio mix of each plan.

The discount rate used in determining the benefit obligation under the U.S. defined benefit pension and OPEB plans was provided by the Firm's actuaries. This rate was selected by reference to the yields on portfolios of bonds with maturity dates and coupons that closely match each of the plan's projected cash flows. The discount rate for the U.K. defined benefit pension plan represents a rate of appropriate duration from the analysis of yield curves provided by the Firm's actuaries.

At December 31, 2018, the Firm increased the discount rates used to determine its benefit obligations for the U.S. defined benefit pension and OPEB plans in light of current

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market interest rates, which will decrease expense by approximately \$20 million in 2019. The 2019 expected long-term rate of return on U.S. defined benefit pension plan assets and U.S. OPEB plan assets are 5.50% and 4.30%, respectively. As of December 31, 2018, the interest crediting rate assumption was 4.90%.

The following table represents the effect of a 25-basis point decline in the two listed rates below on estimated 2019 defined benefit pension and OPEB plan expense, as well as the effect on the postretirement benefit obligations.

(in millions)	Defined benefit pension and OPEB plan expense	Benefit obligation
Expected long-term rate of return	\$ 51	NA
Discount rate	\$ 50	\$ 490

Investment strategy and asset allocation

The assets of the Firm's defined benefit pension plans are held in various trusts and are invested in well-diversified portfolios of equity and fixed income securities, cash and cash equivalents, and alternative investments. The trust-owned assets of the Firm's U.S. OPEB plan are invested primarily in fixed income securities. COLI policies used to defray the cost of the Firm's U.S. OPEB plan are invested in separate accounts of an insurance company and are allocated to investments intended to replicate equity and fixed income indices.

The investment policies for the assets of the Firm's defined benefit pension plans are to optimize the risk-return relationship as appropriate to the needs and goals of each plan using a global portfolio of various asset classes diversified by market segment, economic sector, and issuer. Assets are managed by a combination of internal and external investment managers. The Firm regularly reviews the asset allocations and asset managers, as well as other factors that impact the portfolios, which are rebalanced when deemed necessary.

Investments held by the plans include financial instruments which are exposed to various risks such as interest rate, market and credit risks. Exposure to a concentration of credit risk is mitigated by the broad diversification of both U.S. and non-U.S. investment instruments. Additionally, the investments in each of the collective investment funds and/or registered investment companies are further diversified into various financial instruments. As of December 31, 2018, assets held by the Firm's defined benefit pension and OPEB plans do not include JPMorgan Chase common stock, except through indirect exposures through investments in third-party stock-index funds. The plans hold investments in funds that are sponsored or managed by affiliates of JPMorgan Chase in the amount of \$3.7 billion and \$6.0 billion, as of December 31, 2018 and 2017, respectively.

The following table presents the weighted-average asset allocation of the fair values of total plan assets at December 31 for the years indicated, as well as the respective approved asset allocation ranges by asset class.

December 31,	Defined benefit pension plans ^(a)			OPEB plan ^(d)		
	Asset Allocation	% of plan assets		Asset Allocation	% of plan assets	
		2018	2017		2018	2017
Asset class						
Debt securities ^(b)	27-100%	48%	42%	30-70%	61%	61%
Equity securities	10-45	37	42	30-70	39	39
Real estate	0-10	2	3	–	–	–
Alternatives ^(c)	0-35	13	13	–	–	–
Total	100%	100%	100%	100%	100%	100%

(a) Represents the U.S. defined benefit pension plan only, as that is the most significant plan.

(b) Debt securities primarily includes cash and cash equivalents, corporate debt, U.S. federal, state, local and non-U.S. government, and mortgage-backed securities.

(c) Alternatives primarily include limited partnerships.

(d) Represents the U.S. OPEB plan only, as the U.K. OPEB plan is unfunded.

Fair value measurement of the plans' assets and liabilities

For information on fair value measurements, including descriptions of level 1, 2, and 3 of the fair value hierarchy and the valuation methods employed by the Firm, refer to Note 2.

Pension and OPEB plan assets and liabilities measured at fair value

December 31, (in millions)	Defined benefit pension plans							
	2018				2017			
	Level 1	Level 2	Level 3	Total fair value	Level 1	Level 2	Level 3	Total fair value
Cash and cash equivalents	\$ 343	\$ 1	\$ –	\$ 344	\$ 173	\$ 1	\$ –	\$ 174
Equity securities	5,342	162	2	5,506	6,407	194	2	6,603
Mutual funds	–	–	–	–	325	–	–	325
Collective investment funds ^(a)	161	–	–	161	778	–	–	778
Limited partnerships ^(b)	40	–	–	40	60	–	–	60
Corporate debt securities ^(c)	–	3,540	3	3,543	–	2,644	4	2,648
U.S. federal, state, local and non-U.S. government debt securities	1,191	743	–	1,934	1,096	784	–	1,880
Mortgage-backed securities	82	272	3	357	92	100	2	194
Derivative receivables	–	143	–	143	–	203	–	203
Other ^(d)	885	80	302	1,267	2,353	60	302	2,715
Total assets measured at fair value^(e)	\$ 8,044	\$ 4,941	\$ 310	\$ 13,295	\$ 11,284	\$ 3,986	\$ 310	\$ 15,580
Derivative payables	\$ –	\$ (96)	\$ –	\$ (96)	\$ –	\$ (141)	\$ –	\$ (141)
Total liabilities measured at fair value^(e)	\$ –	\$ (96)	\$ –	\$ (96)	\$ –	\$ (141)	\$ –	\$ (141)

(a) At December 31, 2018 and 2017, collective investment funds primarily included a mix of short-term investment funds, U.S. and non-U.S. equity investments (including index) and real estate funds.

(b) Unfunded commitments to purchase limited partnership investments for the plans were \$521 million and \$605 million for 2018 and 2017, respectively.

(c) Corporate debt securities include debt securities of U.S. and non-U.S. corporations.

(d) Other consists primarily of mutual funds, money market funds and participating and non-participating annuity contracts. Mutual funds and money market funds are primarily classified within level 1 of the fair value hierarchy given they are valued using market observable prices. Participating and non-participating annuity contracts are classified within level 3 of the fair value hierarchy due to a lack of market mechanisms for transferring each policy and surrender restrictions.

(e) At December 31, 2018 and 2017, excludes \$5.0 billion and \$4.4 billion of certain investments that are measured at fair value using the net asset value per share (or its equivalent) as a practical expedient, which are not required to be classified in the fair value hierarchy, \$340 million and \$377 million of defined benefit pension plan receivables for investments sold and dividends and interest receivables, \$479 million and \$561 million of defined benefit pension plan payables for investments purchased, and \$24 million and \$26 million of other liabilities, respectively.

The assets of the U.S. OPEB plan consisted of \$561 million and \$600 million in corporate debt securities, U.S. federal, state, local and non-U.S. government debt securities and other classified in level 1 and level 2 of the valuation hierarchy and in cash and cash equivalents classified in level 1 of the valuation hierarchy and \$2.1 billion and \$2.2 billion of COLI policies classified in level 3 of the valuation hierarchy at December 31, 2018 and 2017, respectively.

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Changes in level 3 fair value measurements using significant unobservable inputs

(in millions)	Fair value, Beginning balance	Actual return on plan assets		Purchases, sales and settlements, net	Transfers in and/or out of level 3	Fair value, Ending balance
		Realized gains/(losses)	Unrealized gains/(losses)			
Year ended December 31, 2018						
U.S. defined benefit pension plan Annuity contracts and other ^(a)	\$ 310	\$ —	\$ —	\$ (1)	\$ 1	\$ 310
U.S. OPEB plan COLI policies	\$ 2,157	\$ —	\$ (85)	\$ —	\$ —	\$ 2,072
Year ended December 31, 2017						
U.S. defined benefit pension plan Annuity contracts and other ^(a)	\$ 396	\$ —	\$ 1	\$ (87)	\$ —	\$ 310
U.S. OPEB plan COLI policies	\$ 1,957	\$ —	\$ 200	\$ —	\$ —	\$ 2,157

(a) Substantially all are participating and non-participating annuity contracts.

Estimated future benefit payments

The following table presents benefit payments expected to be paid, which include the effect of expected future service, for the years indicated. The OPEB medical and life insurance payments are net of expected retiree contributions.

Year ended December 31, (in millions)	Defined benefit pension plans	OPEB before Medicare Part D subsidy	Medicare Part D subsidy
2019	\$ 939	\$ 62	\$ 1
2020	932	60	1
2021	921	57	1
2022	920	55	1
2023	919	52	—
Years 2024–2028	4,529	223	2

Note 9 – Employee share-based incentives

Employee share-based awards

In 2018, 2017 and 2016, JPMorgan Chase granted long-term share-based awards to certain employees under its LTIP, as amended and restated effective May 19, 2015, and further amended and restated effective May 15, 2018. Under the terms of the LTIP, as of December 31, 2018, 86 million shares of common stock were available for issuance through May 2022. The LTIP is the only active plan under which the Firm is currently granting share-based incentive awards. In the following discussion, the LTIP, plus prior Firm plans and plans assumed as the result of acquisitions, are referred to collectively as the “LTI Plans,” and such plans constitute the Firm’s share-based incentive plans.

RSUs are awarded at no cost to the recipient upon their grant. Generally, RSUs are granted annually and vest at a rate of 50% after two years and 50% after three years and are converted into shares of common stock as of the vesting date. In addition, RSUs typically include full-career eligibility provisions, which allow employees to continue to vest upon voluntary termination based on age or service-related requirements, subject to post-employment and other restrictions. All RSU awards are subject to forfeiture until vested and contain clawback provisions that may result in cancellation under certain specified circumstances. Generally, RSUs entitle the recipient to receive cash payments equivalent to any dividends paid on the underlying common stock during the period the RSUs are outstanding and, as such, are considered participating securities as discussed in Note 22.

In January 2018, 2017 and 2016, the Firm’s Board of Directors approved the grant of performance share units (“PSUs”) to members of the Firm’s Operating Committee under the variable compensation program for performance years 2017, 2016 and 2015, respectively. PSUs are subject to the Firm’s achievement of specified performance criteria over a three-year period. The number of awards that vest can range from zero to 150% of the grant amount. The awards vest and are converted into shares of common stock in the quarter after the end of the performance period, which is generally three years. In addition, dividends are notionally reinvested in the Firm’s common stock and will be delivered only in respect of any earned shares.

Once the PSUs have vested, the shares of common stock that are delivered, after applicable tax withholding, must be held for an additional two-year period, typically for a total combined vesting and holding period of five years from the grant date.

Under the LTI Plans, stock options and stock appreciation rights (“SARs”) have generally been granted with an exercise price equal to the fair value of JPMorgan Chase’s common stock on the grant date. The Firm periodically grants employee stock options to individual employees. There were no material grants of stock options or SARs in 2018, 2017 and 2016. SARs generally expire ten years after the grant date.

The Firm separately recognizes compensation expense for each tranche of each award, net of estimated forfeitures, as if it were a separate award with its own vesting date. Generally, for each tranche granted, compensation expense is recognized on a straight-line basis from the grant date until the vesting date of the respective tranche, provided that the employees will not become full-career eligible during the vesting period. For awards with full-career eligibility provisions and awards granted with no future substantive service requirement, the Firm accrues the estimated value of awards expected to be awarded to employees as of the grant date without giving consideration to the impact of post-employment restrictions. For each tranche granted to employees who will become full-career eligible during the vesting period, compensation expense is recognized on a straight-line basis from the grant date until the earlier of the employee’s full-career eligibility date or the vesting date of the respective tranche.

The Firm’s policy for issuing shares upon settlement of employee share-based incentive awards is to issue either new shares of common stock or treasury shares. During 2018, 2017 and 2016, the Firm settled all of its employee share-based awards by issuing treasury shares.

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RSUs, PSUs, employee stock options and SARs activity

Generally, compensation expense for RSUs and PSUs is measured based on the number of units granted multiplied by the stock price at the grant date, and for employee stock options and SARs, is measured at the grant date using the Black-Scholes valuation model. Compensation expense for these awards is recognized in net income as described previously. The following table summarizes JPMorgan Chase's RSUs, PSUs, employee stock options and SARs activity for 2018.

Year ended December 31, 2018 (in thousands, except weighted-average data, and where otherwise stated)	RSUs/PSUs		Options/SARs			
	Number of units	Weighted-average grant date fair value	Number of awards	Weighted-average exercise price	Weighted-average remaining contractual life (in years)	Aggregate intrinsic value
Outstanding, January 1	72,733	\$ 66.36	17,493	\$ 40.76		
Granted	20,489	110.46	46	113.63		
Exercised or vested	(32,277)	58.97	(5,054)	39.65		
Forfeited	(2,136)	84.60	(1)	112.25		
Canceled	NA	NA	(21)	45.75		
Outstanding, December 31	58,809	\$ 85.04	12,463	\$ 41.46	2.4	\$ 702,815
Exercisable, December 31	NA	NA	12,449	41.37	2.4	702,815

The total fair value of RSUs that vested during the years ended December 31, 2018, 2017 and 2016, was \$3.6 billion, \$2.9 billion and \$2.2 billion, respectively. The total intrinsic value of options exercised during the years ended December 31, 2018, 2017 and 2016, was \$370 million, \$651 million and \$338 million, respectively.

Compensation expense

The Firm recognized the following noncash compensation expense related to its various employee share-based incentive plans in its Consolidated statements of income.

Year ended December 31, (in millions)	2018	2017	2016
Cost of prior grants of RSUs, PSUs and SARs that are amortized over their applicable vesting periods	\$ 1,241	\$ 1,125	\$ 1,046
Accrual of estimated costs of share-based awards to be granted in future periods including those to full-career eligible employees	1,081	945	894
Total noncash compensation expense related to employee share-based incentive plans	\$ 2,322	\$ 2,070	\$ 1,940

At December 31, 2018, approximately \$704 million (pretax) of compensation expense related to unvested awards had not yet been charged to net income. That cost is expected to be amortized into compensation expense over a weighted-average period of 1.6 years. The Firm does not capitalize any compensation expense related to share-based compensation awards to employees.

Cash flows and tax benefits

Effective January 1, 2016, the Firm adopted new accounting guidance related to employee share-based payments. As a result of the adoption of this new guidance, all excess tax benefits (including tax benefits from dividends or dividend equivalents) on share-based payment awards are recognized within income tax expense in the Consolidated statements of income. Income tax benefits related to share-based incentive arrangements recognized in the Firm's Consolidated statements of income for the years ended December 31, 2018, 2017 and 2016, were \$1.1 billion, \$1.0 billion and \$916 million, respectively.

The following table sets forth the cash received from the exercise of stock options under all share-based incentive arrangements, and the actual income tax benefit related to tax deductions from the exercise of the stock options.

Year ended December 31, (in millions)	2018	2017	2016
Cash received for options exercised	\$ 14	\$ 18	\$ 26
Tax benefit	75	190	70

Note 10 – Investment securities

Investment securities consist of debt securities that are classified as AFS or HTM. Debt securities classified as trading assets are discussed in Note 2. Predominantly all of the Firm's AFS and HTM securities are held by Treasury and CIO in connection with its asset-liability management activities. At December 31, 2018, the investment securities portfolio consisted of debt securities with an average credit rating of AA+ (based upon external ratings where available, and where not available, based primarily upon internal ratings which correspond to ratings as defined by S&P and Moody's). AFS securities are carried at fair value on the Consolidated balance sheets. Unrealized gains and losses, after any applicable hedge accounting adjustments, are reported as net increases or decreases to AOCI. The specific identification method is used to determine realized gains and losses on AFS securities, which are included in securities gains/(losses) on the Consolidated statements of income. HTM debt securities, which the Firm has the intent and ability to hold until maturity, are carried at amortized cost on the Consolidated balance sheets.

For both AFS and HTM debt securities, purchase discounts or premiums are generally amortized into interest income on a level-yield basis over the contractual life of the security. However, as a result of the adoption of the premium amortization accounting guidance in the first quarter of 2018, premiums on purchased callable debt securities must be amortized to the earliest call date for debt securities with call features that are explicit, noncontingent and callable at fixed prices and on preset dates. The guidance primarily impacts obligations of U.S. states and municipalities held in the Firm's investment securities portfolio. For additional information, refer to Note 23.

As permitted by the new hedge accounting guidance, the Firm also elected to transfer U.S. government agency MBS, commercial MBS, and obligations of U.S. states and municipalities with a carrying value of \$22.4 billion from HTM to AFS in the first quarter of 2018. The transfer of these investment securities resulted in the recognition of a net pretax unrealized gain of \$221 million within AOCI. This transfer was a noncash transaction. For additional information, refer to Notes 1, 5 and 23.

The amortized costs and estimated fair values of the investment securities portfolio were as follows for the dates indicated.

December 31, (in millions)	2018				2017			
	Amortized cost	Gross unrealized gains	Gross unrealized losses	Fair value	Amortized cost	Gross unrealized gains	Gross unrealized losses	Fair value
Available-for-sale securities								
Mortgage-backed securities:								
U.S. government agencies ^(a)	\$ 69,026	\$ 594	\$ 974	\$ 68,646	\$ 69,879	\$ 736	\$ 335	\$ 70,280
Residential:								
U.S.	5,877	79	31	5,925	8,193	185	14	8,364
Non-U.S.	2,529	72	6	2,595	2,882	122	1	3,003
Commercial	6,758	43	147	6,654	4,932	98	5	5,025
Total mortgage-backed securities	84,190	788	1,158	83,820	85,886	1,141	355	86,672
U.S. Treasury and government agencies	55,771	366	78	56,059	22,510	266	31	22,745
Obligations of U.S. states and municipalities	36,221	1,582	80	37,723	30,490	1,881	33	32,338
Certificates of deposit	75	–	–	75	59	–	–	59
Non-U.S. government debt securities	23,771	351	20	24,102	26,900	426	32	27,294
Corporate debt securities	1,904	23	9	1,918	2,657	101	1	2,757
Asset-backed securities:								
Collateralized loan obligations	19,612	1	176	19,437	20,928	69	1	20,996
Other	7,225	57	22	7,260	8,764	77	24	8,817
Total available-for-sale debt securities	228,769	3,168	1,543	230,394	198,194	3,961	477	201,678
Available-for-sale equity securities ^(b)	–	–	–	–	547	–	–	547
Total available-for-sale securities	228,769	3,168	1,543	230,394	198,741	3,961	477	202,225
Held-to-maturity securities								
Mortgage-backed securities								
U.S. government agencies ^(c)	26,610	134	200	26,544	27,577	558	40	28,095
Commercial	–	–	–	–	5,783	1	74	5,710
Total mortgage-backed securities	26,610	134	200	26,544	33,360	559	114	33,805
Obligations of U.S. states and municipalities	4,824	105	15	4,914	14,373	554	80	14,847
Total held-to-maturity securities	31,434	239	215	31,458	47,733	1,113	194	48,652
Total investment securities	\$ 260,203	\$ 3,407	\$ 1,758	\$ 261,852	\$ 246,474	\$ 5,074	\$ 671	\$ 250,877

Notes to consolidated financial statements

- (a) Includes total U.S. government-sponsored enterprise obligations with fair values of \$50.7 billion and \$45.8 billion for the years ended December 31, 2018 and 2017 respectively.
- (b) Effective January 1, 2018, the Firm adopted the recognition and measurement guidance. Equity securities that were previously reported as AFS securities were reclassified to other assets upon adoption.
- (c) Included total U.S. government-sponsored enterprise obligations with amortized cost of \$20.9 billion and \$22.0 billion at December 31, 2018 and 2017, respectively.

Investment securities impairment

The following tables present the fair value and gross unrealized losses for investment securities by aging category at December 31, 2018 and 2017.

December 31, 2018 (in millions)	Investment securities with gross unrealized losses					
	Less than 12 months		12 months or more		Total fair value	Total gross unrealized losses
	Fair value	Gross unrealized losses	Fair value	Gross unrealized losses		
Available-for-sale securities						
Mortgage-backed securities:						
U.S. government agencies	\$ 17,656	\$ 318	\$ 22,728	\$ 656	\$ 40,384	\$ 974
Residential:						
U.S.	623	4	1,445	27	2,068	31
Non-U.S.	907	5	165	1	1,072	6
Commercial	974	6	3,172	141	4,146	147
Total mortgage-backed securities	20,160	333	27,510	825	47,670	1,158
U.S. Treasury and government agencies	4,792	7	2,391	71	7,183	78
Obligations of U.S. states and municipalities	1,808	15	2,477	65	4,285	80
Certificates of deposit	75	—	—	—	75	—
Non-U.S. government debt securities	3,123	5	1,937	15	5,060	20
Corporate debt securities	478	8	37	1	515	9
Asset-backed securities:						
Collateralized loan obligations	18,681	176	—	—	18,681	176
Other	1,208	6	2,354	16	3,562	22
Total available-for-sale securities	50,325	550	36,706	993	87,031	1,543
Held-to-maturity securities						
Mortgage-backed securities						
U.S. government agencies	4,385	23	7,082	177	11,467	200
Commercial	—	—	—	—	—	—
Total mortgage-backed securities	4,385	23	7,082	177	11,467	200
Obligations of U.S. states and municipalities	12	—	1,114	15	1,126	15
Total held-to-maturity securities	4,397	23	8,196	192	12,593	215
Total investment securities with gross unrealized losses	\$ 54,722	\$ 573	\$ 44,902	\$ 1,185	\$ 99,624	\$ 1,758

December 31, 2017 (in millions)	Investment securities with gross unrealized losses					
	Less than 12 months		12 months or more		Total fair value	Total gross unrealized losses
	Fair value	Gross unrealized losses	Fair value	Gross unrealized losses		
Available-for-sale securities						
Mortgage-backed securities:						
U.S. government agencies	\$ 36,037	\$ 139	\$ 7,711	\$ 196	\$ 43,748	\$ 335
Residential:						
U.S.	1,112	5	596	9	1,708	14
Non-U.S.	—	—	266	1	266	1
Commercial	528	4	335	1	863	5
Total mortgage-backed securities	37,677	148	8,908	207	46,585	355
U.S. Treasury and government agencies	1,834	11	373	20	2,207	31
Obligations of U.S. states and municipalities	949	7	1,652	26	2,601	33
Certificates of deposit	—	—	—	—	—	—
Non-U.S. government debt securities	6,500	15	811	17	7,311	32
Corporate debt securities	—	—	52	1	52	1
Asset-backed securities:						
Collateralized loan obligations	—	—	276	1	276	1
Other	3,521	20	720	4	4,241	24
Total available-for-sale securities	50,481	201	12,792	276	63,273	477
Held-to-maturity securities						
Mortgage-backed securities						
U.S. government agencies	4,070	38	205	2	4,275	40
Commercial	3,706	41	1,882	33	5,588	74
Total mortgage-backed securities	7,776	79	2,087	35	9,863	114
Obligations of U.S. states and municipalities	584	9	2,131	71	2,715	80
Total held-to-maturity securities	8,360	88	4,218	106	12,578	194
Total investment securities with gross unrealized losses	\$ 58,841	\$ 289	\$ 17,010	\$ 382	\$ 75,851	\$ 671

Other-than-temporary impairment

AFS and HTM debt securities in unrealized loss positions are analyzed as part of the Firm's ongoing assessment of OTTI. The Firm considers a decline in fair value to be other-than-temporary when the Firm does not expect to recover the entire amortized cost basis of the security.

For AFS debt securities, the Firm recognizes OTTI losses in earnings if the Firm has the intent to sell the debt security, or if it is more likely than not that the Firm will be required to sell the debt security before recovery of its amortized cost basis. In these circumstances the impairment loss is equal to the full difference between the amortized cost basis and the fair value of the securities.

For debt securities in an unrealized loss position that the Firm has the intent and ability to hold, the securities are evaluated to determine if a credit loss exists. In the event of a credit loss, only the amount of impairment associated with the credit loss is recognized in income. Amounts relating to factors other than credit losses are recorded in OCI.

Factors considered in evaluating potential OTTI include adverse conditions specifically related to the industry, geographic area or financial condition of the issuer or underlying collateral of a security; payment structure of the

security; changes to the rating of the security by a rating agency; the volatility of the fair value changes; and the Firm's intent and ability to hold the security until recovery.

The Firm's cash flow evaluations take into account the factors noted above and expectations of relevant market and economic data as of the end of the reporting period. When assessing securities issued in a securitization for OTTI, the Firm estimates cash flows considering underlying loan-level data and structural features of the securitization, such as subordination, excess spread, overcollateralization or other forms of credit enhancement, and compares the losses projected for the underlying collateral ("pool losses") against the level of credit enhancement in the securitization structure to determine whether these features are sufficient to absorb the pool losses, or whether a credit loss exists. The Firm also performs other analyses to support its cash flow projections, such as first-loss analyses or stress scenarios.

For beneficial interests in securitizations that are rated below "AA" at their acquisition, or that can be contractually prepaid or otherwise settled in such a way that the Firm would not recover substantially all of its recorded investment, the Firm considers an impairment to be other-than-temporary when there is an adverse change in expected cash flows.

Notes to consolidated financial statements

As a result of the adoption of the recognition and measurement guidance in the first quarter of 2018, equity securities are no longer permitted to be classified as AFS. For additional information, refer to Note 1. Additionally, the Firm did not recognize any OTTI for AFS equity securities for the years ended December 31, 2017 and 2016.

For the year ended December 31, 2018, the Firm recognized \$22 million of unrealized losses as OTTI on securities it intended to sell and subsequently sold during the year. The Firm does not intend to sell any of the remaining investment securities with an unrealized loss in AOCI as of December 31, 2018, and it is not likely that the Firm will be required to sell these securities before recovery of their amortized cost basis. Further, the Firm did not recognize any credit-related OTTI losses during the year ended December 31, 2018. Accordingly, the Firm believes that the investment securities with an unrealized loss in AOCI as of December 31, 2018, are not other-than-temporarily impaired.

Investment securities gains and losses

The following table presents realized gains and losses and OTTI from AFS securities that were recognized in income.

Year ended December 31, (in millions)	2018	2017	2016
Realized gains	\$ 211	\$ 1,013	\$ 401
Realized losses	(606)	(1,072)	(232)
OTTI losses	–	(7)	(28)
Net investment securities gains/ (losses)	(395)	(66)	141
OTTI losses			
Credit-related losses recognized in income	–	–	(1)
Investment securities the Firm intends to sell ^(a)	–	(7)	(27)
Total OTTI losses recognized in income	\$ –	\$ (7)	\$ (28)

(a) Excludes realized losses on securities sold of \$22 million, \$6 million and \$24 million for the years ended December 31, 2018, 2017 and 2016, respectively, that had been previously reported as an OTTI loss due to the intention to sell the securities.

Changes in the credit loss component of credit-impaired debt securities

The cumulative credit loss component, including any changes therein, of OTTI losses that have been recognized in income related to AFS securities was not material as of and during the years ended December 31, 2018, 2017 and 2016.

Contractual maturities and yields

The following table presents the amortized cost and estimated fair value at December 31, 2018, of JPMorgan Chase's investment securities portfolio by contractual maturity.

By remaining maturity December 31, 2018 (in millions)	Due in one year or less	Due after one year through five years	Due after five years through 10 years	Due after 10 years ^(c)	Total
Available-for-sale securities					
Mortgage-backed securities ^(a)					
Amortized cost	\$ 519	\$ 77	\$ 7,574	\$ 76,020	\$ 84,190
Fair value	520	77	7,616	75,607	83,820
Average yield ^(b)	2.02%	3.50%	3.48%	3.52%	3.51%
U.S. Treasury and government agencies					
Amortized cost	\$ 22,439	\$ 17,945	\$ 9,618	\$ 5,769	\$ 55,771
Fair value	22,444	18,090	9,588	5,937	56,059
Average yield ^(b)	2.42%	2.90%	2.60%	3.05%	2.67%
Obligations of U.S. states and municipalities					
Amortized cost	\$ 177	\$ 617	\$ 2,698	\$ 32,729	\$ 36,221
Fair value	176	629	2,790	34,128	37,723
Average yield ^(b)	1.94%	4.30%	5.26%	5.02%	5.01%
Certificates of deposit					
Amortized cost	\$ 75	\$ —	\$ —	\$ —	\$ 75
Fair value	75	—	—	—	75
Average yield ^(b)	0.49%	—%	—%	—%	0.49%
Non-U.S. government debt securities					
Amortized cost	\$ 5,604	\$ 13,117	\$ 5,050	\$ —	\$ 23,771
Fair value	5,606	13,314	5,182	—	24,102
Average yield ^(b)	3.25%	1.95%	1.33%	—%	2.13%
Corporate debt securities					
Amortized cost	\$ 22	\$ 950	\$ 792	\$ 140	\$ 1,904
Fair value	22	964	792	140	1,918
Average yield ^(b)	4.05%	4.64%	4.56%	4.74%	4.60%
Asset-backed securities					
Amortized cost	\$ —	\$ 3,222	\$ 4,615	\$ 19,000	\$ 26,837
Fair value	—	3,208	4,592	18,897	26,697
Average yield ^(b)	—%	2.85%	3.12%	3.19%	3.14%
Total available-for-sale securities					
Amortized cost	\$ 28,836	\$ 35,928	\$ 30,347	\$ 133,658	\$ 228,769
Fair value	28,843	36,282	30,560	134,709	230,394
Average yield ^(b)	2.57%	2.62%	2.98%	3.82%	3.36%
Held-to-maturity securities					
Mortgage-backed securities ^(a)					
Amortized Cost	\$ —	\$ —	\$ 3,125	\$ 23,485	\$ 26,610
Fair value	—	—	3,141	23,403	26,544
Average yield ^(b)	—%	—%	3.53%	3.34%	3.36%
Obligations of U.S. states and municipalities					
Amortized cost	\$ —	\$ —	\$ 20	\$ 4,804	\$ 4,824
Fair value	—	—	20	4,894	4,914
Average yield ^(b)	—%	—%	3.93%	4.12%	4.12%
Total held-to-maturity securities					
Amortized cost	\$ —	\$ —	\$ 3,145	\$ 28,289	\$ 31,434
Fair value	—	—	3,161	28,297	31,458
Average yield ^(b)	—%	—%	3.53%	3.47%	3.48%

(a) As of December 31, 2018, mortgage-backed securities issued by Fannie Mae exceeded 10% of JPMorgan Chase's total stockholders' equity; both the amortized cost and fair value of such securities was \$52.3 billion.

(b) Average yield is computed using the effective yield of each security owned at the end of the period, weighted based on the amortized cost of each security. The effective yield considers the contractual coupon, amortization of premiums and accretion of discounts, and the effect of related hedging derivatives. Taxable-equivalent amounts are used where applicable. The effective yield excludes unscheduled principal prepayments; and accordingly, actual maturities of securities may differ from their contractual or expected maturities as certain securities may be prepaid.

(c) Substantially all of the Firm's U.S. residential MBS and collateralized mortgage obligations are due in 10 years or more, based on contractual maturity. The estimated weighted-average life, which reflects anticipated future prepayments, is approximately 7 years for agency residential MBS, 3 years for agency residential collateralized mortgage obligations and 2 years for nonagency residential collateralized mortgage obligations.

Note 11 – Securities financing activities

JPMorgan Chase enters into resale, repurchase, securities borrowed and securities loaned agreements (collectively, “securities financing agreements”) primarily to finance the Firm’s inventory positions, acquire securities to cover short sales, accommodate customers’ financing needs, settle other securities obligations and to deploy the Firm’s excess cash.

Securities financing agreements are treated as collateralized financings on the Firm’s Consolidated balance sheets. Resale and repurchase agreements are generally carried at the amounts at which the securities will be subsequently sold or repurchased. Securities borrowed and securities loaned agreements are generally carried at the amount of cash collateral advanced or received. Where appropriate under applicable accounting guidance, securities financing agreements with the same counterparty are reported on a net basis. For further discussion of the offsetting of assets and liabilities, refer to Note 1. Fees received and paid in connection with securities financing agreements are recorded over the life of the agreement in interest income and interest expense on the Consolidated statements of income.

The Firm has elected the fair value option for certain securities financing agreements. For further information regarding the fair value option, refer to Note 3. The securities financing agreements for which the fair value option has been elected are reported within securities purchased under resale agreements, securities loaned or sold under repurchase agreements, and securities borrowed on the Consolidated balance sheets. Generally, for agreements carried at fair value, current-period interest accruals are recorded within interest income and interest expense, with changes in fair value reported in principal transactions revenue. However, for financial instruments containing embedded derivatives that would be separately accounted for in accordance with accounting guidance for hybrid instruments, all changes in fair value, including any interest elements, are reported in principal transactions revenue.

Securities financing agreements expose the Firm primarily to credit and liquidity risk. To manage these risks, the Firm monitors the value of the underlying securities (predominantly high-quality securities collateral, including government-issued debt and agency MBS) that it has received from or provided to its counterparties compared to the value of cash proceeds and exchanged collateral, and either requests additional collateral or returns securities or collateral when appropriate. Margin levels are initially established based upon the counterparty, the type of underlying securities, and the permissible collateral, and are monitored on an ongoing basis.

In resale and securities borrowed agreements, the Firm is exposed to credit risk to the extent that the value of the securities received is less than initial cash principal advanced and any collateral amounts exchanged. In repurchase and securities loaned agreements, credit risk exposure arises to the extent that the value of underlying securities advanced exceeds the value of the initial cash principal received, and any collateral amounts exchanged.

Additionally, the Firm typically enters into master netting agreements and other similar arrangements with its counterparties, which provide for the right to liquidate the underlying securities and any collateral amounts exchanged in the event of a counterparty default. It is also the Firm’s policy to take possession, where possible, of the securities underlying resale and securities borrowed agreements. For further information regarding assets pledged and collateral received in securities financing agreements, refer to Note 28.

As a result of the Firm’s credit risk mitigation practices with respect to resale and securities borrowed agreements as described above, the Firm did not hold any reserves for credit impairment with respect to these agreements as of December 31, 2018 and 2017.

The table below summarizes the gross and net amounts of the Firm's securities financing agreements, as of December 31, 2018 and 2017. When the Firm has obtained an appropriate legal opinion with respect to the master netting agreement with a counterparty and where other relevant netting criteria under U.S. GAAP are met, the Firm nets, on the Consolidated balance sheets, the balances outstanding under its securities financing agreements with the same counterparty. In addition, the Firm exchanges securities and/or cash collateral with its counterparties; this collateral also reduces the economic exposure with the counterparty. Such collateral, along with securities financing balances that do not meet all these relevant netting criteria under U.S. GAAP, is presented as "Amounts not nettable on the Consolidated balance sheets," and reduces the "Net amounts" presented below, if the Firm has an appropriate legal opinion with respect to the master netting agreement with the counterparty. Where a legal opinion has not been either sought or obtained, the securities financing balances are presented gross in the "Net amounts" below, and related collateral does not reduce the amounts presented.

2018					
December 31, (in millions)	Gross amounts	Amounts netted on the Consolidated balance sheets	Amounts presented on the Consolidated balance sheets ^(b)	Amounts not nettable on the Consolidated balance sheets ^(c)	Net amounts ^(d)
Assets					
Securities purchased under resale agreements	\$ 691,116	\$ (369,612)	\$ 321,504	\$ (308,854)	\$ 12,650
Securities borrowed	132,955	(20,960)	111,995	(79,747)	32,248
Liabilities					
Securities sold under repurchase agreements	\$ 541,587	\$ (369,612)	\$ 171,975	\$ (149,125)	\$ 22,850
Securities loaned and other ^(a)	33,700	(20,960)	12,740	(12,358)	382
2017					
December 31, (in millions)	Gross amounts	Amounts netted on the Consolidated balance sheets	Amounts presented on the Consolidated balance sheets ^(b)	Amounts not nettable on the Consolidated balance sheets ^(c)	Net amounts ^(d)
Assets					
Securities purchased under resale agreements	\$ 448,608	\$ (250,505)	\$ 198,103	\$ (188,502)	\$ 9,601
Securities borrowed	113,926	(8,814)	105,112	(76,805)	28,307
Liabilities					
Securities sold under repurchase agreements	\$ 398,218	\$ (250,505)	\$ 147,713	\$ (129,178)	\$ 18,535
Securities loaned and other ^(a)	27,228	(8,814)	18,414	(18,151)	263

- (a) Includes securities-for-securities lending agreements of \$3.3 billion and \$9.2 billion at December 31, 2018 and 2017, respectively, accounted for at fair value, where the Firm is acting as lender. These amounts are presented within accounts payable and other liabilities in the Consolidated balance sheets.
- (b) Includes securities financing agreements accounted for at fair value. At December 31, 2018 and 2017, included securities purchased under resale agreements of \$13.2 billion and \$14.7 billion, respectively; securities sold under repurchase agreements of \$935 million and \$697 million, respectively; and securities borrowed of \$5.1 billion and \$3.0 billion, respectively. There were no securities loaned accounted for at fair value in either period.
- (c) In some cases, collateral exchanged with a counterparty exceeds the net asset or liability balance with that counterparty. In such cases, the amounts reported in this column are limited to the related net asset or liability with that counterparty.
- (d) Includes securities financing agreements that provide collateral rights, but where an appropriate legal opinion with respect to the master netting agreement has not been either sought or obtained. At December 31, 2018 and 2017, included \$7.9 billion and \$7.5 billion, respectively, of securities purchased under resale agreements; \$30.3 billion and \$25.5 billion, respectively, of securities borrowed; \$21.5 billion and \$16.5 billion, respectively, of securities sold under repurchase agreements; and \$25 million and \$29 million, respectively, of securities loaned and other.

Notes to consolidated financial statements

The tables below present as of December 31, 2018 and 2017 the types of financial assets pledged in securities financing agreements and the remaining contractual maturity of the securities financing agreements.

December 31, (in millions)	Gross liability balance			
	2018		2017	
	Securities sold under repurchase agreements	Securities loaned and other	Securities sold under repurchase agreements	Securities loaned and other
Mortgage-backed securities:				
U.S. government agencies	\$ 28,811	\$ —	\$ 13,100	\$ —
Residential - nonagency	2,165	—	2,972	—
Commercial - nonagency	1,390	—	1,594	—
U.S. Treasury and government agencies	323,078	69	177,581	14
Obligations of U.S. states and municipalities	1,150	—	1,557	—
Non-U.S. government debt	154,900	4,313	170,196	2,485
Corporate debt securities	13,898	428	14,231	287
Asset-backed securities	3,867	—	3,508	—
Equity securities	12,328	28,890	13,479	24,442
Total	\$ 541,587	\$ 33,700	\$ 398,218	\$ 27,228

2018 (in millions)	Remaining contractual maturity of the agreements				
	Overnight and continuous	Up to 30 days	30 - 90 days	Greater than 90 days	Total
Total securities sold under repurchase agreements	\$ 247,579	\$ 174,971	\$ 71,637	\$ 47,400	\$ 541,587
Total securities loaned and other	28,402	997	2,132	2,169	33,700

2017 (in millions)	Remaining contractual maturity of the agreements				
	Overnight and continuous	Up to 30 days	30 - 90 days	Greater than 90 days	Total
Total securities sold under repurchase agreements	\$ 142,185 ^(a)	\$ 180,674 ^(a)	\$ 41,611	\$ 33,748	\$ 398,218
Total securities loaned and other	22,876	375	2,328	1,649	27,228

(a) The prior period amounts have been revised to conform with the current period presentation.

Transfers not qualifying for sale accounting

At December 31, 2018 and 2017, the Firm held \$701 million and \$1.5 billion, respectively, of financial assets for which the rights have been transferred to third parties; however, the transfers did not qualify as a sale in accordance with U.S. GAAP. These transfers have been recognized as collateralized financing transactions. The transferred assets are recorded in trading assets and loans, and the corresponding liabilities are recorded predominantly in short-term borrowings on the Consolidated balance sheets.

Note 12 – Loans

Loan accounting framework

The accounting for a loan depends on management's strategy for the loan, and on whether the loan was credit-impaired at the date of acquisition. The Firm accounts for loans based on the following categories:

- Originated or purchased loans held-for-investment (i.e., "retained"), other than PCI loans
- Loans held-for-sale
- Loans at fair value
- PCI loans held-for-investment

The following provides a detailed accounting discussion of these loan categories:

Loans held-for-investment (other than PCI loans)

Originated or purchased loans held-for-investment, other than PCI loans, are recorded at the principal amount outstanding, net of the following: charge-offs; interest applied to principal (for loans accounted for on the cost recovery method); unamortized discounts and premiums; and net deferred loan fees or costs. Credit card loans also include billed finance charges and fees net of an allowance for uncollectible amounts.

Interest income

Interest income on performing loans held-for-investment, other than PCI loans, is accrued and recognized as interest income at the contractual rate of interest. Purchase price discounts or premiums, as well as net deferred loan fees or costs, are amortized into interest income over the contractual life of the loan as an adjustment of yield.

Nonaccrual loans

Nonaccrual loans are those on which the accrual of interest has been suspended. Loans (other than credit card loans and certain consumer loans insured by U.S. government agencies) are placed on nonaccrual status and considered nonperforming when full payment of principal and interest is not expected, regardless of delinquency status, or when principal and interest has been in default for a period of 90 days or more, unless the loan is both well-secured and in the process of collection. A loan is determined to be past due when the minimum payment is not received from the borrower by the contractually specified due date or for certain loans (e.g., residential real estate loans), when a monthly payment is due and unpaid for 30 days or more. Finally, collateral-dependent loans are typically maintained on nonaccrual status.

On the date a loan is placed on nonaccrual status, all interest accrued but not collected is reversed against interest income. In addition, the amortization of deferred amounts is suspended. Interest income on nonaccrual loans may be recognized as cash interest payments are received (i.e., on a cash basis) if the recorded loan balance is deemed fully collectible; however, if there is doubt regarding the ultimate collectibility of the recorded loan balance, all interest cash receipts are applied to reduce the

carrying value of the loan (the cost recovery method). For consumer loans, application of this policy typically results in the Firm recognizing interest income on nonaccrual consumer loans on a cash basis.

A loan may be returned to accrual status when repayment is reasonably assured and there has been demonstrated performance under the terms of the loan or, if applicable, the terms of the restructured loan.

As permitted by regulatory guidance, credit card loans are generally exempt from being placed on nonaccrual status; accordingly, interest and fees related to credit card loans continue to accrue until the loan is charged off or paid in full. The Firm separately establishes an allowance, which reduces loans and is charged to interest income, for the estimated uncollectible portion of accrued and billed interest and fee income on credit card loans.

Allowance for loan losses

The allowance for loan losses represents the estimated probable credit losses inherent in the held-for-investment loan portfolio at the balance sheet date and is recognized on the balance sheet as a contra asset, which brings the recorded investment to the net carrying value. Changes in the allowance for loan losses are recorded in the provision for credit losses on the Firm's Consolidated statements of income. Refer to Note 13 for further information on the Firm's accounting policies for the allowance for loan losses.

Charge-offs

Consumer loans, other than risk-rated business banking and auto loans, and PCI loans, are generally charged off or charged down to the net realizable value of the underlying collateral (i.e., fair value less costs to sell), with an offset to the allowance for loan losses, upon reaching specified stages of delinquency in accordance with standards established by the FFIEC. Residential real estate loans and non-modified credit card loans are generally charged off no later than 180 days past due. Scored auto and modified credit card loans are charged off no later than 120 days past due.

Certain consumer loans will be charged off or charged down to their net realizable value earlier than the FFIEC charge-off standards in certain circumstances as follows:

- Loans modified in a TDR that are determined to be collateral-dependent.
- Loans to borrowers who have experienced an event that suggests a loss is either known or highly certain are subject to accelerated charge-off standards (e.g., residential real estate and auto loans are charged off within 60 days of receiving notification of a bankruptcy filing).
- Auto loans upon repossession of the automobile.

Other than in certain limited circumstances, the Firm typically does not recognize charge-offs on government-guaranteed loans.

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Wholesale loans, risk-rated business banking loans and risk-rated auto loans are charged off when it is highly certain that a loss has been realized, including situations where a loan is determined to be both impaired and collateral-dependent. The determination of whether to recognize a charge-off includes many factors, including the prioritization of the Firm's claim in bankruptcy, expectations of the workout/restructuring of the loan and valuation of the borrower's equity or the loan collateral.

When a loan is charged down to the estimated net realizable value, the determination of the fair value of the collateral depends on the type of collateral (e.g., securities, real estate). In cases where the collateral is in the form of liquid securities, the fair value is based on quoted market prices or broker quotes. For illiquid securities or other financial assets, the fair value of the collateral is estimated using a discounted cash flow model.

For residential real estate loans, collateral values are based upon external valuation sources. When it becomes likely that a borrower is either unable or unwilling to pay, the Firm utilizes a broker's price opinion, appraisal and/or an automated valuation model of the home based on an exterior-only valuation ("exterior opinions"), which is then updated at least every twelve months, or more frequently depending on various market factors. As soon as practicable after the Firm receives the property in satisfaction of a debt (e.g., by taking legal title or physical possession), the Firm generally obtains an appraisal based on an inspection that includes the interior of the home ("interior appraisals"). Exterior opinions and interior appraisals are discounted based upon the Firm's experience with actual liquidation values as compared with the estimated values provided by exterior opinions and interior appraisals, considering state-specific factors.

For commercial real estate loans, collateral values are generally based on appraisals from internal and external valuation sources. Collateral values are typically updated every six to twelve months, either by obtaining a new appraisal or by performing an internal analysis, in accordance with the Firm's policies. The Firm also considers both borrower- and market-specific factors, which may result in obtaining appraisal updates or broker price opinions at more frequent intervals.

Loans held-for-sale

Held-for-sale loans are measured at the lower of cost or fair value, with valuation changes recorded in noninterest revenue. For consumer loans, the valuation is performed on a portfolio basis. For wholesale loans, the valuation is performed on an individual loan basis.

Interest income on loans held-for-sale is accrued and recognized based on the contractual rate of interest.

Loan origination fees or costs and purchase price discounts or premiums are deferred in a contra loan account until the related loan is sold. The deferred fees or costs and discounts or premiums are an adjustment to the basis of the loan and therefore are included in the periodic determination of the lower of cost or fair value adjustments and/or the gain or loss recognized at the time of sale.

Held-for-sale loans are subject to the nonaccrual policies described above.

Because held-for-sale loans are recognized at the lower of cost or fair value, the Firm's allowance for loan losses and charge-off policies do not apply to these loans.

Loans at fair value

Loans used in a market-making strategy or risk managed on a fair value basis are measured at fair value, with changes in fair value recorded in noninterest revenue.

Interest income on these loans is accrued and recognized based on the contractual rate of interest. Changes in fair value are recognized in noninterest revenue. Loan origination fees are recognized upfront in noninterest revenue. Loan origination costs are recognized in the associated expense category as incurred.

Because these loans are recognized at fair value, the Firm's allowance for loan losses and charge-off policies do not apply to these loans. However, loans at fair value are subject to the nonaccrual policies described above.

Refer to Note 3 for further information on the Firm's elections of fair value accounting under the fair value option. Refer to Note 2 and Note 3 for further information on loans carried at fair value and classified as trading assets.

PCI loans

PCI loans held-for-investment are initially measured at fair value. PCI loans have evidence of credit deterioration since the loan's origination date and therefore it is probable, at acquisition, that all contractually required payments will not be collected. Because PCI loans are initially measured at fair value, which includes an estimate of future credit losses, no allowance for loan losses related to PCI loans is recorded at the acquisition date. Refer to page 231 of this Note for information on accounting for PCI loans subsequent to their acquisition.

Loan classification changes

Loans in the held-for-investment portfolio that management decides to sell are transferred to the held-for-sale portfolio at the lower of cost or fair value on the date of transfer. Credit-related losses are charged against the allowance for loan losses; non-credit related losses such as those due to changes in interest rates or foreign currency exchange rates are recognized in noninterest revenue.

In the event that management decides to retain a loan in the held-for-sale portfolio, the loan is transferred to the held-for-investment portfolio at the lower of cost or fair value on the date of transfer. These loans are subsequently assessed for impairment based on the Firm's allowance methodology. For a further discussion of the methodologies used in establishing the Firm's allowance for loan losses, refer to Note 13.

Loan modifications

The Firm seeks to modify certain loans in conjunction with its loss-mitigation activities. Through the modification, JPMorgan Chase grants one or more concessions to a borrower who is experiencing financial difficulty in order to minimize the Firm's economic loss and avoid foreclosure or repossession of the collateral, and to ultimately maximize payments received by the Firm from the borrower. The concessions granted vary by program and by borrower-specific characteristics, and may include interest rate reductions, term extensions, payment deferrals, principal forgiveness, or the acceptance of equity or other assets in lieu of payments.

Such modifications are accounted for and reported as TDRs. A loan that has been modified in a TDR is generally considered to be impaired until it matures, is repaid, or is otherwise liquidated, regardless of whether the borrower performs under the modified terms. In certain limited cases, the effective interest rate applicable to the modified loan is at or above the current market rate at the time of the restructuring. In such circumstances, and assuming that the loan subsequently performs under its modified terms and the Firm expects to collect all contractual principal and interest cash flows, the loan is disclosed as impaired and as a TDR only during the year of the modification; in subsequent years, the loan is not disclosed as an impaired loan or as a TDR so long as repayment of the restructured loan under its modified terms is reasonably assured.

Loans, except for credit card loans, modified in a TDR are generally placed on nonaccrual status, although in many cases such loans were already on nonaccrual status prior to modification. These loans may be returned to performing status (the accrual of interest is resumed) if the following criteria are met: (i) the borrower has performed under the modified terms for a minimum of six months and/or six payments, and (ii) the Firm has an expectation that repayment of the modified loan is reasonably assured based on, for example, the borrower's debt capacity and level of future earnings, collateral values, LTV ratios, and other current market considerations. In certain limited and well-defined circumstances in which the loan is current at the modification date, such loans are not placed on nonaccrual status at the time of modification.

Because loans modified in TDRs are considered to be impaired, these loans are measured for impairment using the Firm's established asset-specific allowance methodology, which considers the expected re-default rates for the modified loans. A loan modified in a TDR generally remains subject to the asset-specific allowance methodology throughout its remaining life, regardless of whether the loan is performing and has been returned to accrual status and/or the loan has been removed from the impaired loans disclosures (i.e., loans restructured at market rates). For further discussion of the methodology used to estimate the Firm's asset-specific allowance, refer to Note 13.

Foreclosed property

The Firm acquires property from borrowers through loan restructurings, workouts, and foreclosures. Property acquired may include real property (e.g., residential real estate, land, and buildings) and commercial and personal property (e.g., automobiles, aircraft, railcars, and ships).

The Firm recognizes foreclosed property upon receiving assets in satisfaction of a loan (e.g., by taking legal title or physical possession). For loans collateralized by real property, the Firm generally recognizes the asset received at foreclosure sale or upon the execution of a deed in lieu of foreclosure transaction with the borrower. Foreclosed assets are reported in other assets on the Consolidated balance sheets and initially recognized at fair value less costs to sell. Each quarter the fair value of the acquired property is reviewed and adjusted, if necessary, to the lower of cost or fair value. Subsequent adjustments to fair value are charged/credited to noninterest revenue. Operating expense, such as real estate taxes and maintenance, are charged to other expense.

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Loan portfolio

The Firm's loan portfolio is divided into three portfolio segments, which are the same segments used by the Firm to determine the allowance for loan losses: Consumer, excluding credit card; Credit card; and Wholesale. Within each portfolio segment the Firm monitors and assesses the credit risk in the following classes of loans, based on the risk characteristics of each loan class.

Consumer, excluding credit card ^(a)	Credit card	Wholesale ^(f)
<u>Residential real estate - excluding PCI</u> <ul style="list-style-type: none"> • Residential mortgage^(b) • Home equity^(c) <u>Other consumer loans^(d)</u> <ul style="list-style-type: none"> • Auto • Consumer & Business Banking^(e) <u>Residential real estate - PCI</u> <ul style="list-style-type: none"> • Home equity • Prime mortgage • Subprime mortgage • Option ARMs 	<ul style="list-style-type: none"> • Credit card loans 	<ul style="list-style-type: none"> • Commercial and industrial • Real estate • Financial institutions • Governments & Agencies • Other^(g)

(a) Includes loans held in CCB, prime mortgage and home equity loans held in AWM and prime mortgage loans held in Corporate.

(b) Predominantly includes prime (including option ARMs) and subprime loans.

(c) Includes senior and junior lien home equity loans.

(d) Includes certain business banking and auto dealer risk-rated loans that apply the wholesale methodology for determining the allowance for loan losses; these loans are managed by CCB, and therefore, for consistency in presentation, are included with the other consumer loan classes.

(e) Predominantly includes Business Banking loans.

(f) Includes loans held in CIB, CB, AWM and Corporate. Excludes prime mortgage and home equity loans held in AWM and prime mortgage loans held in Corporate. Classes are internally defined and may not align with regulatory definitions.

(g) Includes loans to: individuals and individual entities (predominantly consists of Wealth Management clients within AWM and includes exposure to personal investment companies and personal and testamentary trusts), SPEs and Private education and civic organizations. For more information on SPEs, refer to Note 14.

The following tables summarize the Firm's loan balances by portfolio segment.

December 31, 2018 (in millions)	Consumer, excluding credit card	Credit card ^(a)	Wholesale	Total
Retained	\$ 373,637	\$ 156,616	\$ 439,162	\$ 969,415 ^(b)
Held-for-sale	95	16	11,877	11,988
At fair value	-	-	3,151	3,151
Total	\$ 373,732	\$ 156,632	\$ 454,190	\$ 984,554

December 31, 2017 (in millions)	Consumer, excluding credit card	Credit card ^(a)	Wholesale	Total
Retained	\$ 372,553	\$ 149,387	\$ 402,898	\$ 924,838 ^(b)
Held-for-sale	128	124	3,099	3,351
At fair value	-	-	2,508	2,508
Total	\$ 372,681	\$ 149,511	\$ 408,505	\$ 930,697

(a) Includes accrued interest and fees net of an allowance for the uncollectible portion of accrued interest and fee income.

(b) Loans (other than PCI loans and those for which the fair value option has been elected) are presented net of unamortized discounts and premiums and net deferred loan fees or costs. These amounts were not material as of December 31, 2018 and 2017.

The following tables provide information about the carrying value of retained loans purchased, sold and reclassified to held-for-sale during the periods indicated. Reclassifications of loans to held-for sale are non-cash transactions. The Firm manages its exposure to credit risk on an ongoing basis. Selling loans is one way that the Firm reduces its credit exposures. Loans that were reclassified to held-for-sale and sold in a subsequent period are excluded from the sales line of this table.

Year ended December 31, (in millions)	2018			
	Consumer, excluding credit card	Credit card	Wholesale	Total
Purchases	\$ 2,543 ^{(a)(b)}	\$ –	\$ 2,354	\$ 4,897
Sales	9,984	–	16,741	26,725
Retained loans reclassified to held-for-sale	36	–	2,276	2,312

Year ended December 31, (in millions)	2017			
	Consumer, excluding credit card	Credit card	Wholesale	Total
Purchases	\$ 3,461 ^{(a)(b)}	\$ –	\$ 1,799	\$ 5,260
Sales	3,405	–	11,063	14,468
Retained loans reclassified to held-for-sale	6,340 ^(c)	–	1,229	7,569

Year ended December 31, (in millions)	2016			
	Consumer, excluding credit card	Credit card	Wholesale	Total
Purchases	\$ 4,116 ^{(a)(b)}	\$ –	\$ 1,448	\$ 5,564
Sales	6,368	–	8,739	15,107
Retained loans reclassified to held-for-sale	321	–	2,381	2,702

(a) Purchases predominantly represent the Firm's voluntary repurchase of certain delinquent loans from loan pools as permitted by Government National Mortgage Association ("Ginnie Mae") guidelines. The Firm typically elects to repurchase these delinquent loans as it continues to service them and/or manage the foreclosure process in accordance with applicable requirements of Ginnie Mae, FHA, RHS, and/or VA.

(b) Excludes purchases of retained loans sourced through the correspondent origination channel and underwritten in accordance with the Firm's standards. Such purchases were \$18.6 billion, \$23.5 billion and \$30.4 billion for the years ended December 31, 2018, 2017 and 2016, respectively.

(c) Includes the Firm's student loan portfolio which was sold in 2017.

Gains and losses on sales of loans

Gains and losses on sales of loans (including adjustments to record loans held-for-sale at the lower of cost or fair value) recognized in other income were not material to the Firm for the years ended December 31, 2018, 2017 and 2016. In addition, the sale of loans may also result in write downs, recoveries or changes in the allowance recognized in the provision for credit losses.

Consumer, excluding credit card, loan portfolio

Consumer loans, excluding credit card loans, consist primarily of residential mortgages, home equity loans and lines of credit, auto loans and consumer and business banking loans, with a focus on serving the prime consumer credit market. The portfolio also includes home equity loans secured by junior liens, prime mortgage loans with an interest-only payment period, and certain payment-option loans that may result in negative amortization.

The following table provides information about retained consumer loans, excluding credit card, by class. In 2017, the Firm sold its student loan portfolio.

December 31, (in millions)	2018	2017
Residential real estate - excluding PCI		
Residential mortgage	\$ 231,078	\$ 216,496
Home equity	28,340	33,450
Other consumer loans		
Auto	63,573	66,242
Consumer & Business Banking	26,612	25,789
Residential real estate - PCI		
Home equity	8,963	10,799
Prime mortgage	4,690	6,479
Subprime mortgage	1,945	2,609
Option ARMs	8,436	10,689
Total retained loans	\$ 373,637	\$ 372,553

Delinquency rates are a primary credit quality indicator for consumer loans. Loans that are more than 30 days past due provide an early warning of borrowers who may be experiencing financial difficulties and/or who may be unable or unwilling to repay the loan. As the loan continues to age, it becomes more clear whether the borrower is likely either unable or unwilling to pay. In the case of residential real estate loans, late-stage delinquencies (greater than 150 days past due) are a strong indicator of loans that will ultimately result in a foreclosure or similar liquidation transaction. In addition to delinquency rates, other credit quality indicators for consumer loans vary based on the class of loan, as follows:

- For residential real estate loans, including both non-PCI and PCI portfolios, the current estimated LTV ratio, or the combined LTV ratio in the case of junior lien loans, is an indicator of the potential loss severity in the event of default. Additionally, LTV or combined LTV ratios can provide insight into a borrower’s continued willingness to pay, as the delinquency rate of high-LTV loans tends to be greater than that for loans where the borrower has equity in the collateral. The geographic distribution of the loan collateral also provides insight as to the credit quality of the portfolio, as factors such as the regional economy, home price changes and specific events such as natural disasters, will affect credit quality. The borrower’s current or “refreshed” FICO score is a secondary credit-quality indicator for certain loans, as FICO scores are an indication of the borrower’s credit payment history. Thus, a loan to a borrower with a low FICO score (less than 660) is considered to be of higher risk than a loan to a borrower with a higher FICO score. Further, a loan to a borrower with a high LTV ratio and a low FICO score is at greater risk of default than a loan to a borrower that has both a high LTV ratio and a high FICO score.
- For scored auto and scored business banking loans, geographic distribution is an indicator of the credit performance of the portfolio. Similar to residential real estate loans, geographic distribution provides insights into the portfolio performance based on regional economic activity and events.
- Risk-rated business banking and auto loans are similar to wholesale loans in that the primary credit quality indicators are the risk rating that is assigned to the loan and whether the loans are considered to be criticized and/or nonaccrual. Risk ratings are reviewed on a regular and ongoing basis by Credit Risk Management and are adjusted as necessary for updated information about borrowers’ ability to fulfill their obligations. For further information about risk-rated wholesale loan credit quality indicators, refer to page 236 of this Note.

Residential real estate – excluding PCI loans

The following table provides information by class for retained residential real estate – excluding PCI loans.

Residential real estate – excluding PCI loans

December 31, (in millions, except ratios)	Residential mortgage		Home equity		Total residential real estate - excluding PCI	
	2018	2017	2018	2017	2018	2017
Loan delinquency^(a)						
Current	\$ 225,899	\$ 208,713	\$ 27,611	\$ 32,391	\$ 253,510	\$ 241,104
30-149 days past due	2,763	4,234	453	671	3,216	4,905
150 or more days past due	2,416	3,549	276	388	2,692	3,937
Total retained loans	\$ 231,078	\$ 216,496	\$ 28,340	\$ 33,450	\$ 259,418	\$ 249,946
% of 30+ days past due to total retained loans ^(b)	0.48%	0.77%	2.57%	3.17%	0.71%	1.09%
90 or more days past due and government guaranteed ^(c)	\$ 2,541	\$ 4,172	—	—	\$ 2,541	\$ 4,172
Nonaccrual loans	1,765	2,175	1,323	1,610	3,088	3,785
Current estimated LTV ratios^{(d)(e)}						
Greater than 125% and refreshed FICO scores:						
Equal to or greater than 660	\$ 25	\$ 37	\$ 6	\$ 10	\$ 31	\$ 47
Less than 660	13	19	1	3	14	22
101% to 125% and refreshed FICO scores:						
Equal to or greater than 660	37	36	111	296	148	332
Less than 660	53	88	38	95	91	183
80% to 100% and refreshed FICO scores:						
Equal to or greater than 660	3,977	4,369	986	1,676	4,963	6,045
Less than 660	281	483	326	569	607	1,052
Less than 80% and refreshed FICO scores:						
Equal to or greater than 660	212,505	194,758	22,632	25,262	235,137	220,020
Less than 660	6,457	6,952	3,355	3,850	9,812	10,802
No FICO/LTV available	813	1,259	885	1,689	1,698	2,948
U.S. government-guaranteed	6,917	8,495	—	—	6,917	8,495
Total retained loans	\$ 231,078	\$ 216,496	\$ 28,340	\$ 33,450	\$ 259,418	\$ 249,946
Geographic region^(f)						
California	\$ 74,759	\$ 68,855	\$ 5,695	\$ 6,582	\$ 80,454	\$ 75,437
New York	28,847	27,473	5,769	6,866	34,616	34,339
Illinois	15,249	14,501	2,131	2,521	17,380	17,022
Texas	13,769	12,508	1,819	2,021	15,588	14,529
Florida	10,704	9,598	1,575	1,847	12,279	11,445
Washington	8,304	6,962	869	1,026	9,173	7,988
New Jersey	7,302	7,142	1,642	1,957	8,944	9,099
Colorado	8,140	7,335	521	632	8,661	7,967
Massachusetts	6,574	6,323	236	295	6,810	6,618
Arizona	4,434	4,109	1,158	1,439	5,592	5,548
All other ^(g)	52,996	51,690	6,925	8,264	59,921	59,954
Total retained loans	\$ 231,078	\$ 216,496	\$ 28,340	\$ 33,450	\$ 259,418	\$ 249,946

(a) Individual delinquency classifications include mortgage loans insured by U.S. government agencies as follows: current included \$2.8 billion and \$2.4 billion; 30-149 days past due included \$2.1 billion and \$3.2 billion; and 150 or more days past due included \$2.0 billion and \$2.9 billion at December 31, 2018 and 2017, respectively.

(b) At December 31, 2018 and 2017, residential mortgage loans excluded mortgage loans insured by U.S. government agencies of \$4.1 billion and \$6.1 billion, respectively, that are 30 or more days past due. These amounts have been excluded based upon the government guarantee.

(c) These balances, which are 90 days or more past due, were excluded from nonaccrual loans as the loans are guaranteed by U.S. government agencies. Typically the principal balance of the loans is insured and interest is guaranteed at a specified reimbursement rate subject to meeting agreed-upon servicing guidelines. At December 31, 2018 and 2017, these balances included \$999 million and \$1.5 billion, respectively, of loans that are no longer accruing interest based on the agreed-upon servicing guidelines. For the remaining balance, interest is being accrued at the guaranteed reimbursement rate. There were no loans that were not guaranteed by U.S. government agencies that are 90 or more days past due and still accruing interest at December 31, 2018 and 2017.

(d) Represents the aggregate unpaid principal balance of loans divided by the estimated current property value. Current property values are estimated, at a minimum, quarterly, based on home valuation models using nationally recognized home price index valuation estimates incorporating actual data to the extent available and forecasted data where actual data is not available. These property values do not represent actual appraised loan level collateral values; as such, the resulting ratios are necessarily imprecise and should be viewed as estimates. Current estimated combined LTV for junior lien home equity loans considers all available lien positions, as well as unused lines, related to the property.

(e) Refreshed FICO scores represent each borrower's most recent credit score, which is obtained by the Firm on at least a quarterly basis.

(f) The geographic regions presented in the table are ordered based on the magnitude of the corresponding loan balances at December 31, 2018.

(g) At December 31, 2018 and 2017, included mortgage loans insured by U.S. government agencies of \$6.9 billion and \$8.5 billion, respectively. These amounts have been excluded from the geographic regions presented based upon the government guarantee.

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Approximately 37% of the home equity portfolio are senior lien loans; the remaining balance are junior lien HELOANS or HELOCs. The following table provides the Firm's delinquency statistics for junior lien home equity loans and lines as of December 31, 2018 and 2017.

December 31, (in millions except ratios)	Total loans		Total 30+ day delinquency rate	
	2018	2017	2018	2017
HELOCs: ^(a)				
Within the revolving period ^(b)	\$ 5,608	\$ 6,363	0.25%	0.50%
Beyond the revolving period	11,286	13,532	2.80	3.56
HELOANS	1,030	1,371	2.82	3.50
Total	\$ 17,924	\$ 21,266	2.00%	2.64%

(a) These HELOCs are predominantly revolving loans for a 10-year period, after which time the HELOC converts to a loan with a 20-year amortization period, but also include HELOCs that allow interest-only payments beyond the revolving period.

(b) The Firm manages the risk of HELOCs during their revolving period by closing or reducing the undrawn line to the extent permitted by law when borrowers are experiencing financial difficulty.

HELOCs beyond the revolving period and HELOANS have higher delinquency rates than HELOCs within the revolving period. That is primarily because the fully-amortizing payment that is generally required for those products is higher than the minimum payment options available for HELOCs within the revolving period. The higher delinquency rates associated with amortizing HELOCs and HELOANS are factored into the Firm's allowance for loan losses.

Impaired loans

The table below provides information about the Firm's residential real estate impaired loans, excluding PCI loans. These loans are considered to be impaired as they have been modified in a TDR. All impaired loans are evaluated for an asset-specific allowance as described in Note 13.

December 31, (in millions)	Residential mortgage		Home equity		Total residential real estate - excluding PCI	
	2018	2017	2018	2017	2018	2017
Impaired loans						
With an allowance	\$ 3,381	\$ 4,407	\$ 1,142	\$ 1,236	\$ 4,523	\$ 5,643
Without an allowance ^(a)	1,184	1,213	870	882	2,054	2,095
Total impaired loans^{(b)(c)}	\$ 4,565	\$ 5,620	\$ 2,012	\$ 2,118	\$ 6,577	\$ 7,738
Allowance for loan losses related to impaired loans	\$ 88	\$ 62	\$ 45	\$ 111	\$ 133	\$ 173
Unpaid principal balance of impaired loans ^(d)	6,207	7,741	3,466	3,701	9,673	11,442
Impaired loans on nonaccrual status ^(e)	1,459	1,743	955	1,032	2,414	2,775

(a) Represents collateral-dependent residential real estate loans that are charged off to the fair value of the underlying collateral less costs to sell. The Firm reports, in accordance with regulatory guidance, residential real estate loans that have been discharged under Chapter 7 bankruptcy and not reaffirmed by the borrower ("Chapter 7 loans") as collateral-dependent nonaccrual TDRs, regardless of their delinquency status. At December 31, 2018, Chapter 7 residential real estate loans included approximately 13% of residential mortgages and approximately 9% of home equity that were 30 days or more past due.

(b) At December 31, 2018 and 2017, \$4.1 billion and \$3.8 billion, respectively, of loans modified subsequent to repurchase from Ginnie Mae in accordance with the standards of the appropriate government agency (i.e., FHA, VA, RHS) are not included in the table above. When such loans perform subsequent to modification in accordance with Ginnie Mae guidelines, they are generally sold back into Ginnie Mae loan pools. Modified loans that do not re-perform become subject to foreclosure.

(c) Predominantly all residential real estate impaired loans, excluding PCI loans, are in the U.S.

(d) Represents the contractual amount of principal owed at December 31, 2018 and 2017. The unpaid principal balance differs from the impaired loan balances due to various factors including charge-offs, net deferred loan fees or costs, and unamortized discounts or premiums on purchased loans.

(e) As of December 31, 2018 and 2017, nonaccrual loans included \$2.0 billion and \$2.2 billion, respectively, of TDRs for which the borrowers were less than 90 days past due. For additional information about loans modified in a TDR that are on nonaccrual status, refer to the Loan accounting framework on pages 219-221 of this Note.

The following table presents average impaired loans and the related interest income reported by the Firm.

Year ended December 31, (in millions)	Average impaired loans			Interest income on impaired loans ^(a)			Interest income on impaired loans on a cash basis ^(a)		
	2018	2017	2016	2018	2017	2016	2018	2017	2016
Residential mortgage	\$ 5,082	\$ 5,797	\$ 6,376	\$ 257	\$ 287	\$ 305	\$ 75	\$ 75	\$ 77
Home equity	2,078	2,189	2,311	131	127	125	84	80	80
Total residential real estate - excluding PCI	\$ 7,160	\$ 7,986	\$ 8,687	\$ 388	\$ 414	\$ 430	\$ 159	\$ 155	\$ 157

(a) Generally, interest income on loans modified in TDRs is recognized on a cash basis until the borrower has made a minimum of six payments under the new terms, unless the loan is deemed to be collateral-dependent.

Loan modifications

Modifications of residential real estate loans, excluding PCI loans, are generally accounted for and reported as TDRs. There were no additional commitments to lend to borrowers whose residential real estate loans, excluding PCI loans, have been modified in TDRs.

The following table presents new TDRs reported by the Firm.

Year ended December 31, (in millions)	2018	2017	2016
Residential mortgage	\$ 401	\$ 373	\$ 254
Home equity	286	321	385
Total residential real estate - excluding PCI	\$ 687	\$ 694	\$ 639

Nature and extent of modifications

The U.S. Treasury's Making Home Affordable programs, as well as the Firm's proprietary modification programs, generally provide various concessions to financially troubled borrowers including, but not limited to, interest rate reductions, term or payment extensions and deferral of principal and/or interest payments that would otherwise have been required under the terms of the original agreement.

The following table provides information about how residential real estate loans, excluding PCI loans, were modified under the Firm's loss mitigation programs described above during the periods presented. This table excludes Chapter 7 loans where the sole concession granted is the discharge of debt.

Year ended December 31,	Residential mortgage			Home equity			Total residential real estate - excluding PCI		
	2018	2017	2016	2018	2017	2016	2018	2017	2016
Number of loans approved for a trial modification	2,570	1,283	1,945	2,316	2,321	3,760	4,886	3,604	5,705
Number of loans permanently modified	2,907	2,628	3,338	4,946	5,624	4,824	7,853	8,252	8,162
Concession granted:^(a)									
Interest rate reduction	40%	63%	76%	62%	59%	75%	54%	60%	76%
Term or payment extension	55	72	90	66	69	83	62	70	86
Principal and/or interest deferred	44	15	16	20	10	19	29	12	18
Principal forgiveness	8	16	26	7	13	9	7	14	16
Other ^(b)	38	33	25	58	31	6	51	32	14

- (a) Represents concessions granted in permanent modifications as a percentage of the number of loans permanently modified. The sum of the percentages exceeds 100% because predominantly all of the modifications include more than one type of concession. Concessions offered on trial modifications are generally consistent with those granted on permanent modifications.
- (b) Includes variable interest rate to fixed interest rate modifications for the years ended December 31, 2018, 2017 and 2016. Also includes forbearances that meet the definition of a TDR for the year ended December 31, 2018. Forbearances suspend or reduce monthly payments for a specific period of time to address a temporary hardship.

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Financial effects of modifications and redefaults

The following table provides information about the financial effects of the various concessions granted in modifications of residential real estate loans, excluding PCI, under the loss mitigation programs described above and about redefaults of certain loans modified in TDRs for the periods presented. The following table presents only the financial effects of permanent modifications and does not include temporary concessions offered through trial modifications. This table also excludes Chapter 7 loans where the sole concession granted is the discharge of debt.

Year ended December 31, (in millions, except weighted-average data)	Residential mortgage			Home equity			Total residential real estate - excluding PCI		
	2018	2017	2016	2018	2017	2016	2018	2017	2016
Weighted-average interest rate of loans with interest rate reductions - before TDR	5.65%	5.15%	5.59%	5.39%	4.94%	4.99%	5.50%	5.06%	5.36%
Weighted-average interest rate of loans with interest rate reductions - after TDR	3.80	2.99	2.93	3.46	2.64	2.34	3.60	2.83	2.70
Weighted-average remaining contractual term (in years) of loans with term or payment extensions - before TDR	24	24	24	19	21	18	21	23	22
Weighted-average remaining contractual term (in years) of loans with term or payment extensions - after TDR	38	38	38	39	39	38	38	38	38
Charge-offs recognized upon permanent modification	\$ 1	\$ 2	\$ 4	\$ 1	\$ 1	\$ 1	\$ 2	\$ 3	\$ 5
Principal deferred	21	12	30	9	10	23	30	22	53
Principal forgiven	10	20	44	7	13	7	17	33	51
Balance of loans that redefaulted within one year of permanent modification ^(a)	\$ 97	\$ 124	\$ 98	\$ 64	\$ 56	\$ 40	\$ 161	\$ 180	\$ 138

(a) Represents loans permanently modified in TDRs that experienced a payment default in the periods presented, and for which the payment default occurred within one year of the modification. The dollar amounts presented represent the balance of such loans at the end of the reporting period in which such loans defaulted. For residential real estate loans modified in TDRs, payment default is deemed to occur when the loan becomes two contractual payments past due. In the event that a modified loan redefaults, it is probable that the loan will ultimately be liquidated through foreclosure or another similar type of liquidation transaction. Redefaults of loans modified within the last 12 months may not be representative of ultimate redefault levels.

At December 31, 2018, the weighted-average estimated remaining lives of residential real estate loans, excluding PCI loans, permanently modified in TDRs were 9 years for residential mortgage and 8 years for home equity. The estimated remaining lives of these loans reflect estimated prepayments, both voluntary and involuntary (i.e., foreclosures and other forced liquidations).

Active and suspended foreclosure

At December 31, 2018 and 2017, the Firm had non-PCI residential real estate loans, excluding those insured by U.S. government agencies, with a carrying value of \$653 million and \$787 million, respectively, that were not included in REO, but were in the process of active or suspended foreclosure.

Other consumer loans

The table below provides information for other consumer retained loan classes, including auto and business banking loans.

December 31, (in millions, except ratios)	Auto		Consumer & Business Banking		Total other consumer	
	2018	2017	2018	2017	2018	2017
Loan delinquency						
Current	\$ 62,984	\$ 65,651	\$ 26,249	\$ 25,454	\$ 89,233	\$ 91,105
30-119 days past due	589	584	252	213	841	797
120 or more days past due	—	7	111	122	111	129
Total retained loans	\$ 63,573	\$ 66,242	\$ 26,612	\$ 25,789	\$ 90,185	\$ 92,031
% of 30+ days past due to total retained loans	0.93%	0.89%	1.36%	1.30%	1.06%	1.01%
Nonaccrual loans ^(a)	128	141	245	283	373	424
Geographic region^(b)						
California	\$ 8,330	\$ 8,445	\$ 5,520	\$ 5,032	\$ 13,850	\$ 13,477
Texas	6,531	7,013	2,993	2,916	9,524	9,929
New York	3,863	4,023	4,381	4,195	8,244	8,218
Illinois	3,716	3,916	2,046	2,017	5,762	5,933
Florida	3,256	3,350	1,502	1,424	4,758	4,774
Arizona	2,084	2,221	1,491	1,383	3,575	3,604
Ohio	1,973	2,105	1,305	1,380	3,278	3,485
New Jersey	1,981	2,044	723	721	2,704	2,765
Michigan	1,357	1,418	1,329	1,357	2,686	2,775
Louisiana	1,587	1,656	860	849	2,447	2,505
All other	28,895	30,051	4,462	4,515	33,357	34,566
Total retained loans	\$ 63,573	\$ 66,242	\$ 26,612	\$ 25,789	\$ 90,185	\$ 92,031
Loans by risk ratings^(c)						
Noncriticized	\$ 15,749	\$ 15,604	\$ 18,743	\$ 17,938	\$ 34,492	\$ 33,542
Criticized performing	273	93	751	791	1,024	884
Criticized nonaccrual	—	9	191	213	191	222

(a) There were no loans that were 90 or more days past due and still accruing interest at December 31, 2018 and December 31, 2017.

(b) The geographic regions presented in the table are ordered based on the magnitude of the corresponding loan balances at December 31, 2018.

(c) For risk-rated business banking and auto loans, the primary credit quality indicator is the risk rating of the loan, including whether the loans are considered to be criticized and/or nonaccrual.

Notes to consolidated financial statements

Other consumer impaired loans and loan modifications

The following table provides information about the Firm's other consumer impaired loans, including risk-rated business banking and auto loans that have been placed on nonaccrual status, and loans that have been modified in TDRs.

December 31, (in millions)	2018	2017
Impaired loans		
With an allowance	\$ 222	\$ 272
Without an allowance ^(a)	29	26
Total impaired loans^{(b)(c)}	\$ 251	\$ 298
Allowance for loan losses related to impaired loans	\$ 63	\$ 73
Unpaid principal balance of impaired loans ^(d)	355	402
Impaired loans on nonaccrual status	229	268

- (a) When discounted cash flows, collateral value or market price equals or exceeds the recorded investment in the loan, the loan does not require an allowance. This typically occurs when the impaired loans have been partially charged off and/or there have been interest payments received and applied to the loan balance.
- (b) Predominantly all other consumer impaired loans are in the U.S.
- (c) Other consumer average impaired loans were \$275 million, \$427 million and \$635 million for the years ended December 31, 2018, 2017 and 2016, respectively. The related interest income on impaired loans, including those on a cash basis, was not material for the years ended December 31, 2018, 2017 and 2016.
- (d) Represents the contractual amount of principal owed at December 31, 2018 and 2017. The unpaid principal balance differs from the impaired loan balances due to various factors, including charge-offs, interest payments received and applied to the principal balance, net deferred loan fees or costs and unamortized discounts or premiums on purchased loans.

Loan modifications

Certain other consumer loan modifications are considered to be TDRs as they provide various concessions to borrowers who are experiencing financial difficulty. All of these TDRs are reported as impaired loans. At December 31, 2018 and 2017, other consumer loans modified in TDRs were \$79 million and \$102 million, respectively. The impact of these modifications, as well as new TDRs, were not material to the Firm for the years ended December 31, 2018, 2017 and 2016. Additional commitments to lend to borrowers whose loans have been modified in TDRs as of December 31, 2018 and 2017 were not material. TDRs on nonaccrual status were \$57 million and \$72 million at December 31, 2018 and 2017, respectively.

Purchased credit-impaired loans

PCI loans are initially recorded at fair value at acquisition. PCI loans acquired in the same fiscal quarter may be aggregated into one or more pools, provided that the loans have common risk characteristics. A pool is then accounted for as a single asset with a single composite interest rate and an aggregate expectation of cash flows. All of the Firm's residential real estate PCI loans were acquired in the same fiscal quarter and aggregated into pools of loans with common risk characteristics.

On a quarterly basis, the Firm estimates the total cash flows (both principal and interest) expected to be collected over the remaining life of each pool. These estimates incorporate assumptions regarding default rates, loss severities, the amounts and timing of prepayments and other factors that reflect then-current market conditions. Probable decreases in expected cash flows (i.e., increased credit losses) trigger the recognition of impairment, which is then measured as the present value of the expected principal loss plus any related forgone interest cash flows, discounted at the pool's effective interest rate. Impairments are recognized through the provision for credit losses and an increase in the allowance for loan losses. Probable and significant increases in expected cash flows (e.g., decreased credit losses, the net benefit of modifications) would first reverse any previously recorded allowance for loan losses with any remaining increases recognized prospectively as a yield adjustment over the remaining estimated lives of the underlying loans. The impacts of (i) prepayments, (ii) changes in variable interest rates, and (iii) any other changes in the timing of expected cash flows are generally recognized prospectively as adjustments to interest income.

The Firm continues to modify certain PCI loans. The impact of these modifications is incorporated into the Firm's quarterly assessment of whether a probable and significant change in expected cash flows has occurred, and the loans continue to be accounted for and reported as PCI loans. In evaluating the effect of modifications on expected cash flows, the Firm incorporates the effect of any forgone interest and also considers the potential for redefault. The Firm develops product-specific probability of default estimates, which are used to compute expected credit losses. In developing these probabilities of default, the Firm considers the relationship between the credit quality characteristics of the underlying loans and certain assumptions about home prices and unemployment based upon industry-wide data. The Firm also considers its own historical loss experience to-date based on actual redefaulted modified PCI loans.

The excess of cash flows expected to be collected over the carrying value of the underlying loans is referred to as the accretable yield. This amount is not reported on the Firm's Consolidated balance sheets but is accreted into interest income at a level rate of return over the remaining estimated lives of the underlying pools of loans.

Since the timing and amounts of expected cash flows for the Firm's PCI consumer loan pools are reasonably estimable, interest is being accreted and the loan pools are being reported as performing loans. No interest would be accreted and the PCI loan pools would be reported as nonaccrual loans if the timing and/or amounts of expected cash flows on the loan pools were determined not to be reasonably estimable.

The liquidation of PCI loans, which may include sales of loans, receipt of payment in full from the borrower, or foreclosure, results in removal of the loans from the underlying PCI pool. When the amount of the liquidation proceeds (e.g., cash, real estate), if any, is less than the unpaid principal balance of the loan, the difference is first applied against the PCI pool's nonaccretable difference for principal losses (i.e., the lifetime credit loss estimate established as a purchase accounting adjustment at the acquisition date). When the nonaccretable difference for a particular loan pool has been fully depleted, any excess of the unpaid principal balance of the loan over the liquidation proceeds is written off against the PCI pool's allowance for loan losses. Write-offs of PCI loans also include other adjustments, primarily related to principal forgiveness modifications. Because the Firm's PCI loans are accounted for at a pool level, the Firm does not recognize charge-offs of PCI loans when they reach specified stages of delinquency (i.e., unlike non-PCI consumer loans, these loans are not charged off based on FFIEC standards).

The PCI portfolio affects the Firm's results of operations primarily through: (i) contribution to net interest margin; (ii) expense related to defaults and servicing resulting from the liquidation of the loans; and (iii) any provision for loan losses. The Firm's residential real estate PCI loans were funded based on the interest rate characteristics of the loans. For example, variable-rate loans were funded with variable-rate liabilities and fixed-rate loans were funded with fixed-rate liabilities with a similar maturity profile. A net spread will be earned on the declining balance of the portfolio, which is estimated as of December 31, 2018, to have a remaining weighted-average life of 7 years.

Notes to consolidated financial statements

Residential real estate – PCI loans

The table below provides information about the Firm's consumer, excluding credit card, PCI loans.

December 31, (in millions, except ratios)	Home equity		Prime mortgage		Subprime mortgage		Option ARMs		Total PCI	
	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017
Carrying value ^(a)	\$ 8,963	\$ 10,799	\$ 4,690	\$ 6,479	\$ 1,945	\$ 2,609	\$ 8,436	\$ 10,689	\$ 24,034	\$ 30,576
Loan delinquency (based on unpaid principal balance)										
Current	\$ 8,624	\$ 10,272	\$ 4,226	\$ 5,839	\$ 2,033	\$ 2,640	\$ 7,592	\$ 9,662	\$ 22,475	\$ 28,413
30-149 days past due	278	356	259	336	286	381	398	547	1,221	1,620
150 or more days past due	242	392	223	327	123	176	457	689	1,045	1,584
Total loans	\$ 9,144	\$ 11,020	\$ 4,708	\$ 6,502	\$ 2,442	\$ 3,197	\$ 8,447	\$ 10,898	\$ 24,741	\$ 31,617
% of 30+ days past due to total loans	5.69%	6.79%	10.24%	10.20%	16.75%	17.42%	10.12%	11.34%	9.16%	10.13%
Current estimated LTV ratios (based on unpaid principal balance)^{(b)(c)}										
Greater than 125% and refreshed FICO scores:										
Equal to or greater than 660	\$ 17	\$ 33	\$ 1	\$ 4	\$ –	\$ 2	\$ 3	\$ 6	\$ 21	\$ 45
Less than 660	13	21	7	16	9	20	7	9	36	66
101% to 125% and refreshed FICO scores:										
Equal to or greater than 660	135	274	6	16	4	20	17	43	162	353
Less than 660	65	132	22	42	35	75	33	71	155	320
80% to 100% and refreshed FICO scores:										
Equal to or greater than 660	805	1,195	75	221	54	119	119	316	1,053	1,851
Less than 660	388	559	112	230	161	309	190	371	851	1,469
Lower than 80% and refreshed FICO scores:										
Equal to or greater than 660	5,548	6,134	2,689	3,551	739	895	5,111	6,113	14,087	16,693
Less than 660	1,908	2,095	1,568	2,103	1,327	1,608	2,622	3,499	7,425	9,305
No FICO/LTV available	265	577	228	319	113	149	345	470	951	1,515
Total unpaid principal balance	\$ 9,144	\$ 11,020	\$ 4,708	\$ 6,502	\$ 2,442	\$ 3,197	\$ 8,447	\$ 10,898	\$ 24,741	\$ 31,617
Geographic region (based on unpaid principal balance)^(d)										
California	\$ 5,420	\$ 6,555	\$ 2,578	\$ 3,716	\$ 593	\$ 797	\$ 4,798	\$ 6,225	\$ 13,389	\$ 17,293
Florida	976	1,137	332	428	234	296	713	878	2,255	2,739
New York	525	607	365	457	268	330	502	628	1,660	2,022
Washington	419	532	98	135	44	61	177	238	738	966
Illinois	233	273	154	200	123	161	199	249	709	883
New Jersey	210	242	134	178	88	110	258	336	690	866
Massachusetts	65	79	113	149	73	98	240	307	491	633
Maryland	48	57	95	129	96	132	178	232	417	550
Virginia	54	66	91	123	37	51	211	280	393	520
Arizona	165	203	69	106	43	60	112	156	389	525
All other	1,029	1,269	679	881	843	1,101	1,059	1,369	3,610	4,620
Total unpaid principal balance	\$ 9,144	\$ 11,020	\$ 4,708	\$ 6,502	\$ 2,442	\$ 3,197	\$ 8,447	\$ 10,898	\$ 24,741	\$ 31,617

(a) Carrying value includes the effect of fair value adjustments that were applied to the consumer PCI portfolio at the date of acquisition.

(b) Represents the aggregate unpaid principal balance of loans divided by the estimated current property value. Current property values are estimated, at a minimum, quarterly, based on home valuation models using nationally recognized home price index valuation estimates incorporating actual data to the extent available and forecasted data where actual data is not available. These property values do not represent actual appraised loan level collateral values; as such, the resulting ratios are necessarily imprecise and should be viewed as estimates. Current estimated combined LTV for junior lien home equity loans considers all available lien positions, as well as unused lines, related to the property.

(c) Refreshed FICO scores represent each borrower's most recent credit score, which is obtained by the Firm on at least a quarterly basis.

(d) The geographic regions presented in the table are ordered based on the magnitude of the corresponding loan balances at December 31, 2018.

Approximately 26% of the PCI home equity portfolio are senior lien loans; the remaining balance are junior lien HELOANS or HELOCs. The following table provides delinquency statistics for PCI junior lien home equity loans and lines of credit based on the unpaid principal balance as of December 31, 2018 and 2017.

December 31, (in millions, except ratios)	Total loans		Total 30+ day delinquency rate	
	2018	2017	2018	2017
HELOCs: ^{(a)(b)}	\$ 6,531	\$ 7,926	4.00%	4.62%
HELOANS	280	360	3.57	5.28
Total	\$ 6,811	\$ 8,286	3.98%	4.65%

(a) In general, these HELOCs are revolving loans for a 10-year period, after which time the HELOC converts to an interest-only loan with a balloon payment at the end of the loan's term. Substantially all HELOCs are beyond the revolving period.

(b) Includes loans modified into fixed rate amortizing loans.

The table below presents the accretable yield activity for the Firm's PCI consumer loans for the years ended December 31, 2018, 2017 and 2016, and represents the Firm's estimate of gross interest income expected to be earned over the remaining life of the PCI loan portfolios. The table excludes the cost to fund the PCI portfolios, and therefore the accretable yield does not represent net interest income expected to be earned on these portfolios.

Year ended December 31, (in millions, except ratios)	Total PCI		
	2018	2017	2016
Beginning balance	\$ 11,159	\$ 11,768	\$ 13,491
Accretion into interest income	(1,249)	(1,396)	(1,555)
Changes in interest rates on variable-rate loans	(109)	503	260
Other changes in expected cash flows ^(a)	(1,379)	284	(428)
Balance at December 31	\$ 8,422	\$ 11,159	\$ 11,768
Accretable yield percentage	4.92%	4.53%	4.35%

(a) Other changes in expected cash flows may vary from period to period as the Firm continues to refine its cash flow model, for example cash flows expected to be collected due to the impact of modifications and changes in prepayment assumptions.

Active and suspended foreclosure

At December 31, 2018 and 2017, the Firm had PCI residential real estate loans with an unpaid principal balance of \$964 million and \$1.3 billion, respectively, that were not included in REO, but were in the process of active or suspended foreclosure.

Credit card loan portfolio

The credit card portfolio segment includes credit card loans originated and purchased by the Firm. Delinquency rates are the primary credit quality indicator for credit card loans as they provide an early warning that borrowers may be experiencing difficulties (30 days past due); information on those borrowers that have been delinquent for a longer period of time (90 days past due) is also considered. In addition to delinquency rates, the geographic distribution of the loans provides insight as to the credit quality of the portfolio based on the regional economy.

While the borrower’s credit score is another general indicator of credit quality, the Firm does not view credit scores as a primary indicator of credit quality because the borrower’s credit score tends to be a lagging indicator. The distribution of such scores provides a general indicator of credit quality trends within the portfolio; however, the score does not capture all factors that would be predictive of future credit performance. Refreshed FICO score information, which is obtained at least quarterly, for a statistically significant random sample of the credit card portfolio is indicated in the following table. FICO is considered to be the industry benchmark for credit scores.

The Firm generally originates new card accounts to prime consumer borrowers. However, certain cardholders’ FICO scores may decrease over time, depending on the performance of the cardholder and changes in credit score calculation.

The table below provides information about the Firm’s credit card loans.

As of or for the year ended December 31, (in millions, except ratios)	2018	2017
Net charge-offs	\$ 4,518	\$ 4,123
% of net charge-offs to retained loans	3.10%	2.95%
Loan delinquency		
Current and less than 30 days past due and still accruing	\$ 153,746	\$ 146,704
30-89 days past due and still accruing	1,426	1,305
90 or more days past due and still accruing	1,444	1,378
Total retained credit card loans	\$ 156,616	\$ 149,387
Loan delinquency ratios		
% of 30+ days past due to total retained loans	1.83%	1.80%
% of 90+ days past due to total retained loans	0.92	0.92
Credit card loans by geographic region^{a)}		
California	\$ 23,757	\$ 22,245
Texas	15,085	14,200
New York	13,601	13,021
Florida	9,770	9,138
Illinois	8,938	8,585
New Jersey	6,739	6,506
Ohio	5,094	4,997
Pennsylvania	4,996	4,883
Colorado	4,309	4,006
Michigan	3,912	3,826
All other	60,415	57,980
Total retained credit card loans	\$ 156,616	\$ 149,387
Percentage of portfolio based on carrying value with estimated refreshed FICO scores		
Equal to or greater than 660	84.2%	84.0%
Less than 660	15.0	14.6
No FICO available	0.8	1.4

a) The geographic regions presented in the table are ordered based on the magnitude of the corresponding loan balances at December 31, 2018.

Credit card impaired loans and loan modifications

The table below provides information about the Firm's impaired credit card loans. All of these loans are considered to be impaired as they have been modified in TDRs.

December 31, (in millions)	2018	2017
Impaired credit card loans with an allowance ^{(a)(b)(c)}	\$ 1,319	\$ 1,215
Allowance for loan losses related to impaired credit card loans	440	383

(a) The carrying value and the unpaid principal balance are the same for credit card impaired loans.

(b) There were no impaired loans without an allowance.

(c) Predominantly all impaired credit card loans are in the U.S.

The following table presents average balances of impaired credit card loans and interest income recognized on those loans.

Year ended December 31, (in millions)	2018	2017	2016
Average impaired credit card loans	\$ 1,260	\$ 1,214	\$ 1,325
Interest income on impaired credit card loans	65	59	63

Loan modifications

The Firm may offer one of a number of loan modification programs to credit card borrowers who are experiencing financial difficulty. Most of the credit card loans have been modified under long-term programs for borrowers who are experiencing financial difficulties. These modifications involve placing the customer on a fixed payment plan, generally for 60 months, and typically include reducing the interest rate on the credit card. Substantially all modifications are considered to be TDRs.

If the cardholder does not comply with the modified payment terms, then the credit card loan continues to age and will ultimately be charged-off in accordance with the Firm's standard charge-off policy. In most cases, the Firm does not reinstate the borrower's line of credit.

New enrollments in these loan modification programs for the years ended December 31, 2018, 2017 and 2016, were \$866 million, \$756 million and \$636 million, respectively. For all periods disclosed, new enrollments were less than 1% of total retained credit card loans.

Financial effects of modifications and redefaults

The following table provides information about the financial effects of the concessions granted on credit card loans modified in TDRs and redefaults for the periods presented.

Year ended December 31, (in millions, except weighted-average data)	2018	2017	2016
Weighted-average interest rate of loans - before TDR	17.98%	16.58%	15.56%
Weighted-average interest rate of loans - after TDR	5.16	4.88	4.76
Loans that redefaulted within one year of modification ^{(a)(b)}	\$ 116	\$ 93	\$ 74

(a) Represents loans modified in TDRs that experienced a payment default in the periods presented, and for which the payment default occurred within one year of the modification. The amounts presented represent the balance of such loans as of the end of the quarter in which they defaulted.

(b) The prior period amounts have been revised to conform with the current period presentation.

For credit card loans modified in TDRs, payment default is deemed to have occurred when the borrower misses two consecutive contractual payments. A substantial portion of these loans are expected to be charged-off in accordance with the Firm's standard charge-off policy. Based on historical experience, the estimated weighted-average default rate for modified credit card loans was expected to be 33.38%, 31.54% and 28.87% as of December 31, 2018, 2017 and 2016, respectively.

Wholesale loan portfolio

Wholesale loans include loans made to a variety of clients, ranging from large corporate and institutional clients to high-net-worth individuals.

The primary credit quality indicator for wholesale loans is the risk rating assigned to each loan. Risk ratings are used to identify the credit quality of loans and differentiate risk within the portfolio. Risk ratings on loans consider the PD and the LGD. The PD is the likelihood that a loan will default. The LGD is the estimated loss on the loan that would be realized upon the default of the borrower and takes into consideration collateral and structural support for each credit facility.

Management considers several factors to determine an appropriate risk rating, including the obligor's debt capacity and financial flexibility, the level of the obligor's earnings, the amount and sources for repayment, the level and nature of contingencies, management strength, and the industry and geography in which the obligor operates. The Firm's definition of criticized aligns with the banking regulatory definition of criticized exposures, which consist of special mention, substandard and doubtful categories. Risk ratings generally represent ratings profiles similar to those defined by S&P and Moody's. Investment-grade ratings range from "AAA/Aaa" to "BBB-/Baa3." Noninvestment-grade ratings are classified as noncriticized ("BB+/Ba1 and B-/B3") and criticized ("CCC+"/"Caa1 and below"), and the criticized portion is further subdivided into performing and nonaccrual loans, representing management's assessment of the collectibility of principal and interest. Criticized loans have a higher probability of default than noncriticized loans.

Risk ratings are reviewed on a regular and ongoing basis by Credit Risk Management and are adjusted as necessary for updated information affecting the obligor's ability to fulfill its obligations.

As noted above, the risk rating of a loan considers the industry in which the obligor conducts its operations. As part of the overall credit risk management framework, the Firm focuses on the management and diversification of its industry and client exposures, with particular attention paid to industries with actual or potential credit concern. Refer to Note 4 for further detail on industry concentrations.

The table below provides information by class of receivable for the retained loans in the Wholesale portfolio segment. For additional information on industry concentrations, refer to Note 4.

As of or for the year ended December 31, (in millions, except ratios)	Commercial and industrial		Real estate		Financial institutions		Governments & Agencies		Other ^(d)		Total retained loans	
	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017
Loans by risk ratings												
Investment-grade	\$ 73,497	\$ 68,071	\$ 100,107	\$ 98,467	\$ 32,178	\$ 26,791	\$ 13,984	\$ 15,140	\$ 119,963	\$ 103,212	\$ 339,729	\$ 311,681
Noninvestment-grade:												
Noncriticized	51,720	46,558	14,876	14,335	15,316	13,071	201	369	11,478	9,988	93,591	84,321
Criticized performing	3,738	3,983	620	710	150	210	2	–	182	259	4,692	5,162
Criticized nonaccrual	851	1,357	134	136	4	2	–	–	161	239	1,150	1,734
Total noninvestment-grade	56,309	51,898	15,630	15,181	15,470	13,283	203	369	11,821	10,486	99,433	91,217
Total retained loans	\$ 129,806	\$ 119,969	\$ 115,737	\$ 113,648	\$ 47,648	\$ 40,074	\$ 14,187	\$ 15,509	\$ 131,784	\$ 113,698	\$ 439,162	\$ 402,898
% of total criticized exposure to total retained loans	3.54%	4.45%	0.65%	0.74%	0.32%	0.53%	0.01%	–%	0.26%	0.44%	1.33%	1.71%
% of criticized nonaccrual to total retained loans	0.66	1.13	0.12	0.12	0.01	–	–	–	0.12	0.21	0.26	0.43
Loans by geographic distribution^(a)												
Total non-U.S.	\$ 29,572	\$ 28,470	\$ 2,967	\$ 3,101	\$ 18,524	\$ 16,790	\$ 3,150	\$ 2,906	\$ 48,433	\$ 44,112	\$ 102,646	\$ 95,379
Total U.S.	100,234	91,499	112,770	110,547	29,124	23,284	11,037	12,603	83,351	69,586	336,516	307,519
Total retained loans	\$ 129,806	\$ 119,969	\$ 115,737	\$ 113,648	\$ 47,648	\$ 40,074	\$ 14,187	\$ 15,509	\$ 131,784	\$ 113,698	\$ 439,162	\$ 402,898
Net charge-offs/ (recoveries)	\$ 165	\$ 117	\$ (20)	\$ (4)	\$ –	\$ 6	\$ –	\$ 5	\$ 10	\$ (5)	\$ 155	\$ 119
% of net charge-offs/ (recoveries) to end-of-period retained loans	0.13%	0.10%	(0.02)%	–%	–%	0.01%	–%	0.03%	0.01%	–%	0.04%	0.03%
Loan delinquency^(b)												
Current and less than 30 days past due and still accruing	\$ 128,678	\$ 118,288	\$ 115,533	\$ 113,258	\$ 47,622	\$ 40,042	\$ 14,165	\$ 15,493	\$ 130,918	\$ 112,559	\$ 436,916	\$ 399,640
30–89 days past due and still accruing	109	216	67	242	12	15	18	12	702	898	908	1,383
90 or more days past due and still accruing ^(c)	168	108	3	12	10	15	4	4	3	2	188	141
Criticized nonaccrual	851	1,357	134	136	4	2	–	–	161	239	1,150	1,734
Total retained loans	\$ 129,806	\$ 119,969	\$ 115,737	\$ 113,648	\$ 47,648	\$ 40,074	\$ 14,187	\$ 15,509	\$ 131,784	\$ 113,698	\$ 439,162	\$ 402,898

(a) The U.S. and non-U.S. distribution is determined based predominantly on the domicile of the borrower.

(b) The credit quality of wholesale loans is assessed primarily through ongoing review and monitoring of an obligor's ability to meet contractual obligations rather than relying on the past due status, which is generally a lagging indicator of credit quality.

(c) Represents loans that are considered well-collateralized and therefore still accruing interest.

(d) Other includes individuals and individual entities (predominantly consists of Wealth Management clients within AWM and includes exposure to personal investment companies and personal and testamentary trusts), SPEs and Private education and civic organizations. For more information on SPEs, refer to Note 14.

Notes to consolidated financial statements

The following table presents additional information on the real estate class of loans within the Wholesale portfolio for the periods indicated. Exposure consists primarily of secured commercial loans, of which multifamily is the largest segment. Multifamily lending finances acquisition, leasing and construction of apartment buildings, and includes exposure to real estate investment trusts (“REITs”). Other commercial lending largely includes financing for acquisition, leasing and construction, largely for office, retail and industrial real estate, and includes exposure to REITs. Included in real estate loans is \$10.5 billion and \$10.8 billion as of December 31, 2018 and 2017, respectively, of construction and development exposure consisting of loans originally purposed for construction and development, general purpose loans for builders, as well as loans for land subdivision and pre-development.

December 31, (in millions, except ratios)	Multifamily		Other Commercial		Total real estate loans	
	2018	2017	2018	2017	2018	2017
Real estate retained loans	\$ 79,184	\$ 77,597	\$ 36,553	\$ 36,051	\$ 115,737	\$ 113,648
Criticized exposure	388	491	366	355	754	846
% of total criticized exposure to total real estate retained loans	0.49%	0.63%	1.00%	0.98%	0.65%	0.74%
Criticized nonaccrual	\$ 57	\$ 44	\$ 77	\$ 92	\$ 134	\$ 136
% of criticized nonaccrual loans to total real estate retained loans	0.07%	0.06%	0.21%	0.26%	0.12%	0.12%

Wholesale impaired retained loans and loan modifications

Wholesale impaired retained loans consist of loans that have been placed on nonaccrual status and/or that have been modified in a TDR. All impaired loans are evaluated for an asset-specific allowance as described in Note 13.

The table below sets forth information about the Firm’s wholesale impaired retained loans.

December 31, (in millions)	Commercial and industrial		Real estate		Financial institutions		Governments & Agencies		Other		Total retained loans	
	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017
Impaired loans												
With an allowance	\$ 807	\$ 1,170	\$ 107	\$ 78	\$ 4	\$ 93	\$ –	\$ –	\$ 152	\$ 168	\$ 1,070	\$ 1,509
Without an allowance ^(a)	140	228	27	60	–	–	–	–	13	70	180	358
Total impaired loans	\$ 947	\$ 1,398	\$ 134	\$ 138	\$ 4	\$ 93	\$ –	\$ –	\$ 165	\$ 238	\$ 1,250	\$ 1,867
Allowance for loan losses related to impaired loans	\$ 252	\$ 404	\$ 25	\$ 11	\$ 1	\$ 4	\$ –	\$ –	\$ 19	\$ 42	\$ 297	\$ 461
Unpaid principal balance of impaired loans ^(b)	1,043	1,604	203	201	4	94	–	–	473	255	1,723	2,154

- (a) When the discounted cash flows, collateral value or market price equals or exceeds the recorded investment in the loan, the loan does not require an allowance. This typically occurs when the impaired loans have been partially charged-off and/or there have been interest payments received and applied to the loan balance.
- (b) Represents the contractual amount of principal owed at December 31, 2018 and 2017. The unpaid principal balance differs from the impaired loan balances due to various factors, including charge-offs; interest payments received and applied to the carrying value; net deferred loan fees or costs; and unamortized discount or premiums on purchased loans.
- (c) Based upon the domicile of the borrower, largely consists of loans in the U.S.

The following table presents the Firm’s average impaired retained loans for the years ended 2018, 2017 and 2016.

Year ended December 31, (in millions)	2018	2017 ^(b)	2016
Commercial and industrial	\$ 1,027	\$ 1,256	\$ 1,480
Real estate	133	165	217
Financial institutions	57	48	13
Governments & Agencies	–	–	–
Other	199	241	213
Total^(a)	\$ 1,416	\$ 1,710	\$ 1,923

- (a) The related interest income on accruing impaired loans and interest income recognized on a cash basis were not material for the years ended December 31, 2018, 2017 and 2016.
- (b) The prior period amounts have been revised to conform with the current period presentation.

Certain loan modifications are considered to be TDRs as they provide various concessions to borrowers who are experiencing financial difficulty. All TDRs are reported as impaired loans in the tables above. TDRs were \$576 million and \$614 million as of December 31, 2018 and 2017, respectively. The impact of these modifications, as well as new TDRs, were not material to the Firm for the years ended December 31, 2018, 2017 and 2016.

Note 13 – Allowance for credit losses

JPMorgan Chase's allowance for loan losses represents management's estimate of probable credit losses inherent in the Firm's retained loan portfolio, which consists of the two consumer portfolio segments (primarily scored) and the wholesale portfolio segment (risk-rated). The allowance for loan losses includes a formula-based component, an asset-specific component, and a component related to PCI loans, as described below. Management also estimates an allowance for wholesale and certain consumer lending-related commitments using methodologies similar to those used to estimate the allowance on the underlying loans.

The Firm's policies used to determine its allowance for credit losses are described in the following paragraphs.

Determining the appropriateness of the allowance is complex and requires judgment by management about the effect of matters that are inherently uncertain. Subsequent evaluations of the loan portfolio, in light of the factors then prevailing, may result in significant changes in the allowances for loan losses and lending-related commitments in future periods. At least quarterly, the allowance for credit losses is reviewed by the CRO, the CFO and the Controller of the Firm. As of December 31, 2018, JPMorgan Chase deemed the allowance for credit losses to be appropriate and sufficient to absorb probable credit losses inherent in the portfolio.

Formula-based component

The formula-based component is based on a statistical calculation to provide for incurred credit losses in all consumer loans and performing risk-rated loans. All loans restructured in TDRs as well as any impaired risk-rated loans have an allowance assessed as part of the asset-specific component, while PCI loans have an allowance assessed as part of the PCI component. Refer to Note 12 for more information on TDRs, Impaired loans and PCI loans.

Formula-based component - Consumer loans and certain lending-related commitments

The formula-based allowance for credit losses for the consumer portfolio segments is calculated by applying statistical credit loss factors (estimated PD and loss severities) to the recorded investment balances or loan-equivalent amounts of pools of loan exposures with similar risk characteristics over a loss emergence period to arrive at an estimate of incurred credit losses. Estimated loss emergence periods may vary by product and may change over time; management applies judgment in estimating loss emergence periods, using available credit information and trends. In addition, management applies judgment to the statistical loss estimates for each loan portfolio category, using delinquency trends and other risk characteristics to estimate the total incurred credit losses in the portfolio. Management uses additional statistical methods and considers actual portfolio performance, including actual losses recognized on defaulted loans and collateral valuation trends, to review the appropriateness of the primary statistical loss estimate. The economic impact of

potential modifications of residential real estate loans is not included in the statistical calculation because of the uncertainty regarding the type and results of such modifications.

The statistical calculation is then adjusted to take into consideration model imprecision, external factors and current economic events that have occurred but that are not yet reflected in the factors used to derive the statistical calculation; these adjustments are accomplished in part by analyzing the historical loss experience for each major product segment. However, it is difficult to predict whether historical loss experience is indicative of future loss levels. Management applies judgment in making this adjustment, taking into account uncertainties associated with current macroeconomic and political conditions, quality of underwriting standards, borrower behavior, and other relevant internal and external factors affecting the credit quality of the portfolio. In certain instances, the interrelationships between these factors create further uncertainties. The application of different inputs into the statistical calculation, and the assumptions used by management to adjust the statistical calculation, are subject to management judgment, and emphasizing one input or assumption over another, or considering other inputs or assumptions, could affect the estimate of the allowance for credit losses for the consumer credit portfolio.

Overall, the allowance for credit losses for consumer portfolios is sensitive to changes in the economic environment (e.g., unemployment rates), delinquency rates, the realizable value of collateral (e.g., housing prices), FICO scores, borrower behavior and other risk factors. While all of these factors are important determinants of overall allowance levels, changes in the various factors may not occur at the same time or at the same rate, or changes may be directionally inconsistent such that improvement in one factor may offset deterioration in another. In addition, changes in these factors would not necessarily be consistent across all geographies or product types. Finally, it is difficult to predict the extent to which changes in these factors would ultimately affect the frequency of losses, the severity of losses or both.

Notes to consolidated financial statements

Formula-based component - Wholesale loans and lending-related commitments

The Firm's methodology for determining the allowance for loan losses and the allowance for lending-related commitments involves the early identification of credits that are deteriorating. The formula-based component of the allowance for wholesale loans and lending-related commitments is calculated by applying statistical credit loss factors (estimated PD and LGD) to the recorded investment balances or loan-equivalent over a loss emergence period to arrive at an estimate of incurred credit losses in the portfolio. Estimated loss emergence periods may vary by the funded versus unfunded status of the instrument and may change over time.

The Firm assesses the credit quality of a borrower or counterparty and assigns a risk rating. Risk ratings are assigned at origination or acquisition, and if necessary, adjusted for changes in credit quality over the life of the exposure. In assessing the risk rating of a particular loan or lending-related commitment, among the factors considered are the obligor's debt capacity and financial flexibility, the level of the obligor's earnings, the amount and sources for repayment, the level and nature of contingencies, management strength, and the industry and geography in which the obligor operates. These factors are based on an evaluation of historical and current information and involve subjective assessment and interpretation. Determining risk ratings involves significant judgment; emphasizing one factor over another or considering additional factors could affect the risk rating assigned by the Firm.

A PD estimate is determined based on the Firm's history of defaults over more than one credit cycle.

LGD estimate is a judgment-based estimate assigned to each loan or lending-related commitment. The estimate represents the amount of economic loss if the obligor were to default. The type of obligor, quality of collateral, and the seniority of the Firm's lending exposure in the obligor's capital structure affect LGD.

The Firm applies judgment in estimating PD, LGD, loss emergence period and loan-equivalent used in calculating the allowance for credit losses. Estimates of PD, LGD, loss emergence period and loan-equivalent used are subject to periodic refinement based on any changes to underlying external or Firm-specific historical data. Changes to the time period used for PD and LGD estimates could also affect the allowance for credit losses. The use of different inputs, estimates or methodologies could change the amount of the allowance for credit losses determined appropriate by the Firm.

In addition to the statistical credit loss estimates applied to the wholesale portfolio, management applies its judgment to adjust the statistical estimates for wholesale loans and lending-related commitments, taking into consideration model imprecision, external factors and economic events that have occurred but are not yet reflected in the loss factors. Historical experience of both LGD and PD are

considered when estimating these adjustments. Factors related to concentrated and deteriorating industries also are incorporated where relevant. These estimates are based on management's view of uncertainties that relate to current macroeconomic conditions, quality of underwriting standards and other relevant internal and external factors affecting the credit quality of the current portfolio.

Asset-specific component

The asset-specific component of the allowance relates to loans considered to be impaired, which includes loans that have been modified in TDRs as well as risk-rated loans that have been placed on nonaccrual status. To determine the asset-specific component of the allowance, larger risk-rated loans (primarily loans in the wholesale portfolio segment) are evaluated individually, while smaller loans (both risk-rated and scored) are evaluated as pools using historical loss experience for the respective class of assets.

The Firm generally measures the asset-specific allowance as the difference between the recorded investment in the loan and the present value of the cash flows expected to be collected, discounted at the loan's original effective interest rate. Subsequent changes in impairment are reported as an adjustment to the allowance for loan losses. In certain cases, the asset-specific allowance is determined using an observable market price, and the allowance is measured as the difference between the recorded investment in the loan and the loan's fair value. Collateral-dependent loans are charged down to the fair value of collateral less costs to sell. For any of these impaired loans, the amount of the asset-specific allowance required to be recorded, if any, is dependent upon the recorded investment in the loan (including prior charge-offs), and either the expected cash flows or fair value of collateral. Refer to Note 12 for more information about charge-offs and collateral-dependent loans.

The asset-specific component of the allowance for impaired loans that have been modified in TDRs (including forgone interest, principal forgiveness, as well as other concessions) incorporates the effect of the modification on the loan's expected cash flows, which considers the potential for redefault. For residential real estate loans modified in TDRs, the Firm develops product-specific probability of default estimates, which are applied at a loan level to compute expected losses. In developing these probabilities of default, the Firm considers the relationship between the credit quality characteristics of the underlying loans and certain assumptions about home prices and unemployment, based upon industry-wide data. The Firm also considers its own historical loss experience to-date based on actual redefaulted modified loans. For credit card loans modified in TDRs, expected losses incorporate projected redefaults based on the Firm's historical experience by type of modification program. For wholesale loans modified in TDRs, expected losses incorporate management's expectation of the borrower's ability to repay under the modified terms.

Estimating the timing and amounts of future cash flows is highly judgmental as these cash flow projections rely upon estimates such as loss severities, asset valuations, default rates (including redefault rates on modified loans), the amounts and timing of interest or principal payments (including any expected prepayments) or other factors that are reflective of current and expected market conditions. These estimates are, in turn, dependent on factors such as the duration of current overall economic conditions, industry-, portfolio-, or borrower-specific factors, the expected outcome of insolvency proceedings as well as, in certain circumstances, other economic factors, including the level of future home prices. All of these estimates and assumptions require significant management judgment and certain assumptions are highly subjective.

PCI loans

In connection with the acquisition of certain PCI loans, which are accounted for as described in Note 12, the allowance for loan losses for the PCI portfolio is based on quarterly estimates of the amount of principal and interest cash flows expected to be collected over the estimated remaining lives of the loans.

These cash flow projections are based on estimates regarding default rates (including redefault rates on modified loans), loss severities, the amounts and timing of prepayments and other factors that are reflective of current and expected future market conditions. These estimates are dependent on assumptions regarding the level of future home prices, and the duration of current overall economic conditions, among other factors. These estimates and assumptions require significant management judgment and certain assumptions are highly subjective.

Notes to consolidated financial statements

Allowance for credit losses and related information

The table below summarizes information about the allowances for loan losses and lending-related commitments, and includes a breakdown of loans and lending-related commitments by impairment methodology.

(Table continued on next page)

Year ended December 31, (in millions)	2018			
	Consumer, excluding credit card	Credit card	Wholesale	Total
Allowance for loan losses				
Beginning balance at January 1,	\$ 4,579	\$ 4,884	\$ 4,141	\$ 13,604
Gross charge-offs	1,025	5,011	313	6,349
Gross recoveries	(842)	(493)	(158)	(1,493)
Net charge-offs	183	4,518	155	4,856
Write-offs of PCI loans ^(a)	187	—	—	187
Provision for loan losses	(63)	4,818	130	4,885
Other	—	—	(1)	(1)
Ending balance at December 31,	\$ 4,146	\$ 5,184	\$ 4,115	\$ 13,445
Allowance for loan losses by impairment methodology				
Asset-specific ^(b)	\$ 196	\$ 440 ^(c)	\$ 297	\$ 933
Formula-based	2,162	4,744	3,818	10,724
PCI	1,788	—	—	1,788
Total allowance for loan losses	\$ 4,146	\$ 5,184	\$ 4,115	\$ 13,445
Loans by impairment methodology				
Asset-specific	\$ 6,828	\$ 1,319	\$ 1,250	\$ 9,397
Formula-based	342,775	155,297	437,909	935,981
PCI	24,034	—	3	24,037
Total retained loans	\$ 373,637	\$ 156,616	\$ 439,162	\$ 969,415
Impaired collateral-dependent loans				
Net charge-offs	\$ 24	\$ —	\$ 21	\$ 45
Loans measured at fair value of collateral less cost to sell	2,080	—	202	2,282
Allowance for lending-related commitments				
Beginning balance at January 1,	\$ 33	\$ —	\$ 1,035	\$ 1,068
Provision for lending-related commitments	—	—	(14)	(14)
Other	—	—	1	1
Ending balance at December 31,	\$ 33	\$ —	\$ 1,022	\$ 1,055
Allowance for lending-related commitments by impairment methodology				
Asset-specific	\$ —	\$ —	\$ 99	\$ 99
Formula-based	33	—	923	956
Total allowance for lending-related commitments	\$ 33	\$ —	\$ 1,022	\$ 1,055
Lending-related commitments by impairment methodology				
Asset-specific	\$ —	\$ —	\$ 469	\$ 469
Formula-based	46,066	605,379	387,344	1,038,789
Total lending-related commitments	\$ 46,066	\$ 605,379	\$ 387,813	\$ 1,039,258

(a) Write-offs of PCI loans are recorded against the allowance for loan losses when actual losses for a pool exceed estimated losses that were recorded as purchase accounting adjustments at the time of acquisition. A write-off of a PCI loan is recognized when the underlying loan is removed from a pool.

(b) Includes risk-rated loans that have been placed on nonaccrual status and loans that have been modified in a TDR.

(c) The asset-specific credit card allowance for loan losses is related to loans that have been modified in a TDR; such allowance is calculated based on the loans' original contractual interest rates and does not consider any incremental penalty rates.

(table continued from previous page)

2017				2016			
Consumer, excluding credit card	Credit card	Wholesale	Total	Consumer, excluding credit card	Credit card	Wholesale	Total
\$ 5,198	\$ 4,034	\$ 4,544	\$ 13,776	\$ 5,806	\$ 3,434	\$ 4,315	\$ 13,555
1,779	4,521	212	6,512	1,500	3,799	398	5,697
(634)	(398)	(93)	(1,125)	(591)	(357)	(57)	(1,005)
1,145	4,123	119	5,387	909	3,442	341	4,692
86	–	–	86	156	–	–	156
613	4,973	(286)	5,300	467	4,042	571	5,080
(1)	–	2	1	(10)	–	(1)	(11)
\$ 4,579	\$ 4,884	\$ 4,141	\$ 13,604	\$ 5,198	\$ 4,034	\$ 4,544	\$ 13,776
\$ 246	\$ 383 ^(c)	\$ 461	\$ 1,090	\$ 308	\$ 358 ^(c)	\$ 342	\$ 1,008
2,108	4,501	3,680	10,289	2,579	3,676	4,202	10,457
2,225	–	–	2,225	2,311	–	–	2,311
\$ 4,579	\$ 4,884	\$ 4,141	\$ 13,604	\$ 5,198	\$ 4,034	\$ 4,544	\$ 13,776
\$ 8,036	\$ 1,215	\$ 1,867	\$ 11,118	\$ 8,940	\$ 1,240	\$ 2,017	\$ 12,197
333,941	148,172	401,028	883,141	319,787	140,471	381,770	842,028
30,576	–	3	30,579	35,679	–	3	35,682
\$ 372,553	\$ 149,387	\$ 402,898	\$ 924,838	\$ 364,406	\$ 141,711	\$ 383,790	\$ 889,907
\$ 64	\$ –	\$ 31	\$ 95	\$ 98	\$ –	\$ 7	\$ 105
2,133	–	233	2,366	2,391	–	300	2,691
\$ 26	\$ –	\$ 1,052	\$ 1,078	\$ 14	\$ –	\$ 772	\$ 786
7	–	(17)	(10)	–	–	281	281
–	–	–	–	12	–	(1)	11
\$ 33	\$ –	\$ 1,035	\$ 1,068	\$ 26	\$ –	\$ 1,052	\$ 1,078
\$ –	\$ –	\$ 187	\$ 187	\$ –	\$ –	\$ 169	\$ 169
33	–	848	881	26	–	883	909
\$ 33	\$ –	\$ 1,035	\$ 1,068	\$ 26	\$ –	\$ 1,052	\$ 1,078
\$ –	\$ –	\$ 731	\$ 731	\$ –	\$ –	\$ 506	\$ 506
48,553	572,831	369,367	990,751	53,247	553,891	367,508	974,646
\$ 48,553	\$ 572,831	\$ 370,098	\$ 991,482	\$ 53,247	\$ 553,891	\$ 368,014	\$ 975,152

Notes to consolidated financial statements

Note 14 – Variable interest entities

For a further description of JPMorgan Chase’s accounting policies regarding consolidation of VIEs, refer to Note 1. Page 198

The following table summarizes the most significant types of Firm-sponsored VIEs by business segment. The Firm considers a “sponsored” VIE to include any entity where: (1) JPMorgan Chase is the primary beneficiary of the structure; (2) the VIE is used by JPMorgan Chase to securitize Firm assets; (3) the VIE issues financial instruments with the JPMorgan Chase name; or (4) the entity is a JPMorgan Chase-administered asset-backed commercial paper conduit.

Line of Business	Transaction Type	Activity	2018 Form 10-K page references
CCB	Credit card securitization trusts	Securitization of originated credit card receivables	244-245
	Mortgage securitization trusts	Servicing and securitization of both originated and purchased residential mortgages	245-247
CIB	Mortgage and other securitization trusts	Securitization of both originated and purchased residential and commercial mortgages, and other consumer loans	245-247
	Multi-seller conduits	Assist clients in accessing the financial markets in a cost-efficient manner and structures transactions to meet investor needs	247
	Municipal bond vehicles	Financing of municipal bond investments	247-248

The Firm’s other business segments are also involved with VIEs (both third-party and Firm-sponsored), but to a lesser extent, as follows:

- **Asset & Wealth Management:** AWM sponsors and manages certain funds that are deemed VIEs. As asset manager of the funds, AWM earns a fee based on assets managed; the fee varies with each fund’s investment objective and is competitively priced. For fund entities that qualify as VIEs, AWM’s interests are, in certain cases, considered to be significant variable interests that result in consolidation of the financial results of these entities.
- **Commercial Banking:** CB provides financing and lending-related services to a wide spectrum of clients, including certain third-party-sponsored entities that may meet the definition of a VIE. CB does not control the activities of these entities and does not consolidate these entities. CB’s maximum loss exposure, regardless of whether the entity is a VIE, is generally limited to loans and lending-related commitments which are reported and disclosed in the same manner as any other third-party transaction.
- **Corporate:** Corporate is involved with entities that may meet the definition of VIEs; however these entities are generally subject to specialized investment company accounting, which does not require the consolidation of investments, including VIEs. In addition, Treasury and CIO invest in securities generally issued by third parties which may meet the definition of VIEs (e.g., issuers of asset-backed securities). In general, the Firm does not have the power to direct the significant activities of these entities and therefore does not consolidate these entities. Refer to Note 10 for further information on the Firm’s investment securities portfolio.

In addition, CIB also invests in and provides financing and other services to VIEs sponsored by third parties. Refer to page 249 of this Note for more information on the VIEs sponsored by third parties.

Significant Firm-sponsored variable interest entities

Credit card securitizations

CCB’s Card business securitizes originated credit card loans, primarily through the Chase Issuance Trust (the “Trust”). The Firm’s continuing involvement in credit card securitizations includes servicing the receivables, retaining an undivided seller’s interest in the receivables, retaining certain senior and subordinated securities and maintaining escrow accounts.

The Firm is considered to be the primary beneficiary of these Firm-sponsored credit card securitization trusts based on the Firm’s ability to direct the activities of these VIEs through its servicing responsibilities and other duties, including making decisions as to the receivables that are transferred into those trusts and as to any related modifications and workouts. Additionally, the nature and extent of the Firm’s other continuing involvement with the trusts, as indicated above, obligates the Firm to absorb

losses and gives the Firm the right to receive certain benefits from these VIEs that could potentially be significant.

The underlying securitized credit card receivables and other assets of the securitization trusts are available only for payment of the beneficial interests issued by the securitization trusts; they are not available to pay the Firm’s other obligations or the claims of the Firm’s creditors.

The agreements with the credit card securitization trusts require the Firm to maintain a minimum undivided interest in the credit card trusts (generally 5%). As of December 31, 2018 and 2017, the Firm held undivided interests in Firm-sponsored credit card securitization trusts of \$15.1 billion and \$15.8 billion, respectively. The Firm maintained an average undivided interest in principal receivables owned by those trusts of approximately 37% and 26% for the years ended December 31, 2018 and 2017. The Firm did

not retain any senior securities and retained \$3.0 billion and \$4.5 billion of subordinated securities in certain of its credit card securitization trusts as of December 31, 2018 and 2017, respectively. The Firm's undivided interests in the credit card trusts and securities retained are eliminated in consolidation.

Firm-sponsored mortgage and other securitization trusts

The Firm securitizes (or has securitized) originated and purchased residential mortgages, commercial mortgages and other consumer loans primarily in its CCB and CIB businesses. Depending on the particular transaction, as well as the respective business involved, the Firm may act as the servicer of the loans and/or retain certain beneficial interests in the securitization trusts.

The following table presents the total unpaid principal amount of assets held in Firm-sponsored private-label securitization entities, including those in which the Firm has continuing involvement, and those that are consolidated by the Firm. Continuing involvement includes servicing the loans, holding senior interests or subordinated interests (including amounts required to be held pursuant to credit risk retention rules), recourse or guarantee arrangements, and derivative contracts. In certain instances, the Firm's only continuing involvement is servicing the loans. Refer to Securitization activity on page 250 of this Note for further information regarding the Firm's cash flows associated with and interests retained in nonconsolidated VIEs, and pages 250-251 of this Note for information on the Firm's loan sales to U.S. government agencies.

	Principal amount outstanding			JPMorgan Chase interest in securitized assets in nonconsolidated VIEs ^{(c)(d)(e)}			
	Total assets held by securitization VIEs	Assets held in consolidated securitization VIEs	Assets held in nonconsolidated securitization VIEs with continuing involvement	Trading assets	Investment securities	Other financial assets	Total interests held by JPMorgan Chase
December 31, 2018 (in millions)							
Securitization-related^(a)							
Residential mortgage:							
Prime/Alt-A and option ARMs	\$ 63,350	\$ 3,237	\$ 50,679	\$ 623	\$ 647	\$ –	\$ 1,270
Subprime	16,729	32	15,434	53	–	–	53
Commercial and other ^(b)	102,961	–	79,387	783	801	210	1,794
Total	\$ 183,040	\$ 3,269	\$ 145,500	\$ 1,459	\$ 1,448	\$ 210	\$ 3,117

	Principal amount outstanding			JPMorgan Chase interest in securitized assets in nonconsolidated VIEs ^{(c)(d)(e)}			
	Total assets held by securitization VIEs	Assets held in consolidated securitization VIEs	Assets held in nonconsolidated securitization VIEs with continuing involvement	Trading assets	Investment securities	Other financial assets	Total interests held by JPMorgan Chase
December 31, 2017 (in millions)							
Securitization-related^(a)							
Residential mortgage:							
Prime/Alt-A and option ARMs	\$ 68,874	\$ 3,615	\$ 52,280	\$ 410	\$ 943	\$ –	\$ 1,353
Subprime	18,984	7	17,612	93	–	–	93
Commercial and other ^(b)	94,905	63	63,411	745	1,133	157	2,035
Total	\$ 182,763	\$ 3,685	\$ 133,303	\$ 1,248	\$ 2,076	\$ 157	\$ 3,481

- (a) Excludes U.S. government agency securitizations and re-securitizations, which are not Firm-sponsored. Refer to pages 250-251 of this Note for information on the Firm's loan sales to U.S. government agencies.
- (b) Consists of securities backed by commercial loans (predominantly real estate) and non-mortgage-related consumer receivables purchased from third parties.
- (c) Excludes the following: retained servicing (refer to Note 15 for a discussion of MSRs); securities retained from loan sales to U.S. government agencies; interest rate and foreign exchange derivatives primarily used to manage interest rate and foreign exchange risks of securitization entities (refer to Note 5 for further information on derivatives); senior and subordinated securities of \$87 million and \$28 million, respectively, at December 31, 2018, and \$88 million and \$48 million, respectively, at December 31, 2017, which the Firm purchased in connection with CIB's secondary market-making activities.
- (d) Includes interests held in re-securitization transactions.
- (e) As of December 31, 2018 and 2017, 60% and 61%, respectively, of the Firm's retained securitization interests, which are predominantly carried at fair value and include amounts required to be held pursuant to credit risk retention rules, were risk-rated "A" or better, on an S&P-equivalent basis. The retained interests in prime residential mortgages consisted of \$1.3 billion of investment-grade for both periods, and \$16 million and \$48 million of noninvestment-grade at December 31, 2018 and 2017, respectively. The retained interests in commercial and other securitizations trusts consisted of \$1.2 billion and \$1.6 billion of investment-grade and \$623 million and \$412 million of noninvestment-grade retained interests at December 31, 2018 and 2017, respectively.

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Residential mortgage

The Firm securitizes residential mortgage loans originated by CCB, as well as residential mortgage loans purchased from third parties by either CCB or CIB. CCB generally retains servicing for all residential mortgage loans it originated or purchased, and for certain mortgage loans purchased by CIB. For securitizations of loans serviced by CCB, the Firm has the power to direct the significant activities of the VIE because it is responsible for decisions related to loan modifications and workouts. CCB may also retain an interest upon securitization.

In addition, CIB engages in underwriting and trading activities involving securities issued by Firm-sponsored securitization trusts. As a result, CIB at times retains senior and/or subordinated interests (including residual interests and amounts required to be held pursuant to credit risk retention rules) in residential mortgage securitizations at the time of securitization, and/or reacquires positions in the secondary market in the normal course of business. In certain instances, as a result of the positions retained or reacquired by CIB or held by CCB, when considered together with the servicing arrangements entered into by CCB, the Firm is deemed to be the primary beneficiary of certain securitization trusts. Refer to the table on page 248 of this Note for more information on consolidated residential mortgage securitizations.

The Firm does not consolidate a residential mortgage securitization (Firm-sponsored or third-party-sponsored) when it is not the servicer (and therefore does not have the power to direct the most significant activities of the trust) or does not hold a beneficial interest in the trust that could potentially be significant to the trust. Refer to the table on page 248 of this Note for more information on the consolidated residential mortgage securitizations, and the table on the previous page of this Note for further information on interests held in nonconsolidated residential mortgage securitizations.

Commercial mortgages and other consumer securitizations

CIB originates and securitizes commercial mortgage loans, and engages in underwriting and trading activities involving the securities issued by securitization trusts. CIB may retain unsold senior and/or subordinated interests (including amounts required to be held pursuant to credit risk retention rules) in commercial mortgage securitizations at the time of securitization but, generally, the Firm does not service commercial loan securitizations. For commercial mortgage securitizations the power to direct the significant activities of the VIE generally is held by the servicer or investors in a specified class of securities (“controlling class”). The Firm generally does not retain an interest in the controlling class in its sponsored commercial mortgage securitization transactions. Refer to the table on page 248 of this Note for more information on the consolidated commercial mortgage securitizations, and the table on the previous page of this Note for further information on interests held in nonconsolidated securitizations.

Re-securitizations

The Firm engages in certain re-securitization transactions in which debt securities are transferred to a VIE in exchange for new beneficial interests. These transfers occur in connection with both agency (Federal National Mortgage Association (“Fannie Mae”), Federal Home Loan Mortgage Corporation (“Freddie Mac”) and Government National Mortgage Association (“Ginnie Mae”)) and nonagency (private-label) sponsored VIEs, which may be backed by either residential or commercial mortgages. The Firm’s consolidation analysis is largely dependent on the Firm’s role and interest in the re-securitization trusts.

The following table presents the principal amount of securities transferred to re-securitization VIEs.

Year ended December 31, (in millions)	2018	2017	2016
Transfers of securities to VIEs			
Firm-sponsored private-label	\$ –	\$ –	\$ 647
Agency	15,532	12,617	11,241

Most re-securitizations with which the Firm is involved are client-driven transactions in which a specific client or group of clients is seeking a specific return or risk profile. For these transactions, the Firm has concluded that the decision-making power of the entity is shared between the Firm and its clients, considering the joint effort and decisions in establishing the re-securitization trust and its assets, as well as the significant economic interest the client holds in the re-securitization trust; therefore the Firm does not consolidate the re-securitization VIE.

In more limited circumstances, the Firm creates a nonagency re-securitization trust independently and not in conjunction with specific clients. In these circumstances, the Firm is deemed to have the unilateral ability to direct the most significant activities of the re-securitization trust because of the decisions made during the establishment and design of the trust; therefore, the Firm consolidates the re-securitization VIE if the Firm holds an interest that could potentially be significant.

Additionally, the Firm may invest in beneficial interests of third-party-sponsored re-securitizations and generally purchases these interests in the secondary market. In these circumstances, the Firm does not have the unilateral ability to direct the most significant activities of the re-securitization trust, either because it was not involved in the initial design of the trust, or the Firm is involved with an independent third-party sponsor and demonstrates shared power over the creation of the trust; therefore, the Firm does not consolidate the re-securitization VIE.

The following table presents information on nonconsolidated re-securitization VIEs.

December 31, (in millions)	Nonconsolidated re-securitization VIEs	
	2018	2017
Firm-sponsored private-label		
Assets held in VIEs with continuing involvement ^(a)	\$ 118	\$ 783
Interest in VIEs	10	29
Agency		
Interest in VIEs	3,058	2,250

(a) Represents the principal amount and includes the notional amount of interest-only securities.

As of December 31, 2018 and 2017, the Firm did not consolidate any agency re-securitization VIEs or any Firm-sponsored private-label re-securitization VIEs.

Multi-seller conduits

Multi-seller conduit entities are separate bankruptcy remote entities that provide secured financing, collateralized by pools of receivables and other financial assets, to customers of the Firm. The conduits fund their financing facilities through the issuance of highly rated commercial paper. The primary source of repayment of the commercial paper is the cash flows from the pools of assets. In most instances, the assets are structured with deal-specific credit enhancements provided to the conduits by the customers (i.e., sellers) or other third parties. Deal-specific credit enhancements are generally structured to cover a multiple of historical losses expected on the pool of assets, and are typically in the form of overcollateralization provided by the seller. The deal-specific credit enhancements mitigate the Firm's potential losses on its agreements with the conduits.

To ensure timely repayment of the commercial paper, and to provide the conduits with funding to provide financing to customers in the event that the conduits do not obtain funding in the commercial paper market, each asset pool financed by the conduits has a minimum 100% deal-specific liquidity facility associated with it provided by JPMorgan Chase Bank, N.A. JPMorgan Chase Bank, N.A. also provides the multi-seller conduit vehicles with uncommitted program-wide liquidity facilities and program-wide credit enhancement in the form of standby letters of credit. The amount of program-wide credit enhancement required is based upon commercial paper issuance and approximates 10% of the outstanding balance of commercial paper.

The Firm consolidates its Firm-administered multi-seller conduits, as the Firm has both the power to direct the significant activities of the conduits and a potentially significant economic interest in the conduits. As administrative agent and in its role in structuring transactions, the Firm makes decisions regarding asset types and credit quality, and manages the commercial paper funding needs of the conduits. The Firm's interests that could potentially be significant to the VIEs include the fees received as administrative agent and liquidity and

program-wide credit enhancement provider, as well as the potential exposure created by the liquidity and credit enhancement facilities provided to the conduits. Refer to page 248 of this Note for further information on consolidated VIE assets and liabilities.

In the normal course of business, JPMorgan Chase makes markets in and invests in commercial paper issued by the Firm-administered multi-seller conduits. The Firm held \$20.1 billion and \$20.4 billion of the commercial paper issued by the Firm-administered multi-seller conduits at December 31, 2018 and 2017, respectively, which have been eliminated in consolidation. The Firm's investments reflect the Firm's funding needs and capacity and were not driven by market illiquidity. Other than the amounts required to be held pursuant to credit risk retention rules, the Firm is not obligated under any agreement to purchase the commercial paper issued by the Firm-administered multi-seller conduits.

Deal-specific liquidity facilities, program-wide liquidity and credit enhancement provided by the Firm have been eliminated in consolidation. The Firm or the Firm-administered multi-seller conduits provide lending-related commitments to certain clients of the Firm-administered multi-seller conduits. The unfunded commitments were \$8.0 billion and \$8.8 billion at December 31, 2018 and 2017, respectively, and are reported as off-balance sheet lending-related commitments. For more information on off-balance sheet lending-related commitments, refer to Note 27.

Municipal bond vehicles

Municipal bond vehicles or tender option bond ("TOB") trusts allow institutions to finance their municipal bond investments at short-term rates. In a typical TOB transaction, the trust purchases highly rated municipal bond(s) of a single issuer and funds the purchase by issuing two types of securities: (1) puttable floating-rate certificates ("floaters") and (2) inverse floating-rate residual interests ("residuals"). The floaters are typically purchased by money market funds or other short-term investors and may be tendered, with requisite notice, to the TOB trust. The residuals are retained by the investor seeking to finance its municipal bond investment. TOB transactions where the residual is held by a third-party investor are typically known as customer TOB trusts, and non-customer TOB trusts are transactions where the Residual is retained by the Firm. Customer TOB trusts are sponsored by a third party; refer to page 249 on this Note for further information. The Firm serves as sponsor for all non-customer TOB transactions. The Firm may provide various services to a TOB trust, including remarketing agent, liquidity or tender option provider, and/or sponsor.

J.P. Morgan Securities LLC may serve as a remarketing agent on the floaters for TOB trusts. The remarketing agent is responsible for establishing the periodic variable rate on the floaters, conducting the initial placement and remarketing tendered floaters. The remarketing agent may,

Notes to consolidated financial statements

but is not obligated to, make markets in floaters. Floaters held by the Firm were not material during 2018 and 2017.

JPMorgan Chase Bank, N.A. or J.P. Morgan Securities LLC often serves as the sole liquidity or tender option provider for the TOB trusts. The liquidity provider's obligation to perform is conditional and is limited by certain events ("Termination Events"), which include bankruptcy or failure to pay by the municipal bond issuer or credit enhancement provider, an event of taxability on the municipal bonds or the immediate downgrade of the municipal bond to below investment grade. In addition, the liquidity provider's exposure is typically further limited by the high credit quality of the underlying municipal bonds, the excess collateralization in the vehicle, or, in certain transactions, the reimbursement agreements with the Residual holders.

Holders of the floaters may "put," or tender, their floaters to the TOB trust. If the remarketing agent cannot successfully remarket the floaters to another investor, the liquidity provider either provides a loan to the TOB trust for the TOB trust's purchase of the floaters, or it directly purchases the tendered floaters.

TOB trusts are considered to be variable interest entities. The Firm consolidates Non-Customer TOB trusts because as the Residual holder, the Firm has the right to make decisions that significantly impact the economic performance of the municipal bond vehicle, and it has the right to receive benefits and bear losses that could potentially be significant to the municipal bond vehicle.

Consolidated VIE assets and liabilities

The following table presents information on assets and liabilities related to VIEs consolidated by the Firm as of December 31, 2018 and 2017.

December 31, 2018 (in millions)	Assets				Liabilities		
	Trading assets	Loans	Other ^(b)	Total assets ^(c)	Beneficial interests in VIE assets ^(d)	Other ^(e)	Total liabilities
VIE program type							
Firm-sponsored credit card trusts	\$ —	\$ 31,760	\$ 491	\$ 32,251	\$ 13,404	\$ 12	\$ 13,416
Firm-administered multi-seller conduits	—	24,411	300	24,711	4,842	33	4,875
Municipal bond vehicles	1,779	—	4	1,783	1,685	3	1,688
Mortgage securitization entities ^(a)	53	3,285	40	3,378	308	161	469
Other	134	—	178	312	2	103	105
Total	\$ 1,966	\$ 59,456	\$ 1,013	\$ 62,435	\$ 20,241	\$ 312	\$ 20,553

December 31, 2017 (in millions)	Assets				Liabilities		
	Trading assets	Loans	Other ^(b)	Total assets ^(c)	Beneficial interests in VIE assets ^(d)	Other ^(e)	Total liabilities
VIE program type							
Firm-sponsored credit card trusts	\$ —	\$ 41,923	\$ 652	\$ 42,575	\$ 21,278	\$ 16	\$ 21,294
Firm-administered multi-seller conduits	—	23,411	48	23,459	3,045	28	3,073
Municipal bond vehicles	1,278	—	3	1,281	1,265	2	1,267
Mortgage securitization entities ^(a)	66	3,661	55	3,782	359	199	558
Other	105	—	1,916	2,021	134	104	238
Total	\$ 1,449	\$ 68,995	\$ 2,674	\$ 73,118	\$ 26,081	\$ 349	\$ 26,430

(a) Includes residential and commercial mortgage securitizations.

(b) Includes assets classified as cash and other assets on the Consolidated balance sheets.

(c) The assets of the consolidated VIEs included in the program types above are used to settle the liabilities of those entities. The assets and liabilities include third-party assets and liabilities of consolidated VIEs and exclude intercompany balances that eliminate in consolidation.

(d) The interest-bearing beneficial interest liabilities issued by consolidated VIEs are classified in the line item on the Consolidated balance sheets titled, "Beneficial interests issued by consolidated variable interest entities." The holders of these beneficial interests generally do not have recourse to the general credit of JPMorgan Chase. Included in beneficial interests in VIE assets are long-term beneficial interests of \$13.7 billion and \$21.8 billion at December 31, 2018 and 2017, respectively. For additional information on interest-bearing long-term beneficial interests, refer to Note 19.

(e) Includes liabilities classified as accounts payable and other liabilities on the Consolidated balance sheets.

VIEs sponsored by third parties

The Firm enters into transactions with VIEs structured by other parties. These include, for example, acting as a derivative counterparty, liquidity provider, investor, underwriter, placement agent, remarketing agent, trustee or custodian. These transactions are conducted at arm's-length, and individual credit decisions are based on the analysis of the specific VIE, taking into consideration the quality of the underlying assets. Where the Firm does not have the power to direct the activities of the VIE that most significantly impact the VIE's economic performance, or a variable interest that could potentially be significant, the Firm generally does not consolidate the VIE, but it records and reports these positions on its Consolidated balance sheets in the same manner it would record and report positions in respect of any other third-party transaction.

Tax credit vehicles

The Firm holds investments in unconsolidated tax credit vehicles, which are limited partnerships and similar entities that construct, own and operate affordable housing, alternative energy, and other projects. These entities are primarily considered VIEs. A third party is typically the general partner or managing member and has control over the significant activities of the tax credit vehicles, and accordingly the Firm does not consolidate tax credit vehicles. The Firm generally invests in these partnerships as a limited partner and earns a return primarily through the receipt of tax credits allocated to the projects. The maximum loss exposure, represented by equity investments and funding commitments, was \$16.5 billion and \$13.4 billion, of which \$4.0 billion and \$3.2 billion was unfunded at December 31, 2018 and 2017, respectively. In order to reduce the risk of loss, the Firm assesses each project and withholds varying amounts of its capital investment until the project qualifies for tax credits. Refer to Note 24 for further information on affordable housing tax credits. For more information on off-balance sheet lending-related commitments, refer to Note 27.

Customer municipal bond vehicles (TOB trusts)

The Firm may provide various services to Customer TOB trusts, including remarketing agent, liquidity or tender option provider. In certain Customer TOB transactions, the Firm, as liquidity provider, has entered into a reimbursement agreement with the Residual holder. In those transactions, upon the termination of the vehicle, the Firm has recourse to the third-party Residual holders for any shortfall. The Firm does not have any intent to protect Residual holders from potential losses on any of the underlying municipal bonds. The Firm does not consolidate Customer TOB trusts, since the Firm does not have the power to make decisions that significantly impact the economic performance of the municipal bond vehicle. The Firm's maximum exposure as a liquidity provider to Customer TOB trusts at December 31, 2018 and 2017, was \$4.8 billion and \$5.3 billion, respectively. The fair value of assets held by such VIEs at December 31, 2018 and 2017 was \$7.7 billion and \$9.2 billion, respectively. For more

information on off-balance sheet lending-related commitments, refer to Note 27.

Loan securitizations

The Firm has securitized and sold a variety of loans, including residential mortgage, credit card, and commercial mortgage. The purposes of these securitization transactions were to satisfy investor demand and to generate liquidity for the Firm.

For loan securitizations in which the Firm is not required to consolidate the trust, the Firm records the transfer of the loan receivable to the trust as a sale when all of the following accounting criteria for a sale are met: (1) the transferred financial assets are legally isolated from the Firm's creditors; (2) the transferee or beneficial interest holder can pledge or exchange the transferred financial assets; and (3) the Firm does not maintain effective control over the transferred financial assets (e.g., the Firm cannot repurchase the transferred assets before their maturity and it does not have the ability to unilaterally cause the holder to return the transferred assets).

For loan securitizations accounted for as a sale, the Firm recognizes a gain or loss based on the difference between the value of proceeds received (including cash, beneficial interests, or servicing assets received) and the carrying value of the assets sold. Gains and losses on securitizations are reported in noninterest revenue.

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Securitization activity

The following table provides information related to the Firm's securitization activities for the years ended December 31, 2018, 2017 and 2016, related to assets held in Firm-sponsored securitization entities that were not consolidated by the Firm, and where sale accounting was achieved at the time of the securitization.

Year ended December 31, (in millions)	2018		2017		2016	
	Residential mortgage ^(f)	Commercial and other ^(g)	Residential mortgage ^(f)	Commercial and other ^(g)	Residential mortgage ^(f)	Commercial and other ^(g)
Principal securitized	\$ 6,431	\$ 10,159	\$ 5,532	\$ 10,252	\$ 1,817	\$ 8,964
All cash flows during the period:^(a)						
Proceeds received from loan sales as financial instruments ^{(b)(c)}	\$ 6,449	\$ 10,218	\$ 5,661	\$ 10,340	\$ 1,831	\$ 9,094
Servicing fees collected ^(d)	319	2	338	3	477	3
Purchases of previously transferred financial assets (or the underlying collateral) ^(e)	—	—	1	—	37	—
Cash flows received on interests	411	301	463	918	482	1,441

(a) Excludes re-securitization transactions.

(b) Predominantly includes Level 2 assets.

(c) The carrying value of the loans accounted for at fair value approximated the proceeds received upon loan sale.

(d) The prior period amounts have been revised to conform with the current period presentation.

(e) Includes cash paid by the Firm to reacquire assets from nonconsolidated entities - for example, loan repurchases due to representation and warranties and servicer "clean-up" calls.

(f) Includes prime mortgages only. Excludes certain loan securitization transactions entered into with Ginnie Mae, Fannie Mae and Freddie Mac.

(g) Includes commercial mortgage and other consumer loans.

Key assumptions used to value retained interests originated during the year are shown in the table below.

Year ended December 31,	2018	2017	2016
Residential mortgage retained interest:			
Weighted-average life (in years)	7.6	4.8	4.5
Weighted-average discount rate	3.6%	2.9%	4.2%
Commercial mortgage retained interest:			
Weighted-average life (in years)	5.3	7.1	6.2
Weighted-average discount rate	4.0%	4.4%	5.8%

Loans and excess MSR's sold to U.S. government-sponsored enterprises, loans in securitization transactions pursuant to Ginnie Mae guidelines, and other third-party-sponsored securitization entities

In addition to the amounts reported in the securitization activity tables above, the Firm, in the normal course of business, sells originated and purchased mortgage loans and certain originated excess MSR's on a nonrecourse basis, predominantly to U.S. government-sponsored enterprises ("U.S. GSEs"). These loans and excess MSR's are sold primarily for the purpose of securitization by the U.S. GSEs, who provide certain guarantee provisions (e.g., credit enhancement of the loans). The Firm also sells loans into securitization transactions pursuant to Ginnie Mae guidelines; these loans are typically insured or guaranteed by another U.S. government agency. The Firm does not consolidate the securitization vehicles underlying these transactions as it is not the primary beneficiary. For a limited number of loan sales, the Firm is obligated to share a portion of the credit risk associated with the sold loans with the purchaser. Refer to Note 27 for additional information about the Firm's loan sales and securitization-related indemnifications. Refer to Note 15 for additional information about the impact of the Firm's sale of certain excess MSR's.

The following table summarizes the activities related to loans sold to the U.S. GSEs, loans in securitization transactions pursuant to Ginnie Mae guidelines, and other third-party-sponsored securitization entities.

Year ended December 31, (in millions)	2018	2017	2016
Carrying value of loans sold	\$ 44,609	\$ 64,542	\$ 52,869
Proceeds received from loan sales as cash	\$ 9	\$ 117	\$ 592
Proceeds from loans sales as securities ^(a)	43,671	63,542	51,852
Total proceeds received from loan sales^(b)	\$ 43,680	\$ 63,659	\$ 52,444
Gains/(losses) on loan sales ^{(c)(d)}	\$ (93)	\$ 163	\$ 222

(a) Predominantly includes securities from U.S. GSEs and Ginnie Mae that are generally sold shortly after receipt.

(b) Excludes the value of MSRs retained upon the sale of loans.

(c) Gains/(losses) on loan sales include the value of MSRs.

(d) The carrying value of the loans accounted for at fair value approximated the proceeds received upon loan sale.

Options to repurchase delinquent loans

In addition to the Firm's obligation to repurchase certain loans due to material breaches of representations and warranties as discussed in Note 27, the Firm also has the option to repurchase delinquent loans that it services for Ginnie Mae loan pools, as well as for other U.S. government agencies under certain arrangements. The Firm typically elects to repurchase delinquent loans from Ginnie Mae loan pools as it continues to service them and/or manage the

foreclosure process in accordance with the applicable requirements, and such loans continue to be insured or guaranteed. When the Firm's repurchase option becomes exercisable, such loans must be reported on the Consolidated balance sheets as a loan with a corresponding liability. For additional information, refer to Note 12.

The following table presents loans the Firm repurchased or had an option to repurchase, real estate owned, and foreclosed government-guaranteed residential mortgage loans recognized on the Firm's Consolidated balance sheets as of December 31, 2018 and 2017. Substantially all of these loans and real estate are insured or guaranteed by U.S. government agencies.

December 31, (in millions)	2018	2017
Loans repurchased or option to repurchase ^(a)	\$ 7,021	\$ 8,629
Real estate owned	75	95
Foreclosed government-guaranteed residential mortgage loans ^(b)	361	527

(a) Predominantly all of these amounts relate to loans that have been repurchased from Ginnie Mae loan pools.

(b) Relates to voluntary repurchases of loans, which are included in accrued interest and accounts receivable.

Loan delinquencies and liquidation losses

The table below includes information about components of nonconsolidated securitized financial assets held in Firm-sponsored private-label securitization entities, in which the Firm has continuing involvement, and delinquencies as of December 31, 2018 and 2017.

As of or for the year ended December 31, (in millions)	Securitized assets		90 days past due		Net liquidation losses ^(a)	
	2018	2017	2018	2017	2018	2017
Securitized loans						
Residential mortgage:						
Prime/ Alt-A & option ARMs	\$ 50,679	\$ 52,280	\$ 3,354	\$ 4,870	\$ 610	\$ 790
Subprime	15,434	17,612	2,478	3,276	(169)	719
Commercial and other	79,387	63,411	225	957	280	114
Total loans securitized	\$ 145,500	\$ 133,303	\$ 6,057	\$ 9,103	\$ 721	\$ 1,623

(a) Includes liquidation gains as a result of private label mortgage settlement payments during the first quarter of 2018, which were reflected as asset recoveries by trustees.

Note 15 - Goodwill and Mortgage servicing rights

Goodwill

Goodwill is recorded upon completion of a business combination as the difference between the purchase price and the fair value of the net assets acquired. Subsequent to initial recognition, goodwill is not amortized but is tested for impairment during the fourth quarter of each fiscal year, or more often if events or circumstances, such as adverse changes in the business climate, indicate there may be impairment.

The goodwill associated with each business combination is allocated to the related reporting units, which are determined based on how the Firm's businesses are managed and how they are reviewed by the Firm's Operating Committee. The following table presents goodwill attributed to the business segments.

December 31, (in millions)	2018	2017	2016
Consumer & Community Banking	\$ 30,984	\$ 31,013	\$ 30,797
Corporate & Investment Bank	6,770	6,776	6,772
Commercial Banking	2,860	2,860	2,861
Asset & Wealth Management	6,857	6,858	6,858
Total goodwill	\$ 47,471	\$ 47,507	\$ 47,288

The following table presents changes in the carrying amount of goodwill.

Year ended December 31, (in millions)	2018	2017	2016
Balance at beginning of period	\$ 47,507	\$ 47,288	\$ 47,325
Changes during the period from:			
Business combinations ^(a)	–	199	–
Dispositions ^(b)	–	–	(72)
Other ^(c)	(36)	20	35
Balance at December 31,	\$ 47,471	\$ 47,507	\$ 47,288

- (a) For 2017, represents CCB goodwill in connection with an acquisition.
- (b) For 2016, represents AWM goodwill, which was disposed of as part of a sale.
- (c) Includes foreign currency remeasurement and other adjustments.

Goodwill impairment testing

The Firm's goodwill was not impaired at December 31, 2018, 2017, and 2016.

The goodwill impairment test is performed in two steps. In the first step, the current fair value of each reporting unit is compared with its carrying value. If the fair value is in excess of the carrying value, then the reporting unit's goodwill is considered not to be impaired. If the fair value is less than the carrying value, then a second step is performed. In the second step, the implied current fair value of the reporting unit's goodwill is determined by comparing the fair value of the reporting unit (as determined in step one) to the fair value of the net assets of the reporting unit, as if the reporting unit were being acquired in a business combination. The resulting implied current fair value of goodwill is then compared with the carrying value of the reporting unit's goodwill. If the carrying value of the goodwill exceeds its implied current fair value, then an impairment charge is recognized for the excess. If the carrying value of goodwill is less than its implied current fair value, then no goodwill impairment is recognized.

The Firm uses the reporting units' allocated capital plus goodwill and other intangible assets capital as a proxy for the carrying values of equity for the reporting units in the goodwill impairment testing. Reporting unit equity is determined on a similar basis as the allocation of capital to the Firm's lines of business and takes into consideration capital level of similarly-rated peers and applicable regulatory requirements. Proposed line of business equity levels are incorporated into the Firm's annual budget process, which is reviewed by the Firm's Board of Directors. Allocated capital is further reviewed on a periodic basis and updated as needed.

The primary method the Firm uses to estimate the fair value of its reporting units is the income approach. This approach projects cash flows for the forecast period and uses the perpetuity growth method to calculate terminal values. These cash flows and terminal values are then discounted using an appropriate discount rate. Projections of cash flows are based on the reporting units' earnings forecasts which are reviewed with senior management of the Firm. The discount rate used for each reporting unit represents an estimate of the cost of equity for that reporting unit and is determined considering the Firm's overall estimated cost of equity (estimated using the Capital Asset Pricing Model), as adjusted for the risk characteristics specific to each reporting unit (for example, for higher levels of risk or uncertainty associated with the business or management's forecasts and assumptions). To assess the reasonableness of the discount rates used for each reporting unit management compares the discount rate to the estimated cost of equity for publicly traded institutions with similar businesses and risk characteristics. In addition, the weighted average cost of equity (aggregating the various reporting units) is compared with the Firm's overall estimated cost of equity to ensure reasonableness.

The valuations derived from the discounted cash flow analysis are then compared with market-based trading and transaction multiples for relevant competitors. Trading and transaction comparables are used as general indicators to assess the general reasonableness of the estimated fair values, although precise conclusions generally cannot be drawn due to the differences that naturally exist between the Firm's businesses and competitor institutions. Management also takes into consideration a comparison between the aggregate fair values of the Firm's reporting units and JPMorgan Chase's market capitalization. In evaluating this comparison, management considers several factors, including (i) a control premium that would exist in a market transaction, (ii) factors related to the level of execution risk that would exist at the firmwide level that do not exist at the reporting unit level and (iii) short-term market volatility and other factors that do not directly affect the value of individual reporting units.

Declines in business performance, increases in credit losses, increases in capital requirements, as well as deterioration in economic or market conditions, adverse regulatory or legislative changes or increases in the estimated market cost of equity, could cause the estimated fair values of the Firm's reporting units or their associated goodwill to decline in the future, which could result in a material impairment charge to earnings in a future period related to some portion of the associated goodwill.

Mortgage servicing rights

MSRs represent the fair value of expected future cash flows for performing servicing activities for others. The fair value considers estimated future servicing fees and ancillary revenue, offset by estimated costs to service the loans, and generally declines over time as net servicing cash flows are received, effectively amortizing the MSR asset against contractual servicing and ancillary fee income. MSRs are either purchased from third parties or recognized upon sale or securitization of mortgage loans if servicing is retained.

As permitted by U.S. GAAP, the Firm has elected to account for its MSRs at fair value. The Firm treats its MSRs as a single class of servicing assets based on the availability of market inputs used to measure the fair value of its MSR asset and its treatment of MSRs as one aggregate pool for risk management purposes. The Firm estimates the fair value of MSRs using an option-adjusted spread ("OAS") model, which projects MSR cash flows over multiple interest rate scenarios in conjunction with the Firm's prepayment model, and then discounts these cash flows at risk-adjusted rates. The model considers portfolio characteristics, contractually specified servicing fees, prepayment assumptions, delinquency rates, costs to service, late charges and other ancillary revenue, and other economic factors. The Firm compares fair value estimates and assumptions to observable market data where available, and also considers recent market activity and actual portfolio experience.

Notes to consolidated financial statements

The fair value of MSRs is sensitive to changes in interest rates, including their effect on prepayment speeds. MSRs typically decrease in value when interest rates decline because declining interest rates tend to increase prepayments and therefore reduce the expected life of the net servicing cash flows that comprise the MSR asset. Conversely, securities (e.g., mortgage-backed securities), principal-only certificates and certain derivatives (i.e.,

those for which the Firm receives fixed-rate interest payments) increase in value when interest rates decline. JPMorgan Chase uses combinations of derivatives and securities to manage the risk of changes in the fair value of MSRs. The intent is to offset any interest-rate related changes in the fair value of MSRs with changes in the fair value of the related risk management instruments.

The following table summarizes MSR activity for the years ended December 31, 2018, 2017 and 2016.

As of or for the year ended December 31, (in millions, except where otherwise noted)	2018	2017	2016
Fair value at beginning of period	\$ 6,030	\$ 6,096	\$ 6,608
MSR activity:			
Originations of MSRs	931	1,103	679
Purchase of MSRs	315	—	—
Disposition of MSRs ^(a)	(636)	(140)	(109)
Net additions	610	963	570
Changes due to collection/realization of expected cash flows	(740)	(797)	(919)
Changes in valuation due to inputs and assumptions:			
Changes due to market interest rates and other ^(b)	300	(202)	(72)
Changes in valuation due to other inputs and assumptions:			
Projected cash flows (e.g., cost to service)	15	(102)	(35)
Discount rates	24	(19)	7
Prepayment model changes and other ^(c)	(109)	91	(63)
Total changes in valuation due to other inputs and assumptions	(70)	(30)	(91)
Total changes in valuation due to inputs and assumptions	230	(232)	(163)
Fair value at December 31,	\$ 6,130	\$ 6,030	\$ 6,096
Change in unrealized gains/(losses) included in income related to MSRs held at December 31,	\$ 230	\$ (232)	\$ (163)
Contractual service fees, late fees and other ancillary fees included in income	1,778	1,886	2,124
Third-party mortgage loans serviced at December 31, (in billions)	521.0	555.0	593.3
Servicer advances, net of an allowance for uncollectible amounts, at December 31, (in billions) ^(d)	3.0	4.0	4.7

- (a) Includes excess MSRs transferred to agency-sponsored trusts in exchange for stripped mortgage backed securities ("SMBS"). In each transaction, a portion of the SMBS was acquired by third parties at the transaction date; the Firm acquired the remaining balance of those SMBS as trading securities.
- (b) Represents both the impact of changes in estimated future prepayments due to changes in market interest rates, and the difference between actual and expected prepayments.
- (c) Represents changes in prepayments other than those attributable to changes in market interest rates.
- (d) Represents amounts the Firm pays as the servicer (e.g., scheduled principal and interest, taxes and insurance), which will generally be reimbursed within a short period of time after the advance from future cash flows from the trust or the underlying loans. The Firm's credit risk associated with these servicer advances is minimal because reimbursement of the advances is typically senior to all cash payments to investors. In addition, the Firm maintains the right to stop payment to investors if the collateral is insufficient to cover the advance. However, certain of these servicer advances may not be recoverable if they were not made in accordance with applicable rules and agreements.

The following table presents the components of mortgage fees and related income (including the impact of MSR risk management activities) for the years ended December 31, 2018, 2017 and 2016.

Year ended December 31, (in millions)	2018	2017	2016
CCB mortgage fees and related income			
Net production revenue	\$ 268	\$ 636	\$ 853
Net mortgage servicing revenue:			
Operating revenue:			
Loan servicing revenue	1,835	2,014	2,336
Changes in MSR asset fair value due to collection/realization of expected cash flows	(740)	(795)	(916)
Total operating revenue	1,095	1,219	1,420
Risk management:			
Changes in MSR asset fair value due to market interest rates and other ^(a)	300	(202)	(72)
Other changes in MSR asset fair value due to other inputs and assumptions in model ^(b)	(70)	(30)	(91)
Change in derivative fair value and other	(341)	(10)	380
Total risk management	(111)	(242)	217
Total net mortgage servicing revenue	984	977	1,637
Total CCB mortgage fees and related income	1,252	1,613	2,490
All other	2	3	1
Mortgage fees and related income	\$ 1,254	\$ 1,616	\$ 2,491

- (a) Represents both the impact of changes in estimated future prepayments due to changes in market interest rates, and the difference between actual and expected prepayments.
- (b) Represents the aggregate impact of changes in model inputs and assumptions such as projected cash flows (e.g., cost to service), discount rates and changes in prepayments other than those attributable to changes in market interest rates (e.g., changes in prepayments due to changes in home prices).

The table below outlines the key economic assumptions used to determine the fair value of the Firm's MSRs at December 31, 2018 and 2017, and outlines the sensitivities of those fair values to immediate adverse changes in those assumptions, as defined below.

December 31, (in millions, except rates)	2018	2017
Weighted-average prepayment speed assumption ("CPR")	8.78%	9.35%
Impact on fair value of 10% adverse change	\$ (205)	\$ (221)
Impact on fair value of 20% adverse change	(397)	(427)
Weighted-average option adjusted spread	8.70%	9.04%
Impact on fair value of 100 basis points adverse change	\$ (235)	\$ (250)
Impact on fair value of 200 basis points adverse change	(452)	(481)

CPR: Constant prepayment rate.

Changes in fair value based on variations in assumptions generally cannot be easily extrapolated, because the relationship of the change in the assumptions to the change in fair value are often highly interrelated and may not be linear. In this table, the effect that a change in a particular assumption may have on the fair value is calculated without changing any other assumption. In reality, changes in one factor may result in changes in another, which would either magnify or counteract the impact of the initial change.

Notes to consolidated financial statements

Note 16 – Premises and equipment

Premises and equipment, including leasehold improvements, are carried at cost less accumulated depreciation and amortization. JPMorgan Chase computes depreciation using the straight-line method over the estimated useful life of an asset. For leasehold improvements, the Firm uses the straight-line method computed over the lesser of the remaining term of the leased facility or the estimated useful life of the leased asset.

JPMorgan Chase capitalizes certain costs associated with the acquisition or development of internal-use software. Once the software is ready for its intended use, these costs are amortized on a straight-line basis over the software's expected useful life and reviewed for impairment on an ongoing basis.

Note 17 – Deposits

At December 31, 2018 and 2017, noninterest-bearing and interest-bearing deposits were as follows.

December 31, (in millions)	2018	2017
U.S. offices		
Noninterest-bearing	\$ 369,505	\$ 393,645
Interest-bearing (included \$19,691, and \$14,947 at fair value) ^(a)	831,085	793,618
Total deposits in U.S. offices	1,200,590	1,187,263
Non-U.S. offices		
Noninterest-bearing	19,092	15,576
Interest-bearing (included \$3,526 and \$6,374 at fair value) ^(a)	250,984	241,143
Total deposits in non-U.S. offices	270,076	256,719
Total deposits	\$ 1,470,666	\$ 1,443,982

(a) Includes structured notes classified as deposits for which the fair value option has been elected. For further discussion, refer to Note 3.

At December 31, 2018 and 2017, time deposits in denominations of \$250,000 or more were as follows.

December 31, (in millions)	2018	2017
U.S. offices	\$ 25,119	\$ 30,671
Non-U.S. offices	41,661	29,049
Total	\$ 66,780	\$ 59,720

At December 31, 2018, the maturities of interest-bearing time deposits were as follows.

December 31, 2018 (in millions)	U.S.	Non-U.S.	Total
2019	\$ 31,757	\$ 40,259	\$ 72,016
2020	6,309	229	6,538
2021	5,235	19	5,254
2022	2,884	173	3,057
2023	1,719	372	2,091
After 5 years	3,515	2,023	5,538
Total	\$ 51,419	\$ 43,075	\$ 94,494

Note 18 – Accounts payable and other liabilities

Accounts payable and other liabilities consist of brokerage payables, which includes payables to customers, dealers and clearing organizations, and payables from security purchases that did not settle; accrued expenses, including income tax payables and credit card rewards liability; and all other liabilities, including obligations to return securities received as collateral and litigation reserves.

The following table details the components of accounts payable and other liabilities.

December 31, (in millions)	2018	2017
Brokerage payables	\$ 114,794	\$ 102,727
Other payables and liabilities ^(a)	81,916	86,656
Total accounts payable and other liabilities	\$ 196,710	\$ 189,383

(a) Includes credit card rewards liability of \$5.8 billion and \$4.9 billion at December 31, 2018 and 2017, respectively.

Note 19 – Long-term debt

JPMorgan Chase issues long-term debt denominated in various currencies, predominantly U.S. dollars, with both fixed and variable interest rates. Included in senior and subordinated debt below are various equity-linked or other indexed instruments, which the Firm has elected to measure at fair value. Changes in fair value are recorded in principal transactions revenue in the Consolidated statements of income, except for unrealized gains/(losses) due to DVA which are recorded in OCI. The following table is a summary of long-term debt carrying values (including unamortized premiums and discounts, issuance costs, valuation adjustments and fair value adjustments, where applicable) by remaining contractual maturity as of December 31, 2018.

By remaining maturity at December 31, (in millions, except rates)	2018				2017	
	Under 1 year	1-5 years	After 5 years	Total	Total	
Parent company						
Senior debt:	Fixed rate	\$ 8,958	\$ 55,362	\$ 81,500	\$ 145,820	\$ 141,551
	Variable rate	4,037	14,025	4,916	22,978	26,461
	Interest rates ^(a)	0.17-6.30%	0.23-4.95%	0.45-6.40%	0.17-6.40%	0.16-7.25%
Subordinated debt:	Fixed rate	\$ 146	\$ 1,948	\$ 12,214	\$ 14,308	\$ 14,646
	Variable rate	–	–	9	9	9
	Interest rates ^(a)	8.53%	3.38%	3.63-8.00%	3.38-8.53%	3.38-8.53%
	Subtotal	\$ 13,141	\$ 71,335	\$ 98,639	\$ 183,115	\$ 182,667
Subsidiaries						
Federal Home Loan Banks advances:	Fixed rate	\$ 12	\$ 25	\$ 118	\$ 155	\$ 167
	Variable rate	11,000	29,300	4,000	44,300	60,450
	Interest rates ^(a)	2.58-2.95%	2.36-2.96%	2.43-2.52%	2.36-2.96%	1.18-2.00%
Senior debt:	Fixed rate	\$ 1,574	\$ 6,454	\$ 8,406	\$ 16,434	\$ 11,990
	Variable rate	6,667	22,277	6,657	35,601	26,218
	Interest rates ^(a)	1.65-7.50%	2.60-7.50%	1.00-7.50%	1.00-7.50%	0.22-7.50%
Subordinated debt:	Fixed rate	\$ –	\$ –	\$ 301	\$ 301	\$ 313
	Variable rate	–	–	–	–	–
	Interest rates ^(a)	–%	–%	8.25%	8.25%	8.25%
	Subtotal	\$ 19,253	\$ 58,056	\$ 19,482	\$ 96,791	\$ 99,138
Junior subordinated debt:	Fixed rate	\$ –	\$ –	\$ 659	\$ 659	\$ 690
	Variable rate	–	–	1,466	1,466	1,585
	Interest rates ^(a)	–%	–%	3.04-8.75%	3.04-8.75%	1.88-8.75%
	Subtotal	\$ –	\$ –	\$ 2,125	\$ 2,125	\$ 2,275
Total long-term debt^{(b)(c)(d)}	\$ 32,394	\$ 129,391	\$ 120,246	\$ 282,031	^{(f)(g)} \$ 284,080	
Long-term beneficial interests:	Fixed rate	\$ 4,634	\$ 2,977	\$ –	\$ 7,611	\$ 13,579
	Variable rate	2,324	3,471	308	6,103	8,192
	Interest rates	1.27-2.87%	0.00-3.01%	2.50-4.62%	0.00-4.62%	0.00-6.54%
Total long-term beneficial interests^(e)	\$ 6,958	\$ 6,448	\$ 308	\$ 13,714	\$ 21,771	

- (a) The interest rates shown are the range of contractual rates in effect at December 31, 2018 and 2017, respectively, including non-U.S. dollar fixed- and variable-rate issuances, which excludes the effects of the associated derivative instruments used in hedge accounting relationships, if applicable. The use of these derivative instruments modifies the Firm's exposure to the contractual interest rates disclosed in the table above. Including the effects of the hedge accounting derivatives, the range of modified rates in effect at December 31, 2018, for total long-term debt was (0.06)% to 8.88%, versus the contractual range of 0.17% to 8.75% presented in the table above. The interest rate ranges shown exclude structured notes accounted for at fair value.
- (b) Included long-term debt of \$47.7 billion and \$63.5 billion secured by assets totaling \$207.0 billion and \$208.4 billion at December 31, 2018 and 2017, respectively. The amount of long-term debt secured by assets does not include amounts related to hybrid instruments.
- (c) Included \$54.9 billion and \$47.5 billion of long-term debt accounted for at fair value at December 31, 2018 and 2017, respectively.
- (d) Included \$11.2 billion and \$10.3 billion of outstanding zero-coupon notes at December 31, 2018 and 2017, respectively. The aggregate principal amount of these notes at their respective maturities is \$37.4 billion and \$33.5 billion, respectively. The aggregate principal amount reflects the contractual principal payment at maturity, which may exceed the contractual principal payment at the Firm's next call date, if applicable.
- (e) Included on the Consolidated balance sheets in beneficial interests issued by consolidated VIEs. Also included \$28 million and \$45 million accounted for at fair value at December 31, 2018 and 2017, respectively. Excluded short-term commercial paper and other short-term beneficial interests of \$6.5 billion and \$4.3 billion at December 31, 2018 and 2017, respectively.
- (f) At December 31, 2018, long-term debt in the aggregate of \$138.2 billion was redeemable at the option of JPMorgan Chase, in whole or in part, prior to maturity, based on the terms specified in the respective instruments.
- (g) The aggregate carrying values of debt that matures in each of the five years subsequent to 2018 is \$32.4 billion in 2019, \$46.7 billion in 2020, \$40.0 billion in 2021, \$16.3 billion in 2022 and \$26.4 billion in 2023.

Notes to consolidated financial statements

The weighted-average contractual interest rates for total long-term debt excluding structured notes accounted for at fair value were 3.28% and 2.87% as of December 31, 2018 and 2017, respectively. In order to modify exposure to interest rate and currency exchange rate movements, JPMorgan Chase utilizes derivative instruments, primarily interest rate and cross-currency interest rate swaps, in conjunction with some of its debt issuances. The use of these instruments modifies the Firm's interest expense on the associated debt. The modified weighted-average interest rates for total long-term debt, including the effects of related derivative instruments, were 3.64% and 2.56% as of December 31, 2018 and 2017, respectively.

JPMorgan Chase & Co. has guaranteed certain long-term debt of its subsidiaries, including both long-term debt and structured notes. These guarantees rank on parity with the Firm's other unsecured and unsubordinated indebtedness. The amount of such guaranteed long-term debt and structured notes was \$10.9 billion and \$7.9 billion at December 31, 2018 and 2017, respectively.

The Firm's unsecured debt does not contain requirements that would call for an acceleration of payments, maturities or changes in the structure of the existing debt, provide any limitations on future borrowings or require additional collateral, based on unfavorable changes in the Firm's credit ratings, financial ratios, earnings or stock price.

Junior subordinated deferrable interest debentures

On September 10, 2018 the Firm's last remaining issuer of outstanding trust preferred securities ("issuer trust") was liquidated, resulting in \$475 million of trust preferred securities and \$15 million of trust common securities originally issued by the issuer trust being cancelled. The junior subordinated debentures previously held by the trust issuer were distributed pro rata to the holders of the trust preferred and trust common securities. The carrying value of the junior subordinated debt was \$659 million as of December 31, 2018.

Note 20 – Preferred stock

At December 31, 2018 and 2017, JPMorgan Chase was authorized to issue 200 million shares of preferred stock, in one or more series, with a par value of \$1 per share.

In the event of a liquidation or dissolution of the Firm, JPMorgan Chase's preferred stock then outstanding takes precedence over the Firm's common stock with respect to the payment of dividends and the distribution of assets.

The following is a summary of JPMorgan Chase's non-cumulative preferred stock outstanding as of December 31, 2018 and 2017.

	Shares at December 31, ^(a)		Carrying value (in millions) at December 31,		Issue date	Contractual rate in effect at December 31, 2018	Earliest redemption date	Date at which dividend rate becomes floating	Floating annual rate of three-month LIBOR plus:	Dividend declared per share ^(b)
	2018	2017	2018	2017						
Fixed-rate:										
Series P	90,000	90,000	\$ 900	\$ 900	2/5/2013	5.450%	3/1/2018	NA	NA	\$136.25
Series T	92,500	92,500	925	925	1/30/2014	6.700	3/1/2019	NA	NA	167.50
Series W	88,000	88,000	880	880	6/23/2014	6.300	9/1/2019	NA	NA	157.50
Series Y	143,000	143,000	1,430	1,430	2/12/2015	6.125	3/1/2020	NA	NA	153.13
Series AA	142,500	142,500	1,425	1,425	6/4/2015	6.100	9/1/2020	NA	NA	152.50
Series BB	115,000	115,000	1,150	1,150	7/29/2015	6.150	9/1/2020	NA	NA	153.75
Series DD	169,625	–	1,696	–	9/21/2018	5.750	12/1/2023	NA	NA	111.81 ^(c)
Fixed-to-floating-rate:										
Series I	430,375	600,000	4,304	6,000	4/23/2008	LIBOR + 3.47%	4/30/2018	4/30/2018	LIBOR + 3.47%	\$395.00 ^(d)
										147.34 ^(d)
										148.45 ^(d)
										153.09 ^(d)
Series Q	150,000	150,000	1,500	1,500	4/23/2013	5.150	5/1/2023	5/1/2023	LIBOR + 3.25	257.50
Series R	150,000	150,000	1,500	1,500	7/29/2013	6.000	8/1/2023	8/1/2023	LIBOR + 3.30	300.00
Series S	200,000	200,000	2,000	2,000	1/22/2014	6.750	2/1/2024	2/1/2024	LIBOR + 3.78	337.50
Series U	100,000	100,000	1,000	1,000	3/10/2014	6.125	4/30/2024	4/30/2024	LIBOR + 3.33	306.25
Series V	250,000	250,000	2,500	2,500	6/9/2014	5.000	7/1/2019	7/1/2019	LIBOR + 3.32	250.00
Series X	160,000	160,000	1,600	1,600	9/23/2014	6.100	10/1/2024	10/1/2024	LIBOR + 3.33	305.00
Series Z	200,000	200,000	2,000	2,000	4/21/2015	5.300	5/1/2020	5/1/2020	LIBOR + 3.80	265.00
Series CC	125,750	125,750	1,258	1,258	10/20/2017	4.625	11/1/2022	11/1/2022	LIBOR + 2.58	231.25 ^(c)
Total preferred stock	2,606,750	2,606,750	\$26,068	\$26,068						

(a) Represented by depositary shares.

(b) Dividends on fixed-rate preferred stock are payable quarterly. Dividends on fixed-to-floating-rate preferred stock are payable semiannually while at a fixed rate, and payable quarterly after converting to a floating rate.

(c) Dividend per share is prorated based on the number of days outstanding for the period.

(d) The dividend rate for Series I preferred stock became floating and payable quarterly starting on April 30, 2018; prior to which the dividend rate was fixed at 7.90% or \$395.00 per share payable semi annually. The Firm declared a dividend of \$147.34, \$148.45 and \$153.09 per share on outstanding Series I preferred stock on June 15, 2018, September 14, 2018 and December 14, 2018, respectively.

Each series of preferred stock has a liquidation value and redemption price per share of \$10,000, plus accrued but unpaid dividends.

On January 24, 2019, the Firm issued \$1.85 billion of 6.00% non-cumulative preferred stock, Series EE, and on January 30, 2019, the Firm announced that it will redeem all \$925 million of its outstanding 6.70% non-cumulative preferred stock, Series T, on March 1, 2019. On September 21, 2018, the Firm issued \$1.7 billion of 5.75% non-cumulative preferred stock, Series DD. On October 30, 2018, the Firm redeemed \$1.7 billion of its fixed-to-floating rate non-cumulative perpetual preferred stock, Series I.

On October 20, 2017, the Firm issued \$1.3 billion of fixed-to-floating rate non-cumulative preferred stock, Series CC, with an initial dividend rate of 4.625%. On December 1,

2017, the Firm redeemed all \$1.3 billion of its outstanding 5.50% non-cumulative preferred stock, Series O. Quarterly dividend per share for Series O was \$137.50 for the years ended December 31, 2017 and 2016.

Redemption rights

Each series of the Firm's preferred stock may be redeemed on any dividend payment date on or after the earliest redemption date for that series. All outstanding preferred stock series except Series I may also be redeemed following a "capital treatment event," as described in the terms of each series. Any redemption of the Firm's preferred stock is subject to non-objection from the Board of Governors of the Federal Reserve System (the "Federal Reserve").

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Note 21 – Common stock

At December 31, 2018 and 2017, JPMorgan Chase was authorized to issue 9.0 billion shares of common stock with a par value of \$1 per share.

Common shares issued (newly issued or reissuance from treasury) by JPMorgan Chase during the years ended December 31, 2018, 2017 and 2016 were as follows.

Year ended December 31, (in millions)	2018	2017	2016
Total issued - balance at January 1	4,104.9	4,104.9	4,104.9
Treasury - balance at January 1	(679.6)	(543.7)	(441.4)
Repurchase	(181.5)	(166.6)	(140.4)
Reissuance:			
Employee benefits and compensation plans	21.7	24.5	26.0
Warrant exercise	9.4	5.4	11.1
Employee stock purchase plans	0.9	0.8	1.0
Total reissuance	32.0	30.7	38.1
Total treasury - balance at December 31	(829.1)	(679.6)	(543.7)
Outstanding at December 31	3,275.8	3,425.3	3,561.2

There were no warrants to purchase shares of common stock (“Warrants”) outstanding at December 31, 2018, as any Warrants that were not exercised on or before October 29, 2018, have expired. At December 31, 2017, and 2016, respectively, the Firm had 15.0 million and 24.9 million Warrants outstanding.

On June 28, 2018, in conjunction with the Federal Reserve’s release of its 2018 CCAR results, the Firm’s Board of Directors authorized a \$20.7 billion common equity repurchase program. As of December 31, 2018, \$10.4 billion of authorized repurchase capacity remained under the program. This authorization includes shares repurchased to offset issuances under the Firm’s share-based compensation plans.

The following table sets forth the Firm’s repurchases of common equity for the years ended December 31, 2018, 2017 and 2016. There were no Warrants repurchased during the years ended December 31, 2018, 2017 and 2016.

Year ended December 31, (in millions)	2018	2017	2016
Total number of shares of common stock repurchased	181.5	166.6	140.4
Aggregate purchase price of common stock repurchases	\$19,983	\$15,410	\$ 9,082

The Firm from time to time enters into written trading plans under Rule 10b5-1 of the Securities Exchange Act of 1934 to facilitate repurchases in accordance with the common equity repurchase program. A Rule 10b5-1 repurchase plan allows the Firm to repurchase its equity during periods when it would not otherwise be repurchasing common equity – for example, during internal trading “blackout periods.” All purchases under a Rule 10b5-1 plan must be made according to a predefined plan established when the Firm is not aware of material nonpublic information. For additional information regarding repurchases of the Firm’s equity securities, refer to Part II, Item 5: Market for registrant’s common equity, related stockholder matters and issuer purchases of equity securities, on page 30. As of December 31, 2018, approximately 85 million shares of common stock were reserved for issuance under various employee incentive, compensation, option and stock purchase plans, and directors’ compensation plans.

Note 22 – Earnings per share

Basic earnings per share (“EPS”) is calculated using the two-class method. Dilutive EPS is calculated under both the two-class and treasury stock methods, and the more dilutive amount is reported. Under the two-class method, all earnings (distributed and undistributed) are allocated to each class of common stock and participating securities based on their respective rights to receive dividends.

JPMorgan Chase grants RSUs under its share-based compensation programs, which entitle recipients to receive nonforfeitable dividends during the vesting period on a basis equivalent to the dividends paid to holders of common stock; these unvested awards meet the definition of participating securities. Accordingly, these RSUs are treated as a separate class of securities in computing basic EPS, and are not included as incremental shares in computing dilutive EPS; refer to Note 9 for additional information. For each of the periods presented diluted EPS calculated under the two-class method was more dilutive.

The following table presents the calculation of basic and diluted EPS for the years ended December 31, 2018, 2017 and 2016.

Year ended December 31, (in millions, except per share amounts)	2018	2017	2016
Basic earnings per share			
Net income	\$ 32,474	\$ 24,441	\$ 24,733
Less: Preferred stock dividends	1,551	1,663	1,647
Net income applicable to common equity	30,923	22,778	23,086
Less: Dividends and undistributed earnings allocated to participating securities	214	211	252
Net income applicable to common stockholders	\$ 30,709	\$ 22,567	\$ 22,834
Total weighted-average basic shares outstanding	3,396.4	3,551.6	3,658.8
Net income per share	\$ 9.04	\$ 6.35	\$ 6.24
Diluted earnings per share			
Net income applicable to common stockholders	\$ 30,709	\$ 22,567	\$ 22,834
Total weighted-average basic shares outstanding	3,396.4	3,551.6	3,658.8
Add: Employee stock options, SARs, warrants and unvested PSUs	17.6	25.2	31.2
Total weighted-average diluted shares outstanding	3,414.0	3,576.8	3,690.0
Net income per share	\$ 9.00	\$ 6.31	\$ 6.19

Notes to consolidated financial statements

Note 23 – Accumulated other comprehensive income/(loss)

AOCI includes the after-tax change in unrealized gains and losses on investment securities, foreign currency translation adjustments (including the impact of related derivatives), fair value changes of excluded components on fair value hedges, cash flow hedging activities, and net loss and prior service costs/(credit) related to the Firm's defined benefit pension and OPEB plans.

Year ended December 31, (in millions)	Unrealized gains/(losses) on investment securities	Translation adjustments, net of hedges	Fair value hedges ^(c)	Cash flow hedges	Defined benefit pension and OPEB plans	DVA on fair value option elected liabilities	Accumulated other comprehensive income/(loss)
Balance at December 31, 2015	\$ 2,629	\$ (162)	NA	\$ (44)	\$ (2,231)	\$ –	\$ 192
Cumulative effect of change in accounting principle ^(a)	–	–	NA	–	–	154	154
Net change	(1,105)	(2)	NA	(56)	(28)	(330)	(1,521)
Balance at December 31, 2016	\$ 1,524	\$ (164)	NA	\$ (100)	\$ (2,259)	\$ (176)	\$ (1,175)
Net change	640	(306)	NA	176	738	(192)	1,056
Balance at December 31, 2017	\$ 2,164	\$ (470)	\$ –	\$ 76	\$ (1,521)	\$ (368)	\$ (119)
Cumulative effect of changes in accounting principles: ^(b)							
Premium amortization on purchased callable debt securities	261	–	–	–	–	–	261
Hedge accounting	169	–	(54)	–	–	–	115
Reclassification of certain tax effects from AOCI	466	(277)	–	16	(414)	(79)	(288)
Net change	(1,858)	20	(107)	(201)	(373)	1,043	(1,476)
Balance at December 31, 2018	\$ 1,202	\$ (727)	\$ (161)	\$ (109)	\$ (2,308)	\$ 596	\$ (1,507)

- (a) Effective January 1, 2016, the Firm adopted new accounting guidance related to the recognition and measurement of financial liabilities where the fair value option has been elected. This guidance requires the portion of the total change in fair value caused by changes in the Firm's own credit risk (DVA) to be presented separately in OCI; previously these amounts were recognized in net income.
- (b) Represents the adjustment to AOCI as a result of the new accounting standards adopted in the first quarter of 2018. For additional information, refer to Note 1.
- (c) Represents changes in fair value of cross-currency swaps attributable to changes in cross-currency basis spreads, which are excluded from the assessment of hedge effectiveness and recorded in other comprehensive income. The initial cost of cross-currency basis spreads is recognized in earnings as part of the accrual of interest on the cross currency swap.

The following table presents the pre-tax and after-tax changes in the components of OCI.

Year ended December 31, (in millions)	2018			2017			2016		
	Pre-tax	Tax effect	After-tax	Pre-tax	Tax effect	After-tax	Pre-tax	Tax effect	After-tax
Unrealized gains/(losses) on investment securities:									
Net unrealized gains/(losses) arising during the period	\$ (2,825)	\$ 665	\$ (2,160)	\$ 944	\$ (346)	\$ 598	\$ (1,628)	\$ 611	\$ (1,017)
Reclassification adjustment for realized (gains)/losses included in net income ^(a)	395	(93)	302	66	(24)	42	(141)	53	(88)
Net change	(2,430)	572	(1,858)	1,010	(370)	640	(1,769)	664	(1,105)
Translation adjustments^(b):									
Translation	(1,078)	156	(922)	1,313	(801)	512	(261)	99	(162)
Hedges	1,236	(294)	942	(1,294)	476	(818)	262	(102)	160
Net change	158	(138)	20	19	(325)	(306)	1	(3)	(2)
Fair value hedges, net change^(c):	(140)	33	(107)	NA	NA	NA	NA	NA	NA
Cash flow hedges:									
Net unrealized gains/(losses) arising during the period	(245)	58	(187)	147	(55)	92	(450)	168	(282)
Reclassification adjustment for realized (gains)/losses included in net income ^(d)	(18)	4	(14)	134	(50)	84	360	(134)	226
Net change	(263)	62	(201)	281	(105)	176	(90)	34	(56)
Defined benefit pension and OPEB plans:									
Prior service credit/(cost) arising during the period	(29)	7	(22)	–	–	–	–	–	–
Net gain/(loss) arising during the period	(558)	102	(456)	802	(160)	642	(366)	145	(221)
Reclassification adjustments included in net income ^(e) :									
Amortization of net loss	103	(24)	79	250	(90)	160	257	(97)	160
Amortization of prior service cost/(credit)	(23)	6	(17)	(36)	13	(23)	(36)	14	(22)
Curtailed (gain)/loss	21	(5)	16	–	–	–	–	–	–
Settlement (gain)/loss	2	–	2	2	(1)	1	4	(1)	3
Foreign exchange and other	34	(9)	25	(54)	12	(42)	77	(25)	52
Net change	(450)	77	(373)	964	(226)	738	(64)	36	(28)
DVA on fair value option elected liabilities, net change:	\$ 1,364	\$ (321)	\$ 1,043	\$ (303)	\$ 111	\$ (192)	\$ (529)	\$ 199	\$ (330)
Total other comprehensive income/(loss)	\$ (1,761)	\$ 285	\$ (1,476)	\$ 1,971	\$ (915)	\$ 1,056	\$ (2,451)	\$ 930	\$ (1,521)

(a) The pre-tax amount is reported in investment securities gains/(losses) in the Consolidated statements of income.

(b) Reclassifications of pre-tax realized gains/(losses) on translation adjustments and related hedges are reported in other income/expense in the Consolidated statements of income. During the year ended December 31, 2018, the Firm reclassified a net pre-tax loss of \$168 million to other expense related to the liquidation of certain legal entities, \$17 million related to net investment hedge losses and \$151 million related to cumulative translation adjustments. During the year ended December 31, 2017, the Firm reclassified a net pre-tax loss of \$25 million to other expense related to the liquidation of a legal entity, \$50 million related to net investment hedge gains and \$75 million related to cumulative translation adjustments.

(c) Represents changes in fair value of cross-currency swaps attributable to changes in cross-currency basis spreads, which are excluded from the assessment of hedge effectiveness and recorded in other comprehensive income. The initial cost of cross-currency basis spreads is recognized in earnings as part of the accrual of interest on the cross-currency swap.

(d) The pre-tax amounts are predominantly recorded in noninterest revenue, net interest income and compensation expense in the Consolidated statements of income.

(e) The pre-tax amount is reported in other expense in the Consolidated statements of income.

Note 24 – Income taxes

JPMorgan Chase and its eligible subsidiaries file a consolidated U.S. federal income tax return. JPMorgan Chase uses the asset and liability method to provide income taxes on all transactions recorded in the Consolidated Financial Statements. This method requires that income taxes reflect the expected future tax consequences of temporary differences between the carrying amounts of assets or liabilities for book and tax purposes. Accordingly, a deferred tax asset or liability for each temporary difference is determined based on the tax rates that the Firm expects to be in effect when the underlying items of income and expense are realized. JPMorgan Chase’s expense for income taxes includes the current and deferred portions of that expense. A valuation allowance is established to reduce deferred tax assets to the amount the Firm expects to realize.

Due to the inherent complexities arising from the nature of the Firm’s businesses, and from conducting business and being taxed in a substantial number of jurisdictions, significant judgments and estimates are required to be made. Agreement of tax liabilities between JPMorgan Chase and the many tax jurisdictions in which the Firm files tax returns may not be finalized for several years. Thus, the Firm’s final tax-related assets and liabilities may ultimately be different from those currently reported.

Effective tax rate and expense

A reconciliation of the applicable statutory U.S. federal income tax rate to the effective tax rate for each of the years ended December 31, 2018, 2017 and 2016, is presented in the following table.

Year ended December 31,	2018	2017	2016
Statutory U.S. federal tax rate	21.0%	35.0%	35.0%
Increase/(decrease) in tax rate resulting from:			
U.S. state and local income taxes, net of U.S. federal income tax benefit	4.0	2.2	2.4
Tax-exempt income	(1.5)	(3.3)	(3.1)
Non-U.S. subsidiary earnings	0.6	(3.1) ^(a)	(1.7) ^(a)
Business tax credits	(3.5)	(4.2)	(3.9)
Impact of the TCJA	(0.7)	5.4	–
Other, net	0.4	(0.1)	(0.3)
Effective tax rate	20.3%	31.9%	28.4%

(a) Predominantly includes earnings of U.K. subsidiaries that were deemed to be reinvested indefinitely through December 31, 2017.

Impact of the TCJA

2018

The Firm’s effective tax rate decreased in 2018 due to the TCJA, including the reduction in the U.S. federal statutory income tax rate as well as a \$302 million net tax benefit recorded in 2018 resulting from changes in the estimates related to the remeasurement of certain deferred taxes and the deemed repatriation tax on non-U.S. earnings. The change in estimate was recorded under SEC Staff Accounting Bulletin No. 118 (“SAB 118”) and the accounting under SAB 118 is complete.

2017

The Firm’s effective tax rate increased in 2017 driven by a \$1.9 billion income tax expense representing the estimated impact of the enactment of the TCJA. The \$1.9 billion tax expense was predominantly driven by a deemed repatriation of the Firm’s unremitted non-U.S. earnings and adjustments to the value of certain tax-oriented investments partially offset by a benefit from the revaluation of the Firm’s net deferred tax liability.

The deemed repatriation of the Firm’s unremitted non-U.S. earnings is based on the post-1986 earnings and profits of each controlled foreign corporation. The calculation resulted in an estimated income tax expense of \$3.7 billion. Furthermore, accounting for income taxes requires the remeasurement of certain deferred tax assets and liabilities based on the rates at which they are expected to reverse in the future. The Firm remeasured its deferred tax asset and liability balances in the fourth quarter of 2017 to the new statutory U.S. federal income tax rate of 21% as well as any federal benefit associated with state and local deferred income taxes. The remeasurement resulted in an estimated income tax benefit of \$2.1 billion.

Adjustments were also recorded in 2017 to income tax expense for certain tax-oriented investments. These adjustments were driven by changes to affordable housing proportional amortization resulting from the reduction of the federal income tax rate under the TCJA. SAB 118 did not apply to these adjustments.

The components of income tax expense/(benefit) included in the Consolidated statements of income were as follows for each of the years ended December 31, 2018, 2017, and 2016.

Income tax expense/(benefit)

Year ended December 31, (in millions)	2018	2017	2016
Current income tax expense/(benefit)			
U.S. federal	\$ 2,854	\$ 5,718	\$ 2,488
Non-U.S.	2,077	2,400	1,760
U.S. state and local	1,638	1,029	904
Total current income tax expense/ (benefit)	6,569	9,147	5,152
Deferred income tax expense/(benefit)			
U.S. federal	1,359	2,174	4,364
Non-U.S.	(93)	(144)	(73)
U.S. state and local	455	282	360
Total deferred income tax expense/(benefit)	1,721	2,312	4,651
Total income tax expense	\$ 8,290	\$ 11,459	\$ 9,803

Total income tax expense includes \$54 million, \$252 million and \$55 million of tax benefits recorded in 2018, 2017, and 2016, respectively, as a result of tax audit resolutions.

Tax effect of items recorded in stockholders' equity

The preceding table does not reflect the tax effect of certain items that are recorded each period directly in stockholders' equity. The tax effect of all items recorded directly to stockholders' equity resulted in an increase of \$172 million in 2018, a decrease of \$915 million in 2017, and an increase of \$925 million in 2016.

Results from Non-U.S. earnings

The following table presents the U.S. and non-U.S. components of income before income tax expense for the years ended December 31, 2018, 2017 and 2016.

Year ended December 31, (in millions)	2018	2017	2016
U.S.	\$ 33,052	\$ 27,103	\$ 26,651
Non-U.S. ^(a)	7,712	8,797	7,885
Income before income tax expense	\$ 40,764	\$ 35,900	\$ 34,536

(a) For purposes of this table, non-U.S. income is defined as income generated from operations located outside the U.S.

Prior to December 31, 2017, U.S. federal income taxes had not been provided on the undistributed earnings of certain non-U.S. subsidiaries, to the extent that such earnings had been reinvested abroad for an indefinite period of time. The Firm is no longer maintaining the indefinite reinvestment assertion on the undistributed earnings of those non-U.S. subsidiaries in light of the enactment of the TCJA. The U.S. federal and state and local income taxes associated with the undistributed and previously untaxed earnings of those non-U.S. subsidiaries was included in the deemed repatriation charge recorded as of December 31, 2017.

Affordable housing tax credits

The Firm recognized \$1.5 billion, \$1.7 billion and \$1.7 billion of tax credits and other tax benefits associated with investments in affordable housing projects within income tax expense for the years 2018, 2017 and 2016, respectively. The amount of amortization of such investments reported in income tax expense was \$1.2 billion, \$1.7 billion and \$1.2 billion, respectively. The carrying value of these investments, which are reported in other assets on the Firm's Consolidated balance sheets, was \$7.9 billion and \$7.8 billion at December 31, 2018 and 2017, respectively. The amount of commitments related to these investments, which are reported in accounts payable and other liabilities on the Firm's Consolidated balance sheets, was \$2.3 billion and \$2.4 billion at December 31, 2018 and 2017, respectively.

Notes to consolidated financial statements

Deferred taxes

Deferred income tax expense/(benefit) results from differences between assets and liabilities measured for financial reporting purposes versus income tax return purposes. Deferred tax assets are recognized if, in management's judgment, their realizability is determined to be more likely than not. If a deferred tax asset is determined to be unrealizable, a valuation allowance is established. The significant components of deferred tax assets and liabilities are reflected in the following table as of December 31, 2018 and 2017.

December 31, (in millions)	2018	2017
Deferred tax assets		
Allowance for loan losses	\$ 3,433	\$ 3,395
Employee benefits	1,129	688
Accrued expenses and other	2,701	3,528
Non-U.S. operations	629	327
Tax attribute carryforwards	163	219
Gross deferred tax assets	8,055	8,157
Valuation allowance	(89)	(46)
Deferred tax assets, net of valuation allowance	\$ 7,966	\$ 8,111
Deferred tax liabilities		
Depreciation and amortization	\$ 2,533	\$ 2,299
Mortgage servicing rights, net of hedges	2,586	2,757
Leasing transactions	4,719	3,483
Non-U.S. operations	—	200
Other, net	3,713	3,502
Gross deferred tax liabilities	13,551	12,241
Net deferred tax (liabilities)/assets	\$ (5,585)	\$ (4,130)

JPMorgan Chase has recorded deferred tax assets of \$163 million at December 31, 2018, in connection with U.S. federal and non-U.S. net operating loss ("NOL") carryforwards and state and local capital loss carryforwards. At December 31, 2018, total U.S. federal NOL carryforwards were approximately \$423 million, non-U.S. NOL carryforwards were approximately \$120 million and state and local capital loss carryforwards were \$1.3 billion. If not utilized, the U.S. federal NOL carryforwards will expire between 2022 and 2036 and the state and local capital loss carryforwards will expire between 2020 and 2022. Certain non-U.S. NOL carryforwards will expire between 2028 and 2034 whereas others have an unlimited carryforward period.

The valuation allowance at December 31, 2018, was due to the state and local capital loss carryforwards and certain non-U.S. deferred tax assets, including NOL carryforwards.

Unrecognized tax benefits

At December 31, 2018, 2017 and 2016, JPMorgan Chase's unrecognized tax benefits, excluding related interest expense and penalties, were \$4.9 billion, \$4.7 billion and \$3.5 billion, respectively, of which \$3.8 billion, \$3.5 billion and \$2.6 billion, respectively, if recognized, would reduce the annual effective tax rate. Included in the amount of unrecognized tax benefits are certain items that would not affect the effective tax rate if they were recognized in the Consolidated statements of income. These unrecognized items include the tax effect of certain temporary differences, the portion of gross state and local unrecognized tax benefits that would be offset by the benefit from associated U.S. federal income tax deductions, and the portion of gross non-U.S. unrecognized tax benefits that would have offsets in other jurisdictions. JPMorgan Chase is presently under audit by a number of taxing authorities, most notably by the Internal Revenue Service as summarized in the Tax examination status table below. As JPMorgan Chase is presently under audit by a number of taxing authorities, it is reasonably possible that over the next 12 months the resolution of these examinations may increase or decrease the gross balance of unrecognized tax benefits by as much as \$0.9 billion. Upon settlement of an audit, the change in the unrecognized tax benefit would result from payment or income statement recognition.

The following table presents a reconciliation of the beginning and ending amount of unrecognized tax benefits for the years ended December 31, 2018, 2017 and 2016.

Year ended December 31, (in millions)	2018	2017	2016
Balance at January 1,	\$ 4,747	\$ 3,450	\$ 3,497
Increases based on tax positions related to the current period	980	1,355	262
Increases based on tax positions related to prior periods	649	626	583
Decreases based on tax positions related to prior periods	(1,249)	(350)	(785)
Decreases related to cash settlements with taxing authorities	(266)	(334)	(56)
Decreases related to a lapse of applicable statute of limitations	—	—	(51)
Balance at December 31,	\$ 4,861	\$ 4,747	\$ 3,450

After-tax interest expense/(benefit) and penalties related to income tax liabilities recognized in income tax expense were \$192 million, \$102 million and \$86 million in 2018, 2017 and 2016, respectively.

At December 31, 2018 and 2017, in addition to the liability for unrecognized tax benefits, the Firm had accrued \$887 million and \$639 million, respectively, for income tax-related interest and penalties.

Tax examination status

JPMorgan Chase is continually under examination by the Internal Revenue Service, by taxing authorities throughout the world, and by many state and local jurisdictions throughout the U.S. The following table summarizes the status of significant income tax examinations of JPMorgan Chase and its consolidated subsidiaries as of December 31, 2018.

December 31, 2018	Periods under examination	Status
JPMorgan Chase - U.S.	2006 - 2010	Field examination of amended returns
JPMorgan Chase - U.S.	2011 - 2013	Field Examination
JPMorgan Chase - U.S.	2014 - 2016	Field Examination
JPMorgan Chase - New York State	2012 - 2014	Field Examination
JPMorgan Chase - New York City	2012 - 2014	Field Examination
JPMorgan Chase - California	2011 - 2012	Field Examination
JPMorgan Chase - U.K.	2006 - 2016	Field examination of certain select entities

Note 25 – Restricted cash, other restricted assets and intercompany funds transfers

Restricted cash and other restricted assets

Certain of the Firm’s cash and other assets are restricted as to withdrawal or usage. These restrictions are imposed by various regulatory authorities based on the particular activities of the Firm’s subsidiaries.

The business of JPMorgan Chase Bank, N.A. is subject to examination and regulation by the OCC. The Bank is a member of the U.S. Federal Reserve System, and its deposits in the U.S. are insured by the FDIC, subject to applicable limits.

The Federal Reserve requires depository institutions to maintain cash reserves with a Federal Reserve Bank. The average required amount of reserve balances is deposited by the Firm’s bank subsidiaries. In addition, the Firm is required to maintain cash reserves at certain non-US central banks.

The Firm is also subject to rules and regulations established by other U.S. and non U.S. regulators. As part of its compliance with the respective regulatory requirements, the Firm’s broker-dealers (principally J.P. Morgan Securities LLC in the U.S and J.P. Morgan Securities plc in the U.K.) are subject to certain restrictions on cash and other assets.

Upon the adoption of the restricted cash guidance in the first quarter of 2018, restricted and unrestricted cash are reported together on the Consolidated balance sheets and Consolidated statements of cash flows. The following table presents the components of the Firm’s restricted cash:

December 31, (in billions)	2018	2017
Cash reserves – Federal Reserve Banks	\$ 22.1	\$ 25.7
Segregated for the benefit of securities and futures brokerage customers	14.6	16.8
Cash reserves at non-U.S. central banks and held for other general purposes	4.1	3.3
Total restricted cash^(a)	\$ 40.8	\$ 45.8

(a) Comprises \$39.6 billion and \$44.8 billion in deposits with banks, and \$1.2 billion and \$1.0 billion in cash and due from banks on the Consolidated balance sheets as of December 31, 2018 and 2017, respectively.

Also, as of December 31, 2018 and 2017, the Firm had the following other restricted assets:

- Cash and securities pledged with clearing organizations for the benefit of customers of \$20.6 billion and \$18.0 billion, respectively.
- Securities with a fair value of \$9.7 billion and \$3.5 billion, respectively, were also restricted in relation to customer activity.

Intercompany funds transfers

Restrictions imposed by U.S. federal law prohibit JPMorgan Chase & Co. (“Parent Company”) and certain of its affiliates from borrowing from banking subsidiaries unless the loans are secured in specified amounts. Such secured loans provided by any banking subsidiary to the Parent Company or to any particular affiliate, together with certain other transactions with such affiliate (collectively referred to as “covered transactions”), are generally limited to 10% of the banking subsidiary’s total capital, as determined by the risk-based capital guidelines; the aggregate amount of covered transactions between any banking subsidiary and all of its affiliates is limited to 20% of the banking subsidiary’s total capital.

The Parent Company’s two principal subsidiaries are JPMorgan Chase Bank, N.A. and JPMorgan Chase Holdings LLC, an intermediate holding company (the “IHC”). The IHC holds the stock of substantially all of JPMorgan Chase’s subsidiaries other than JPMorgan Chase Bank, N.A. and its subsidiaries. The IHC also owns other assets and intercompany indebtedness owing to the holding company. The Parent Company is obligated to contribute to the IHC substantially all the net proceeds received from securities issuances (including issuances of senior and subordinated debt securities and of preferred and common stock).

The principal sources of income and funding for the Parent Company are dividends from JPMorgan Chase Bank, N.A. and dividends and extensions of credit from the IHC. In addition to dividend restrictions set forth in statutes and regulations, the Federal Reserve, the OCC and the FDIC have authority under the Financial Institutions Supervisory Act to prohibit or to limit the payment of dividends by the banking organizations they supervise, including the Parent Company and its subsidiaries that are banks or bank holding companies, if, in the banking regulator’s opinion, payment of a dividend would constitute an unsafe or unsound practice in light of the financial condition of the banking organization. The IHC is prohibited from paying dividends or extending credit to the Parent Company if certain capital or liquidity “thresholds” are breached or if limits are otherwise imposed by the Parent Company’s management or Board of Directors.

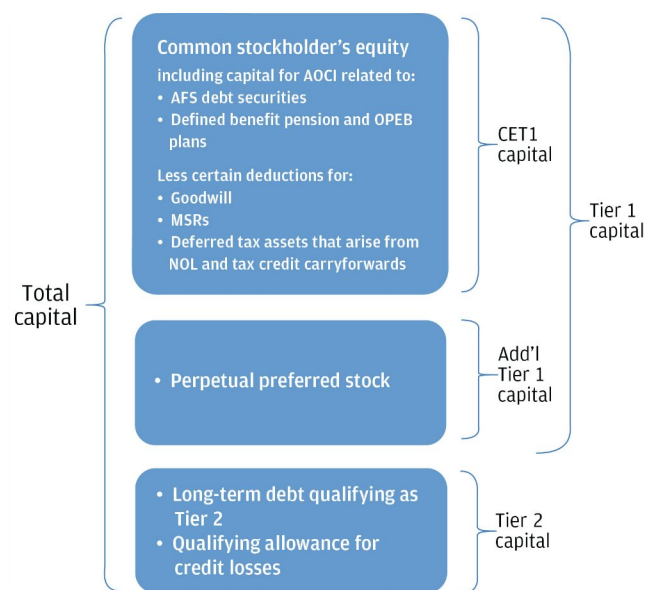
At January 1, 2019, the Parent Company’s banking subsidiaries could pay, in the aggregate, approximately \$10 billion in dividends to their respective bank holding companies without the prior approval of their relevant banking regulators. The capacity to pay dividends in 2019 will be supplemented by the banking subsidiaries’ earnings during the year.

Note 26 – Regulatory capital

The Federal Reserve establishes capital requirements, including well-capitalized standards, for the consolidated financial holding company. The OCC establishes similar minimum capital requirements and standards for the Firm’s IDI, including JPMorgan Chase Bank, N.A. and Chase Bank USA, N.A.

Capital rules under Basel III establish minimum capital ratios and overall capital adequacy standards for large and internationally active U.S. bank holding companies and banks, including the Firm and its IDI subsidiaries. Basel III set forth two comprehensive approaches for calculating RWA: a standardized approach (“Basel III Standardized”) and an advanced approach (“Basel III Advanced”). Certain of the requirements of Basel III were subject to phase-in periods that began on January 1, 2014 and continued through the end of 2018 (“transitional period”).

The three components of regulatory capital under the Basel III rules are as illustrated below:



Under the risk-based and leverage-based capital guidelines of the Federal Reserve, JPMorgan Chase is required to maintain minimum ratios for CET1, Tier 1, Total, Tier 1 leverage and the SLR. Failure to meet these minimum requirements could cause the Federal Reserve to take action. IDI subsidiaries are also subject to these capital requirements by their respective primary regulators.

The following table presents the minimum and well-capitalized ratios to which the Firm and its IDI subsidiaries were subject as of December 31, 2018.

	Minimum capital ratios		Well-capitalized ratios	
	BHC ^{(a)(e)(f)}	IDI ^{(b)(e)(f)}	BHC ^(c)	IDI ^(d)
Capital ratios				
CET1	9.0%	6.375%	—%	6.5%
Tier 1	10.5	7.875	6.0	8.0
Total	12.5	9.875	10.0	10.0
Tier 1 leverage	4.0	4.00	5.0	5.0
SLR	5.0	6.00	—	6.0

Note: The table above is as defined by the regulations issued by the Federal Reserve, OCC and FDIC and to which the Firm and its IDI subsidiaries are subject.

- Represents the Transitional minimum capital ratios applicable to the Firm under Basel III at December 31, 2018. At December 31, 2018, the CET1 minimum capital ratio includes 1.875% resulting from the phase in of the Firm’s 2.5% capital conservation buffer, and 2.625% resulting from the phase in of the Firm’s 3.5% GSIB surcharge.
- Represents requirements for JPMorgan Chase’s IDI subsidiaries. The CET1 minimum capital ratio includes 1.875% resulting from the phase in of the 2.5% capital conservation buffer that is applicable to the IDI subsidiaries. The IDI subsidiaries are not subject to the GSIB surcharge.
- Represents requirements for bank holding companies pursuant to regulations issued by the Federal Reserve.
- Represents requirements for IDI subsidiaries pursuant to regulations issued under the FDIC Improvement Act.
- For the period ended December 31, 2017 the CET1, Tier 1, Total and Tier 1 leverage minimum capital ratios applicable to the Firm were 7.5%, 9.0%, 11.0% and 4.0% and the CET1, Tier 1, Total and Tier 1 leverage minimum capital ratios applicable to the Firm’s IDI subsidiaries were 5.75%, 7.25%, 9.25% and 4.0% respectively.
- Represents minimum SLR requirement of 3.0%, as well as, supplementary leverage buffers of 2.0% and 3.0% for BHC and IDI, respectively.

Notes to consolidated financial statements

The following tables present the risk-based and leverage-based capital metrics for JPMorgan Chase and its significant IDI subsidiaries under both the Basel III Standardized and Basel III Advanced Approaches. As of December 31, 2018 and 2017, JPMorgan Chase and all of its IDI subsidiaries were well-capitalized and met all capital requirements to which each was subject.

December 31, 2018 (in millions, except ratios)	Basel III Standardized Transitional			Basel III Advanced Transitional		
	JPMorgan Chase & Co.	JPMorgan Chase Bank, N.A.	Chase Bank USA, N.A.	JPMorgan Chase & Co.	JPMorgan Chase Bank, N.A.	Chase Bank USA, N.A.
Regulatory capital						
CET1 capital	\$ 183,474	\$ 187,259	\$ 23,696	\$ 183,474	\$ 187,259	\$ 23,696
Tier 1 capital	209,093	187,259	23,696	209,093	187,259	23,696
Total capital	237,511	198,494	28,628	227,435	192,250	27,196
Assets						
Risk-weighted	1,528,916	1,348,230	112,513	1,421,205	1,205,539	174,469
Adjusted average ^(a)	2,589,887	2,189,293	118,036	2,589,887	2,189,293	118,036
Capital ratios^(b)						
CET1	12.0%	13.9%	21.1%	12.9%	15.5%	13.6%
Tier 1	13.7	13.9	21.1	14.7	15.5	13.6
Total	15.5	14.7	25.4	16.0	15.9	15.6
Tier 1 leverage ^(c)	8.1	8.6	20.1	8.1	8.6	20.1

December 31, 2017 (in millions, except ratios)	Basel III Standardized Transitional			Basel III Advanced Transitional		
	JPMorgan Chase & Co.	JPMorgan Chase Bank, N.A.	Chase Bank USA, N.A.	JPMorgan Chase & Co.	JPMorgan Chase Bank, N.A.	Chase Bank USA, N.A.
Regulatory capital						
CET1 capital	\$ 183,300	\$ 184,375	\$ 21,600	\$ 183,300	\$ 184,375	\$ 21,600
Tier 1 capital	208,644	184,375	21,600	208,644	184,375	21,600
Total capital	238,395	195,839	27,691	227,933	189,510 ^(d)	26,250
Assets						
Risk-weighted	1,499,506	1,338,970 ^(d)	113,108	1,435,825	1,241,916 ^(d)	190,523
Adjusted average ^(a)	2,514,270	2,116,031	126,517	2,514,270	2,116,031	126,517
Capital ratios^(b)						
CET1	12.2%	13.8%	19.1%	12.8%	14.8% ^(d)	11.3%
Tier 1	13.9	13.8	19.1	14.5	14.8 ^(d)	11.3
Total	15.9	14.6 ^(d)	24.5	15.9	15.3 ^(d)	13.8
Tier 1 leverage ^(c)	8.3	8.7	17.1	8.3	8.7	17.1

(a) Adjusted average assets, for purposes of calculating the Tier 1 leverage ratio, includes total quarterly average assets adjusted for on-balance sheet assets that are subject to deduction from Tier 1 capital, predominantly goodwill and other intangible assets.

(b) For each of the risk-based capital ratios, the capital adequacy of the Firm and its IDI subsidiaries is evaluated against the lower of the two ratios as calculated under Basel III approaches (Standardized or Advanced).

(c) The Tier 1 leverage ratio is not a risk-based measure of capital.

(d) The prior period amounts have been revised to conform with the current period presentation.

(in millions, except ratios)	December 31, 2018			December 31, 2017		
	Basel III Advanced Fully Phased-In			Basel III Advanced Transitional		
	JPMorgan Chase & Co.	JPMorgan Chase Bank, N.A.	Chase Bank USA, N.A.	JPMorgan Chase & Co.	JPMorgan Chase Bank, N.A.	Chase Bank USA, N.A.
Total leverage exposure ^(a)	3,269,988	\$ 2,813,396	\$ 177,328	\$ 3,204,463	\$ 2,775,041	\$ 182,803
SLR ^(a)	6.4%	6.7%	13.4%	6.5%	6.6%	11.8%

(a) Effective January 1, 2018, the SLR was fully phased-in under Basel III. The December 31, 2017 amounts were calculated under the Basel III Transitional rules.

Note 27 – Off-balance sheet lending-related financial instruments, guarantees, and other commitments

JPMorgan Chase provides lending-related financial instruments (e.g., commitments and guarantees) to address the financing needs of its customers and clients. The contractual amount of these financial instruments represents the maximum possible credit risk to the Firm should the customer or client draw upon the commitment or the Firm be required to fulfill its obligation under the guarantee, and should the customer or client subsequently fail to perform according to the terms of the contract. Most of these commitments and guarantees are refinanced, extended, cancelled, or expire without being drawn or a default occurring. As a result, the total contractual amount of these instruments is not, in the Firm's view, representative of its expected future credit exposure or funding requirements.

To provide for probable credit losses inherent in wholesale and certain consumer lending-commitments, an allowance for credit losses on lending-related commitments is maintained. Refer to Note 13 for further information regarding the allowance for credit losses on lending-related commitments. The following table summarizes the contractual amounts and carrying values of off-balance sheet lending-related financial instruments, guarantees and other commitments at December 31, 2018 and 2017. The amounts in the table below for credit card and home equity lending-related commitments represent the total available credit for these products. The Firm has not experienced, and does not anticipate, that all available lines of credit for these products will be utilized at the same time. The Firm can reduce or cancel credit card lines of credit by providing the borrower notice or, in some cases as permitted by law, without notice. In addition, the Firm typically closes credit card lines when the borrower is 60 days or more past due. The Firm may reduce or close HELOCs when there are significant decreases in the value of the underlying property, or when there has been a demonstrable decline in the creditworthiness of the borrower.

Notes to consolidated financial statements

Off-balance sheet lending-related financial instruments, guarantees and other commitments

By remaining maturity at December 31, (in millions)	Contractual amount						Carrying value ⁽ⁱ⁾	
	2018					2017	2018	2017
	Expires in 1 year or less	Expires after 1 year through 3 years	Expires after 3 years through 5 years	Expires after 5 years	Total	Total		
Lending-related								
Consumer, excluding credit card:								
Home equity	\$ 796	\$ 1,095	\$ 1,813	\$ 17,197	\$ 20,901	\$ 20,360	\$ 12	\$ 12
Residential mortgage ^(a)	5,469	–	–	12	5,481	5,736	–	–
Auto	6,954	878	78	101	8,011	9,255	2	2
Consumer & Business Banking	10,580	566	102	425	11,673	13,202	19	19
Total consumer, excluding credit card	23,799	2,539	1,993	17,735	46,066	48,553	33	33
Credit card	605,379	–	–	–	605,379	572,831	–	–
Total consumer^(b)	629,178	2,539	1,993	17,735	651,445	621,384	33	33
Wholesale:								
Other unfunded commitments to extend credit ^(c)	62,384	123,751	154,177	11,178	351,490	331,160	852	840
Standby letters of credit and other financial guarantees ^(c)	14,408	11,462	5,248	2,380	33,498	35,226	521	636
Other letters of credit ^(c)	2,608	177	40	–	2,825	3,712	3	3
Total wholesale^(d)	79,400	135,390	159,465	13,558	387,813	370,098	1,376	1,479
Total lending-related	\$ 708,578	\$ 137,929	\$ 161,458	\$ 31,293	\$ 1,039,258	\$ 991,482	\$ 1,409	\$ 1,512
Other guarantees and commitments								
Securities lending indemnification agreements and guarantees ^(e)	\$ 186,077	\$ –	\$ –	\$ –	\$ 186,077	\$ 179,490	\$ –	\$ –
Derivatives qualifying as guarantees	2,099	299	12,614	40,259	55,271	57,174	367	304
Unsettled resale and securities borrowed agreements	102,008	–	–	–	102,008	76,859	–	–
Unsettled repurchase and securities loaned agreements	57,732	–	–	–	57,732	44,205	–	–
Loan sale and securitization-related indemnifications:								
Mortgage repurchase liability	NA	NA	NA	NA	NA	NA	89	111
Loans sold with recourse	NA	NA	NA	NA	1,019	1,169	30	38
Exchange & clearing house guarantees and commitments ^{(f)(g)}	58,960	–	–	–	58,960	13,871	–	–
Other guarantees and commitments ^{(g)(h)}	3,874	542	299	3,468	8,183	8,206	(73)	(76)

(a) Includes certain commitments to purchase loans from correspondents.

(b) Predominantly all consumer lending-related commitments are in the U.S.

(c) At December 31, 2018 and 2017, reflected the contractual amount net of risk participations totaling \$282 million and \$334 million, respectively, for other unfunded commitments to extend credit; \$10.4 billion and \$10.4 billion, respectively, for standby letters of credit and other financial guarantees; and \$385 million and \$405 million, respectively, for other letters of credit. In regulatory filings with the Federal Reserve these commitments are shown gross of risk participations.

(d) Predominantly all wholesale lending-related commitments are in the U.S.

(e) At December 31, 2018 and 2017, collateral held by the Firm in support of securities lending indemnification agreements was \$195.6 billion and \$188.7 billion, respectively. Securities lending collateral primarily consists of cash and securities issued by governments that are members of G7 and U.S. government agencies.

(f) At December 31, 2018, includes guarantees to the Fixed Income Clearing Corporation under the sponsored member repo program and commitments and guarantees associated with the Firm's membership in certain clearing houses. At December 31, 2017 includes commitments and guarantees associated with the Firm's membership in certain clearing houses.

(g) Certain guarantees and commitments associated with the Firm's membership in clearing houses previously disclosed in "other guarantees and commitments" are now disclosed in "Exchange and clearing house guarantees and commitments". Prior period amounts have been revised to conform with the current period presentation.

(h) At December 31, 2018 and 2017, primarily includes letters of credit hedged by derivative transactions and managed on a market risk basis, and unfunded commitments related to institutional lending. Additionally, includes unfunded commitments predominantly related to certain tax-oriented equity investments.

(i) For lending-related products, the carrying value represents the allowance for lending-related commitments and the guarantee liability; for derivative-related products, the carrying value represents the fair value.

Other unfunded commitments to extend credit

Other unfunded commitments to extend credit generally consist of commitments for working capital and general corporate purposes, extensions of credit to support commercial paper facilities and bond financings in the event that those obligations cannot be remarketed to new investors, as well as committed liquidity facilities to clearing organizations. The Firm also issues commitments under multipurpose facilities which could be drawn upon in several forms, including the issuance of a standby letter of credit.

The Firm acts as a settlement and custody bank in the U.S. tri-party repurchase transaction market. In its role as settlement and custody bank, the Firm in part is exposed to the intra-day credit risk of its cash borrower clients, usually broker-dealers. This exposure arises under secured clearance advance facilities that the Firm extended to its clients (i.e. cash borrowers); these facilities contractually limit the Firm's intra-day credit risk to the facility amount and must be repaid by the end of the day. As of December 31, 2017, the secured clearance advance facility maximum outstanding commitment amount was \$1.5 billion. As of December 31, 2018 the Firm no longer offers such arrangements to its clients.

Guarantees

U.S. GAAP requires that a guarantor recognize, at the inception of a guarantee, a liability in an amount equal to the fair value of the obligation undertaken in issuing the guarantee. U.S. GAAP defines a guarantee as a contract that contingently requires the guarantor to pay a guaranteed party based upon: (a) changes in an underlying asset, liability or equity security of the guaranteed party; or (b) a third party's failure to perform under a specified agreement. The Firm considers the following off-balance sheet arrangements to be guarantees under U.S. GAAP: standby letters of credit and other financial guarantees, securities lending indemnifications, certain indemnification

agreements included within third-party contractual arrangements, certain derivative contracts and the guarantees under the sponsored member repo program.

As required by U.S. GAAP, the Firm initially records guarantees at the inception date fair value of the obligation assumed (e.g., the amount of consideration received or the net present value of the premium receivable). For certain types of guarantees, the Firm records this fair value amount in other liabilities with an offsetting entry recorded in cash (for premiums received), or other assets (for premiums receivable). Any premium receivable recorded in other assets is reduced as cash is received under the contract, and the fair value of the liability recorded at inception is amortized into income as lending and deposit-related fees over the life of the guarantee contract. For indemnifications provided in sales agreements, a portion of the sale proceeds is allocated to the guarantee, which adjusts the gain or loss that would otherwise result from the transaction. For these indemnifications, the initial liability is amortized to income as the Firm's risk is reduced (i.e., over time or when the indemnification expires). Any contingent liability that exists as a result of issuing the guarantee or indemnification is recognized when it becomes probable and reasonably estimable. The contingent portion of the liability is not recognized if the estimated amount is less than the carrying amount of the liability recognized at inception (adjusted for any amortization). The contractual amount and carrying value of guarantees and indemnifications are included in the table on page 272. For additional information on the guarantees, see below.

Standby letters of credit and other financial guarantees

Standby letters of credit and other financial guarantees are conditional lending commitments issued by the Firm to guarantee the performance of a client or customer to a third party under certain arrangements, such as commercial paper facilities, bond financings, acquisition financings, trade and similar transactions.

The following table summarizes the contractual amount and carrying value of standby letters of credit and other financial guarantees and other letters of credit arrangements as of December 31, 2018 and 2017.

Standby letters of credit, other financial guarantees and other letters of credit

December 31, (in millions)	2018		2017	
	Standby letters of credit and other financial guarantees	Other letters of credit	Standby letters of credit and other financial guarantees	Other letters of credit
Investment-grade ^(a)	\$ 26,420	\$ 2,079	\$ 28,492	\$ 2,646
Noninvestment-grade ^(a)	7,078	746	6,734	1,066
Total contractual amount	\$ 33,498	\$ 2,825	\$ 35,226	\$ 3,712
Allowance for lending-related commitments	\$ 167	\$ 3	\$ 192	\$ 3
Guarantee liability	354	—	444	—
Total carrying value	\$ 521	\$ 3	\$ 636	\$ 3
Commitments with collateral	\$ 17,400	\$ 583	\$ 17,421	\$ 878

(a) The ratings scale is based on the Firm's internal ratings which generally correspond to ratings as defined by S&P and Moody's.

Notes to consolidated financial statements

Securities lending indemnifications

Through the Firm's securities lending program, counterparties' securities, via custodial and non-custodial arrangements, may be lent to third parties. As part of this program, the Firm provides an indemnification in the lending agreements which protects the lender against the failure of the borrower to return the lent securities. To minimize its liability under these indemnification agreements, the Firm obtains cash or other highly liquid collateral with a market value exceeding 100% of the value of the securities on loan from the borrower. Collateral is marked to market daily to help assure that collateralization is adequate. Additional collateral is called from the borrower if a shortfall exists, or collateral may be released to the borrower in the event of overcollateralization. If a borrower defaults, the Firm would use the collateral held to purchase replacement securities in the market or to credit the lending client or counterparty with the cash equivalent thereof.

Derivatives qualifying as guarantees

The Firm transacts certain derivative contracts that have the characteristics of a guarantee under U.S. GAAP. These contracts include written put options that require the Firm to purchase assets upon exercise by the option holder at a specified price by a specified date in the future. The Firm may enter into written put option contracts in order to meet client needs, or for other trading purposes. The terms of written put options are typically five years or less.

Derivatives deemed to be guarantees also includes stable value contracts, commonly referred to as "stable value products", that require the Firm to make a payment of the difference between the market value and the book value of a counterparty's reference portfolio of assets in the event that market value is less than book value and certain other conditions have been met. Stable value products are transacted in order to allow investors to realize investment returns with less volatility than an unprotected portfolio. These contracts are typically longer-term or may have no stated maturity, but allow the Firm to elect to terminate the contract under certain conditions.

The notional value of derivatives guarantees generally represents the Firm's maximum exposure. However, exposure to certain stable value products is contractually limited to a substantially lower percentage of the notional amount.

The fair value of derivative guarantees reflects the probability, in the Firm's view, of whether the Firm will be required to perform under the contract. The Firm reduces exposures to these contracts by entering into offsetting transactions, or by entering into contracts that hedge the market risk related to the derivative guarantees.

The following table summarizes the derivatives qualifying as guarantees as of December 31, 2018 and 2017.

(in millions)	December 31, 2018	December 31, 2017
Notional amounts		
Derivative guarantees	\$ 55,271	\$ 57,174
Stable value contracts with contractually limited exposure	28,637	29,104
Maximum exposure of stable value contracts with contractually limited exposure	2,963	3,053
Fair value		
Derivative payables	367	304
Derivative receivables	—	—

In addition to derivative contracts that meet the characteristics of a guarantee, the Firm is both a purchaser and seller of credit protection in the credit derivatives market. For a further discussion of credit derivatives, refer to Note 5.

Unsettled securities financing agreements

In the normal course of business, the Firm enters into resale and securities borrowed agreements. At settlement, these commitments result in the Firm advancing cash to and receiving securities collateral from the counterparty. The Firm also enters into repurchase and securities loaned agreements. At settlement, these commitments result in the Firm receiving cash from and providing securities collateral to the counterparty. Such agreements settle at a future date. These agreements generally do not meet the definition of a derivative, and therefore, are not recorded on the Consolidated balance sheets until settlement date. These agreements predominantly have regular-way settlement terms. For a further discussion of securities financing agreements, refer to Note 11.

Loan sales- and securitization-related indemnifications

Mortgage repurchase liability

In connection with the Firm's mortgage loan sale and securitization activities with GSEs the Firm has made representations and warranties that the loans sold meet certain requirements, and that may require the Firm to repurchase mortgage loans and/or indemnify the loan purchaser if such representations and warranties are breached by the Firm. Further, although the Firm's securitizations are predominantly nonrecourse, the Firm does provide recourse servicing in certain limited cases where it agrees to share credit risk with the owner of the mortgage loans. To the extent that repurchase demands that are received relate to loans that the Firm purchased from third parties that remain viable, the Firm typically will have the right to seek a recovery of related repurchase losses from the third party. Generally, the maximum amount of future payments the Firm would be required to make for breaches of these representations and warranties would be equal to the unpaid principal balance of such loans that are deemed to have defects that were sold to purchasers (including securitization-related SPEs) plus, in certain circumstances, accrued interest on such loans and certain expenses.

Private label securitizations

The liability related to repurchase demands associated with private label securitizations is separately evaluated by the Firm in establishing its litigation reserves.

For additional information regarding litigation, refer to Note 29.

Loans sold with recourse

The Firm provides servicing for mortgages and certain commercial lending products on both a recourse and nonrecourse basis. In nonrecourse servicing, the principal credit risk to the Firm is the cost of temporary servicing advances of funds (i.e., normal servicing advances). In recourse servicing, the servicer agrees to share credit risk with the owner of the mortgage loans, such as Fannie Mae or Freddie Mac or a private investor, insurer or guarantor. Losses on recourse servicing predominantly occur when foreclosure sales proceeds of the property underlying a defaulted loan are less than the sum of the outstanding principal balance, plus accrued interest on the loan and the cost of holding and disposing of the underlying property. The Firm's securitizations are predominantly nonrecourse, thereby effectively transferring the risk of future credit losses to the purchaser of the mortgage-backed securities issued by the trust. At December 31, 2018 and 2017, the unpaid principal balance of loans sold with recourse totaled \$1.0 billion and \$1.2 billion, respectively. The carrying value of the related liability that the Firm has recorded in accounts payable and other liabilities on the Consolidated balance sheets, which is representative of the Firm's view of the likelihood it will have to perform under its recourse obligations, was \$30 million and \$38 million at December 31, 2018 and 2017, respectively.

Other off-balance sheet arrangements

Indemnification agreements - general

In connection with issuing securities to investors outside the U.S., the Firm may agree to pay additional amounts to the holders of the securities in the event that, due to a change in tax law, certain types of withholding taxes are imposed on payments on the securities. The terms of the securities may also give the Firm the right to redeem the securities if such additional amounts are payable. The Firm may also enter into indemnification clauses in connection with the licensing of software to clients ("software licensees") or when it sells a business or assets to a third party ("third-party purchasers"), pursuant to which it indemnifies software licensees for claims of liability or damages that may occur subsequent to the licensing of the software, or third-party purchasers for losses they may incur due to actions taken by the Firm prior to the sale of the business or assets. It is difficult to estimate the Firm's maximum exposure under these indemnification arrangements, since this would require an assessment of future changes in tax law and future claims that may be made against the Firm that have not yet occurred. However, based on historical experience, management expects the risk of loss to be remote.

Card charge-backs

Under the rules of Visa USA, Inc., and MasterCard International, JPMorgan Chase Bank, N.A., is primarily liable for the amount of each processed card sales transaction that is the subject of a dispute between a cardmember and a merchant. If a dispute is resolved in the cardmember's favor, Merchant Services will (through the cardmember's issuing bank) credit or refund the amount to the cardmember and will charge back the transaction to the merchant. If Merchant Services is unable to collect the amount from the merchant, Merchant Services will bear the loss for the amount credited or refunded to the cardmember. Merchant Services mitigates this risk by withholding future settlements, retaining cash reserve accounts or by obtaining other collateral. However, in the unlikely event that: (1) a merchant ceases operations and is unable to deliver products, services or a refund; (2) Merchant Services does not have sufficient collateral from the merchant to provide cardmember refunds; and (3) Merchant Services does not have sufficient financial resources to provide cardmember refunds, JPMorgan Chase Bank, N.A., would recognize the loss.

Merchant Services incurred aggregate losses of \$30 million, \$28 million, and \$85 million on \$1,366.1 billion, \$1,191.7 billion, and \$1,063.4 billion of aggregate volume processed for the years ended December 31, 2018, 2017 and 2016, respectively. Incurred losses from merchant charge-backs are charged to other expense, with the offset recorded in a valuation allowance against accrued interest and accounts receivable on the Consolidated balance sheets. The carrying value of the valuation allowance was \$23 million and \$7 million at December 31, 2018 and 2017, respectively, which the Firm believes, based on historical experience and the collateral held by Merchant Services of \$144 million and \$141 million at December 31, 2018 and 2017, respectively, is representative of the payment or performance risk to the Firm related to charge-backs.

Clearing Services - Client Credit Risk

The Firm provides clearing services for clients by entering into securities purchases and sales and derivative contracts with CCPs, including ETDs such as futures and options, as well as OTC-cleared derivative contracts. As a clearing member, the Firm stands behind the performance of its clients, collects cash and securities collateral (margin) as well as any settlement amounts due from or to clients, and remits them to the relevant CCP or client in whole or part. There are two types of margin: variation margin is posted on a daily basis based on the value of clients' derivative contracts and initial margin is posted at inception of a derivative contract, generally on the basis of the potential changes in the variation margin requirement for the contract.

As a clearing member, the Firm is exposed to the risk of nonperformance by its clients, but is not liable to clients for the performance of the CCPs. Where possible, the Firm seeks to mitigate its risk to the client through the collection of appropriate amounts of margin at inception and throughout the life of the transactions. The Firm can also cease providing clearing services if clients do not adhere to

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their obligations under the clearing agreement. In the event of nonperformance by a client, the Firm would close out the client's positions and access available margin. The CCP would utilize any margin it holds to make itself whole, with any remaining shortfalls required to be paid by the Firm as a clearing member.

The Firm reflects its exposure to nonperformance risk of the client through the recognition of margin receivables from clients and margin payables to CCPs; the clients' underlying securities or derivative contracts are not reflected in the Firm's Consolidated Financial Statements.

It is difficult to estimate the Firm's maximum possible exposure through its role as a clearing member, as this would require an assessment of transactions that clients may execute in the future. However, based upon historical experience, and the credit risk mitigants available to the Firm, management believes it is unlikely that the Firm will have to make any material payments under these arrangements and the risk of loss is expected to be remote.

For information on the derivatives that the Firm executes for its own account and records in its Consolidated Financial Statements, refer to Note 5.

Exchange & Clearing House Memberships

The Firm is a member of several securities and derivative exchanges and clearing houses, both in the U.S. and other countries, and it provides clearing services to its clients. Membership in some of these organizations requires the Firm to pay a pro rata share of the losses incurred by the organization as a result of the default of another member. Such obligations vary with different organizations. These obligations may be limited to the amount (or a multiple of the amount) of the Firm's contribution to the guarantee fund maintained by a clearing house or exchange as part of the resources available to cover any losses in the event of a member default. Alternatively, these obligations may also include a pro rata share of the residual losses after applying the guarantee fund. Additionally, certain clearing houses require the Firm as a member to pay a pro rata share of losses that may result from the clearing house's investment of guarantee fund contributions and initial margin, unrelated to and independent of the default of another member. Generally a payment would only be required should such losses exceed the resources of the clearing house or exchange that are contractually required to absorb the losses in the first instance. In certain cases, it is difficult to estimate the Firm's maximum possible exposure under these membership agreements, since this would require an assessment of future claims that may be made against the Firm that have not yet occurred. However, based on historical experience, management expects the risk of loss to the Firm to be remote. Where the Firm's maximum possible exposure can be estimated, the amount is disclosed in the table on page 272, in the Exchange & clearing house guarantees and commitments line.

Sponsored Member Repo Program

In 2018 the Firm commenced the sponsored member repo program, wherein the Firm acts as a sponsoring member to clear eligible overnight resale and repurchase agreements through the Government Securities Division of the Fixed Income Clearing Corporation ("FICC") on behalf of clients that become sponsored members under the FICC's rules. The Firm also guarantees to the FICC the prompt and full payment and performance of its sponsored member clients' respective obligations under the FICC's rules. The Firm minimizes its liability under these overnight guarantees by obtaining a security interest in the cash or high quality securities collateral that the clients place with the clearing house therefore the Firm expects the risk of loss to be remote. The Firm's maximum possible exposure, without taking into consideration the associated collateral, is included in the Exchange & clearing house guarantees and commitments line on page 272. For additional information on credit risk mitigation practices on resale agreements and the types of collateral pledged under repurchase agreements, refer to Note 11.

Guarantees of subsidiaries

In the normal course of business, the Parent Company may provide counterparties with guarantees of certain of the trading and other obligations of its subsidiaries on a contract-by-contract basis, as negotiated with the Firm's counterparties. The obligations of the subsidiaries are included on the Firm's Consolidated balance sheets or are reflected as off-balance sheet commitments; therefore, the Parent Company has not recognized a separate liability for these guarantees. The Firm believes that the occurrence of any event that would trigger payments by the Parent Company under these guarantees is remote.

The Parent Company has guaranteed certain long-term debt and structured notes of its subsidiaries, including JPMorgan Chase Financial Company LLC ("JPMFC"), a 100%-owned finance subsidiary. All securities issued by JPMFC are fully and unconditionally guaranteed by the Parent Company. These guarantees, which rank on a parity with the Firm's unsecured and unsubordinated indebtedness, are not included in the table on page 272 of this Note. For additional information, refer to Note 19.

Note 28 – Commitments, pledged assets and collateral

Lease commitments

At December 31, 2018, JPMorgan Chase and its subsidiaries were obligated under a number of noncancelable operating leases for premises and equipment used primarily for banking purposes. Certain leases contain renewal options or escalation clauses providing for increased rental payments based on maintenance, utility and tax increases, or they require the Firm to perform restoration work on leased premises. No lease agreement imposes restrictions on the Firm's ability to pay dividends, engage in debt or equity financing transactions or enter into further lease agreements.

The following table presents required future minimum rental payments under operating leases with noncancelable lease terms that expire after December 31, 2018.

Year ended December 31, (in millions)	
2019	1,561
2020	1,520
2021	1,320
2022	1,138
2023	973
After 2023	4,480
Total minimum payments required	10,992
Less: Sublease rentals under noncancelable subleases	(825)
Net minimum payments required	\$ 10,167

Total rental expense was as follows.

Year ended December 31, (in millions)	2018	2017	2016
Gross rental expense	\$ 1,881	\$ 1,853	\$ 1,860
Sublease rental income	(239)	(251)	(241)
Net rental expense	\$ 1,642	\$ 1,602	\$ 1,619

Pledged assets

The Firm may pledge financial assets that it owns to maintain potential borrowing capacity at discount windows with Federal Reserve banks, various other central banks and FHLBs. Additionally, pledged assets are used for other purposes, including to collateralize repurchase and other securities financing agreements, to cover short sales and to collateralize derivative contracts and deposits. Certain of these pledged assets may be sold or repledged or otherwise used by the secured parties and are parenthetically identified on the Consolidated balance sheets as assets pledged.

The following table presents the Firm's pledged assets.

December 31, (in billions)	2018	2017
Assets that may be sold or repledged or otherwise used by secured parties	\$ 104.0	\$ 135.8
Assets that may not be sold or repledged or otherwise used by secured parties	83.7	68.1
Assets pledged at Federal Reserve banks and FHLBs	475.3	493.7
Total assets pledged	\$ 663.0	\$ 697.6

Total assets pledged do not include assets of consolidated VIEs; these assets are used to settle the liabilities of those entities. Refer to Note 14 for additional information on assets and liabilities of consolidated VIEs. For additional information on the Firm's securities financing activities, refer to Note 11. For additional information on the Firm's long-term debt, refer to Note 19. The significant components of the Firm's pledged assets were as follows.

December 31, (in billions)	2018	2017
Investment securities	\$ 59.5	\$ 86.2
Loans	440.1	437.7
Trading assets and other	163.4	173.7
Total assets pledged	\$ 663.0	\$ 697.6

Collateral

The Firm accepts financial assets as collateral that it is permitted to sell or repledge, deliver or otherwise use. This collateral is generally obtained under resale and other securities financing agreements, customer margin loans and derivative contracts. Collateral is generally used under repurchase and other securities financing agreements, to cover short sales and to collateralize derivative contracts and deposits.

The following table presents the fair value of collateral accepted.

December 31, (in billions)	2018	2017
Collateral permitted to be sold or repledged, delivered, or otherwise used	\$ 1,245.3	\$ 968.8
Collateral sold, repledged, delivered or otherwise used	998.3	771.0

Certain prior period amounts for both collateral and pledged assets (including the corresponding pledged assets parenthetical disclosure for trading assets and other assets on the Consolidated balance sheets) have been revised to conform with the current period presentation.

Note 29 – Litigation

Contingencies

As of December 31, 2018, the Firm and its subsidiaries and affiliates are defendants or putative defendants in numerous legal proceedings, including private, civil litigations and regulatory/government investigations. The litigations range from individual actions involving a single plaintiff to class action lawsuits with potentially millions of class members. Investigations involve both formal and informal proceedings, by both governmental agencies and self-regulatory organizations. These legal proceedings are at varying stages of adjudication, arbitration or investigation, and involve each of the Firm's lines of business and geographies and a wide variety of claims (including common law tort and contract claims and statutory antitrust, securities and consumer protection claims), some of which present novel legal theories.

The Firm believes the estimate of the aggregate range of reasonably possible losses, in excess of reserves established, for its legal proceedings is from \$0 to approximately \$1.5 billion at December 31, 2018. This estimated aggregate range of reasonably possible losses was based upon currently available information for those proceedings in which the Firm believes that an estimate of reasonably possible loss can be made. For certain matters, the Firm does not believe that such an estimate can be made, as of that date. The Firm's estimate of the aggregate range of reasonably possible losses involves significant judgment, given:

- the number, variety and varying stages of the proceedings, including the fact that many are in preliminary stages,
- the existence in many such proceedings of multiple defendants, including the Firm, whose share of liability (if any) has yet to be determined,
- the numerous yet-unresolved issues in many of the proceedings, including issues regarding class certification and the scope of many of the claims, and
- the attendant uncertainty of the various potential outcomes of such proceedings, including where the Firm has made assumptions concerning future rulings by the court or other adjudicator, or about the behavior or incentives of adverse parties or regulatory authorities, and those assumptions prove to be incorrect.

In addition, the outcome of a particular proceeding may be a result which the Firm did not take into account in its estimate because the Firm had deemed the likelihood of that outcome to be remote. Accordingly, the Firm's estimate of the aggregate range of reasonably possible losses will change from time to time, and actual losses may vary significantly.

Set forth below are descriptions of the Firm's material legal proceedings.

American Depositary Receipts Pre-Release Inquiry. In December 2018, JPMorgan Chase Bank, N.A. reached a settlement with the U.S. Securities and Exchange Commission regarding its inquiry into activity relating to pre-released American Depositary Receipts.

Foreign Exchange Investigations and Litigation. The Firm previously reported settlements with certain government authorities relating to its foreign exchange ("FX") sales and trading activities and controls related to those activities. FX-related investigations and inquiries by government authorities, including competition authorities, are ongoing, and the Firm is cooperating with and working to resolve those matters. In May 2015, the Firm pleaded guilty to a single violation of federal antitrust law. In January 2017, the Firm was sentenced, with judgment entered thereafter and a term of probation ending in January 2020. The Department of Labor has granted the Firm a five-year exemption of disqualification that allows the Firm and its affiliates to continue to rely on the Qualified Professional Asset Manager exemption under the Employee Retirement Income Security Act ("ERISA") until January 2023. The Firm will need to reapply in due course for a further exemption to cover the remainder of the ten-year disqualification period. Separately, in February 2017 the South Africa Competition Commission referred its FX investigation of the Firm and other banks to the South Africa Competition Tribunal, which is conducting civil proceedings concerning that matter.

The Firm is also one of a number of foreign exchange dealers named as defendants in a class action filed in the United States District Court for the Southern District of New York by U.S.-based plaintiffs, principally alleging violations of federal antitrust laws based on an alleged conspiracy to manipulate foreign exchange rates (the "U.S. class action"). In January 2015, the Firm entered into a settlement agreement in the U.S. class action. Following this settlement, a number of additional putative class actions were filed seeking damages for persons who transacted FX futures and options on futures (the "exchanged-based actions"), consumers who purchased foreign currencies at allegedly inflated rates (the "consumer action"), participants or beneficiaries of qualified ERISA plans (the "ERISA actions"), and purported indirect purchasers of FX instruments (the "indirect purchaser action"). Since then, the Firm has entered into a revised settlement agreement to resolve the consolidated U.S. class action, including the exchange-based actions. The Court granted final approval of that settlement agreement in August 2018. Certain members of the settlement class filed requests to the Court to be excluded from the class, and certain of them filed a complaint against the Firm and a number of other foreign exchange dealers in November 2018 (the "opt-out action").

The District Court has dismissed one of the ERISA actions, and the United States Court of Appeals for the Second Circuit affirmed that dismissal in July 2018. The second ERISA action was voluntarily dismissed with prejudice in November 2018. The indirect purchaser action, the consumer action and the opt-out action remain pending in the District Court.

General Motors Litigation. JPMorgan Chase Bank, N.A. participated in, and was the Administrative Agent on behalf of a syndicate of lenders on, a \$1.5 billion syndicated Term Loan facility (“Term Loan”) for General Motors Corporation (“GM”). In July 2009, in connection with the GM bankruptcy proceedings, the Official Committee of Unsecured Creditors of Motors Liquidation Company (“Creditors Committee”) filed a lawsuit against JPMorgan Chase Bank, N.A., in its individual capacity and as Administrative Agent for other lenders on the Term Loan, seeking to hold the underlying lien invalid based on the filing of a UCC-3 termination statement relating to the Term Loan. In January 2015, following several court proceedings, the United States Court of Appeals for the Second Circuit reversed the Bankruptcy Court’s dismissal of the Creditors Committee’s claim and remanded the case to the Bankruptcy Court with instructions to enter partial summary judgment for the Creditors Committee as to the termination statement. The proceedings in the Bankruptcy Court thereafter continued with respect to, among other things, additional defenses asserted by JPMorgan Chase Bank, N.A. and the value of additional collateral on the Term Loan that was unaffected by the filing of the termination statement at issue. In addition, certain Term Loan lenders filed cross-claims in the Bankruptcy Court against JPMorgan Chase Bank, N.A. seeking indemnification and asserting various claims. In January 2019, the parties reached an agreement in principle to fully resolve the litigation, including the cross-claims filed against the Firm. The agreement is subject to definitive documentation and court approval, and is not expected to have any material impact on the Firm. The Bankruptcy Court has stayed all deadlines in the action to allow the parties to finalize the settlement agreement for submission to the Bankruptcy Court.

Interchange Litigation. A group of merchants and retail associations filed a series of class action complaints alleging that Visa and Mastercard, as well as certain banks, conspired to set the price of credit and debit card interchange fees and enacted respective rules in violation of antitrust laws. The parties settled the cases for a cash payment, a temporary reduction of credit card interchange, and modifications to certain credit card network rules. In December 2013, the District Court granted final approval of the settlement.

A number of merchants appealed the settlement to the United States Court of Appeals for the Second Circuit, which, in June 2016, vacated the District Court’s certification of the class action and reversed the approval of the class settlement. In March 2017, the U.S. Supreme Court declined petitions seeking review of the decision of

the Court of Appeals. The case was remanded to the District Court for further proceedings consistent with the appellate decision. The original class action was divided into two separate actions, one seeking primarily monetary relief and the other seeking primarily injunctive relief. In September 2018, the parties to the class action seeking monetary relief finalized an agreement which amends and supersedes the prior settlement agreement, and the plaintiffs filed a motion seeking preliminary approval of the modified settlement. This settlement provides for the defendants to contribute an additional \$900 million to the approximately \$5.3 billion currently held in escrow from the original settlement. In January 2019, the amended agreement was preliminarily approved by the District Court, and formal notice of the class settlement will proceed in accordance with the District Court’s order. \$600 million of the additional amount will be funded from the litigation escrow account established under the Visa defendants’ Retrospective Responsibility Plan, and \$300 million will be paid by Mastercard and certain banks in accordance with an agreement among themselves regarding their respective shares. In June 2018, Visa deposited an additional \$600 million into its litigation escrow account, which in turn led to a corresponding change in the conversion rate of Visa Class B to Class A shares. Of the Mastercard-related portion, the Firm’s share is approximately \$36 million. The class action seeking primarily injunctive relief continues separately.

In addition, certain merchants have filed individual actions raising similar allegations against Visa and Mastercard, as well as against the Firm and other banks, and those actions are proceeding.

LIBOR and Other Benchmark Rate Investigations and Litigation. JPMorgan Chase has received subpoenas and requests for documents and, in some cases, interviews, from federal and state agencies and entities, including the U.S. Commodity Futures Trading Commission and various state attorneys general, as well as the European Commission (“EC”), the Swiss Competition Commission (“ComCo”) and other regulatory authorities and banking associations around the world relating primarily to the process by which interest rates were submitted to the British Bankers Association (“BBA”) in connection with the setting of the BBA’s London Interbank Offered Rate (“LIBOR”) for various currencies, principally in 2007 and 2008. Some of the inquiries also relate to similar processes by which information on rates was submitted to the European Banking Federation (“EBF”) in connection with the setting of the EBF’s Euro Interbank Offered Rate (“EURIBOR”). The Firm continues to cooperate with these investigations to the extent that they are ongoing. ComCo’s investigation relating to EURIBOR, to which the Firm and other banks are subject, continues. In December 2016, the EC issued a decision against the Firm and other banks finding an infringement of European antitrust rules relating to EURIBOR. The Firm has filed an appeal of that decision

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with the European General Court, and that appeal is pending.

In addition, the Firm has been named as a defendant along with other banks in a series of individual and putative class actions related to benchmarks filed in various United States District Courts, including two putative class actions relating to U.S. dollar LIBOR during the period that it was administered by ICE Benchmark Administration. These actions have been filed, or consolidated for pre-trial purposes, in the United States District Court for the Southern District of New York. In these actions, plaintiffs make varying allegations that in various periods, starting in 2000 or later, defendants either individually or collectively manipulated various benchmark rates by submitting rates that were artificially low or high. Plaintiffs allege that they transacted in loans, derivatives or other financial instruments whose values are affected by changes in these rates and assert a variety of claims including antitrust claims seeking treble damages. These matters are in various stages of litigation.

The Firm has agreed to settle putative class actions related to exchange-traded Eurodollar futures contracts, Swiss franc LIBOR, EURIBOR, the Singapore Interbank Offered Rate, the Singapore Swap Offer Rate and the Australian Bank Bill Swap Reference Rate. Those settlements are all subject to further documentation and court approval.

In actions related to U.S. dollar LIBOR during the period that it was administered by the BBA, the District Court dismissed certain claims, including antitrust claims brought by some plaintiffs whom the District Court found did not have standing to assert such claims, and permitted antitrust claims, claims under the Commodity Exchange Act and common law claims to proceed. The plaintiffs whose antitrust claims were dismissed for lack of standing have filed an appeal. In February 2018, as to those actions which the Firm has not agreed to settle, the District Court (i) granted class certification with respect to certain antitrust claims related to bonds and interest rate swaps sold directly by the defendants, (ii) denied class certification with respect to state common law claims brought by the holders of those bonds and swaps and (iii) denied class certification with respect to the putative class action related to LIBOR-based loans held by plaintiff lending institutions.

Municipal Derivatives Litigation. Several civil actions were commenced against the Firm relating to certain Jefferson County, Alabama (the “County”) warrant underwritings and swap transactions. The actions generally alleged that the Firm made payments to certain third parties in exchange for being chosen to underwrite more than \$3.0 billion in warrants issued by the County and to act as the counterparty for certain swaps executed by the County. The County subsequently filed for bankruptcy and in November 2013, the Bankruptcy Court confirmed a Plan of Adjustment pursuant to which the above-described actions against the Firm were released and dismissed with prejudice. Certain sewer rate payers filed an appeal challenging the

confirmation of the Plan of Adjustment, and that appeal was dismissed by the United States Court of Appeals for the Eleventh Circuit. The appellants have filed a petition seeking review by the Supreme Court of the United States.

Precious Metals Investigations and Litigation. Various authorities, including the Department of Justice’s Criminal Division, are conducting investigations relating to trading practices in the precious metals markets and related conduct. The Firm is responding to and cooperating with these investigations. Several putative class action complaints have been filed in the United States District Court for the Southern District of New York against the Firm and certain current and former employees, alleging a precious metals futures and options price manipulation scheme in violation of the Commodity Exchange Act. The Firm is also a defendant in a consolidated action filed in the United States District Court for the Southern District of New York alleging monopolization of silver futures in violation of the Sherman Act.

Wendel. Since 2012, the French criminal authorities have been investigating a series of transactions entered into by senior managers of Wendel Investissement (“Wendel”) during the period from 2004 through 2007 to restructure their shareholdings in Wendel. JPMorgan Chase Bank, N.A., Paris branch provided financing for the transactions to a number of managers of Wendel in 2007. JPMorgan Chase has cooperated with the investigation. The investigating judges issued an *ordonnance de renvoi* in November 2016, referring JPMorgan Chase Bank, N.A. to the French *tribunal correctionnel* for alleged complicity in tax fraud. No date for trial has been set by the court. The Firm has been successful in legal challenges made to the Court of Cassation, France’s highest court, with respect to the criminal proceedings. In January 2018, the Paris Court of Appeal issued a decision cancelling the *mise en examen* of JPMorgan Chase Bank, N.A. The Court of Cassation ruled in September 2018 that a *mise en examen* is a prerequisite for an *ordonnance de renvoi* and remanded the case to the Court of Appeal to consider JPMorgan Chase Bank, N.A.’s application for the annulment of the *ordonnance de renvoi* referring JPMorgan Chase Bank, N.A. to the French *tribunal correctionnel*. Any further actions in the criminal proceedings are stayed pending the outcome of that application. In addition, a number of the managers have commenced civil proceedings against JPMorgan Chase Bank, N.A. The claims are separate, involve different allegations and are at various stages of proceedings.

* * *

In addition to the various legal proceedings discussed above, JPMorgan Chase and its subsidiaries are named as defendants or are otherwise involved in a substantial number of other legal proceedings. The Firm believes it has meritorious defenses to the claims asserted against it in its currently outstanding legal proceedings and it intends to defend itself vigorously. Additional legal proceedings may be initiated from time to time in the future.

The Firm has established reserves for several hundred of its currently outstanding legal proceedings. In accordance with the provisions of U.S. GAAP for contingencies, the Firm accrues for a litigation-related liability when it is probable that such a liability has been incurred and the amount of the loss can be reasonably estimated. The Firm evaluates its outstanding legal proceedings each quarter to assess its litigation reserves, and makes adjustments in such reserves, upwards or downward, as appropriate, based on management's best judgment after consultation with counsel. During the year ended December 31, 2018, the Firm's legal expense was \$72 million, and for the years ended December 31, 2017 and 2016, it was a benefit of \$(35) million and \$(317) million, respectively. There is no assurance that the Firm's litigation reserves will not need to be adjusted in the future.

In view of the inherent difficulty of predicting the outcome of legal proceedings, particularly where the claimants seek very large or indeterminate damages, or where the matters present novel legal theories, involve a large number of parties or are in early stages of discovery, the Firm cannot state with confidence what will be the eventual outcomes of the currently pending matters, the timing of their ultimate resolution or the eventual losses, fines, penalties or consequences related to those matters. JPMorgan Chase believes, based upon its current knowledge and after consultation with counsel, consideration of the material legal proceedings described above and after taking into account its current litigation reserves and its estimated aggregate range of possible losses, that the other legal proceedings currently pending against it should not have a material adverse effect on the Firm's consolidated financial condition. The Firm notes, however, that in light of the uncertainties involved in such proceedings, there is no assurance that the ultimate resolution of these matters will not significantly exceed the reserves it has currently accrued or that a matter will not have material reputational consequences. As a result, the outcome of a particular matter may be material to JPMorgan Chase's operating results for a particular period, depending on, among other factors, the size of the loss or liability imposed and the level of JPMorgan Chase's income for that period.

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Note 30 – International operations

The following table presents income statement and balance sheet-related information for JPMorgan Chase by major international geographic area. The Firm defines international activities for purposes of this footnote presentation as business transactions that involve clients residing outside of the U.S., and the information presented below is based predominantly on the domicile of the client, the location from which the client relationship is managed, or the location of the trading desk. However, many of the Firm's U.S. operations serve international businesses.

As the Firm's operations are highly integrated, estimates and subjective assumptions have been made to apportion revenue and expense between U.S. and international operations. These estimates and assumptions are consistent with the allocations used for the Firm's segment reporting as set forth in Note 31.

The Firm's long-lived assets for the periods presented are not considered by management to be significant in relation to total assets. The majority of the Firm's long-lived assets are located in the U.S.

As of or for the year ended December 31, (in millions)	Revenue ^{(b)(c)}	Expense ^{(c)(d)}	Income before income tax expense	Net income	Total assets
2018					
Europe/Middle East/Africa	\$ 16,181	\$ 9,953	\$ 6,228	\$ 4,444	\$ 423,835 ^(e)
Asia/Pacific	7,119	4,866	2,253	1,593	171,242
Latin America/Caribbean	2,435	1,413	1,022	718	46,560
Total international	25,735	16,232	9,503	6,755	641,637
North America ^(a)	83,294	52,033	31,261	25,719	1,980,895
Total	\$ 109,029	\$ 68,265	\$ 40,764	\$ 32,474	\$ 2,622,532
2017					
Europe/Middle East/Africa	\$ 15,120	\$ 9,347	\$ 5,773	\$ 4,007	\$ 407,145 ^(e)
Asia/Pacific	6,028	4,500	1,528	852	163,718
Latin America/Caribbean	1,994	1,523	471	299	44,569
Total international	23,142	15,370	7,772	5,158	615,432
North America ^(a)	77,563	49,435	28,128	19,283	1,918,168
Total	\$ 100,705	\$ 64,805	\$ 35,900	\$ 24,441	\$ 2,533,600
2016					
Europe/Middle East/Africa	\$ 14,418	\$ 9,126	\$ 5,292	\$ 3,783	\$ 394,134 ^(e)
Asia/Pacific	6,313	4,414	1,899	1,212	156,946
Latin America/Caribbean	1,959	1,632	327	208	42,971
Total international	22,690	15,172	7,518	5,203	594,051
North America ^(a)	73,879	46,861	27,018	19,530	1,896,921
Total	\$ 96,569	\$ 62,033	\$ 34,536	\$ 24,733	\$ 2,490,972

(a) Substantially reflects the U.S.

(b) Revenue is composed of net interest income and noninterest revenue.

(c) Effective January 1, 2018, the Firm adopted the revenue recognition guidance. The revenue recognition guidance was applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

(d) Expense is composed of noninterest expense and the provision for credit losses.

(e) Total assets for the U.K. were approximately \$296 billion, \$309 billion, and \$310 billion at December 31, 2018, 2017 and 2016, respectively.

Note 31 – Business segments

The Firm is managed on a line of business basis. There are four major reportable business segments – Consumer & Community Banking, Corporate & Investment Bank, Commercial Banking and Asset & Wealth Management. In addition, there is a Corporate segment. The business segments are determined based on the products and services provided, or the type of customer served, and they reflect the manner in which financial information is currently evaluated by the Firm's Operating Committee. Segment results are presented on a managed basis. For a further discussion concerning JPMorgan Chase's business segments, refer to Segment results of this footnote.

The following is a description of each of the Firm's business segments, and the products and services they provide to their respective client bases.

Consumer & Community Banking

CCB offers services to consumers and businesses through bank branches, ATMs, digital (including online and mobile) and telephone banking. CCB is organized into Consumer & Business Banking (including Consumer Banking/Chase Wealth Management and Business Banking), Home Lending (including Home Lending Production, Home Lending Servicing and Real Estate Portfolios) and Card, Merchant Services & Auto. Consumer & Business Banking offers deposit and investment products and services to consumers, and lending, deposit, and cash management and payment solutions to small businesses. Home Lending includes mortgage origination and servicing activities, as well as portfolios consisting of residential mortgages and home equity loans. Card, Merchant Services & Auto issues credit cards to consumers and small businesses, offers payment processing services to merchants, and originates and services auto loans and leases.

Corporate & Investment Bank

The CIB, which consists of Banking and Markets & Investor Services, offers a broad suite of investment banking, market-making, prime brokerage, and treasury and securities products and services to a global client base of corporations, investors, financial institutions, government and municipal entities. Banking offers a full range of investment banking products and services in all major capital markets, including advising on corporate strategy and structure, capital-raising in equity and debt markets, as well as loan origination and syndication. Banking also includes Treasury Services, which provides transaction services, consisting of cash management and liquidity solutions. Markets & Investor Services is a global market-

maker in cash securities and derivative instruments, and also offers sophisticated risk management solutions, prime brokerage, and research. Markets & Investor Services also includes Securities Services, a leading global custodian which provides custody, fund accounting and administration, and securities lending products principally for asset managers, insurance companies and public and private investment funds.

Commercial Banking

CB delivers extensive industry knowledge, local expertise and dedicated service to U.S. and U.S. multinational clients, including corporations, municipalities, financial institutions and nonprofit entities with annual revenue generally ranging from \$20 million to \$2 billion. In addition, CB provides financing to real estate investors and owners. Partnering with the Firm's other businesses, CB provides comprehensive financial solutions, including lending, treasury services, investment banking and asset management to meet its clients' domestic and international financial needs.

Asset & Wealth Management

AWM, with client assets of \$2.7 trillion, is a global leader in investment and wealth management. AWM clients include institutions, high-net-worth individuals and retail investors in many major markets throughout the world. AWM offers investment management across most major asset classes including equities, fixed income, alternatives and money market funds. AWM also offers multi-asset investment management, providing solutions for a broad range of clients' investment needs. For Wealth Management clients, AWM also provides retirement products and services, brokerage and banking services including trusts and estates, loans, mortgages and deposits. The majority of AWM's client assets are in actively managed portfolios.

Corporate

The Corporate segment consists of Treasury and Chief Investment Office and Other Corporate, which includes corporate staff functions and expense that is centrally managed. Treasury and CIO is predominantly responsible for measuring, monitoring, reporting and managing the Firm's liquidity, funding, capital, structural interest rate and foreign exchange risks. The major Other Corporate functions include Real Estate, Technology, Legal, Corporate Finance, Human Resources, Internal Audit, Risk Management, Compliance, Control Management, Corporate Responsibility and various Other Corporate groups.

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Segment results

The following table provides a summary of the Firm's segment results as of or for the years ended December 31, 2018, 2017 and 2016, on a managed basis. The Firm's definition of managed basis starts with the reported U.S. GAAP results and includes certain reclassifications to present total net revenue for the Firm (and each of the reportable business segments) on an FTE basis. Accordingly, revenue from investments that receive tax credits and tax-exempt securities is presented in the managed results on a basis comparable to taxable investments and securities. This allows management to assess the comparability of revenue from year-to-year arising from both taxable and tax-exempt sources. The corresponding income tax impact related to tax-exempt items is recorded within income tax expense/(benefit). These adjustments have no impact on net income as reported by the Firm as a whole or by the lines of business.

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

Net income in 2018 for each of the business segments reflects the favorable impact of the reduction in the U.S. federal statutory income tax rate as a result of the TCJA.

Segment results and reconciliation

(Table continued on next page)

As of or for the year ended December 31, (in millions, except ratios)	Consumer & Community Banking			Corporate & Investment Bank			Commercial Banking			Asset & Wealth Management		
	2018	2017	2016	2018	2017	2016	2018	2017	2016	2018	2017	2016
Noninterest revenue	\$ 16,260	\$ 14,710	\$ 15,255	\$ 26,968	\$ 24,539	\$ 24,449	\$ 2,343	\$ 2,522	\$ 2,320	\$ 10,539	\$ 10,456	\$ 9,789
Net interest income	35,819	31,775	29,660	9,480	10,118	10,891	6,716	6,083	5,133	3,537	3,379	3,033
Total net revenue	52,079	46,485	44,915	36,448	34,657	35,340	9,059	8,605	7,453	14,076	13,835	12,822
Provision for credit losses	4,753	5,572	4,494	(60)	(45)	563	129	(276)	282	53	39	26
Noninterest expense	27,835	26,062	24,905	20,918	19,407	19,116	3,386	3,327	2,934	10,353	10,218	9,255
Income/(loss) before income tax expense/(benefit)	19,491	14,851	15,516	15,590	15,295	15,661	5,544	5,554	4,237	3,670	3,578	3,541
Income tax expense/(benefit)	4,639	5,456	5,802	3,817	4,482	4,846	1,307	2,015	1,580	817	1,241	1,290
Net income/(loss)	\$ 14,852	\$ 9,395	\$ 9,714	\$ 11,773	\$ 10,813	\$ 10,815	\$ 4,237	\$ 3,539	\$ 2,657	\$ 2,853	\$ 2,337	\$ 2,251
Average equity	\$ 51,000	\$ 51,000	\$ 51,000	\$ 70,000	\$ 70,000	\$ 64,000	\$ 20,000	\$ 20,000	\$ 16,000	\$ 9,000	\$ 9,000	\$ 9,000
Total assets	557,441	552,601	535,310	903,051	826,384	803,511	220,229	221,228	214,341	170,024	151,909	138,384
Return on equity	28%	17%	18%	16%	14%	16%	20%	17%	16%	31%	25%	24%
Overhead ratio	53	56	55	57	56	54	37	39	39	74	74	72

(Table continued from previous page)

As of or for the year ended December 31, (in millions, except ratios)	Corporate			Reconciling Items ^(a)			Total		
	2018	2017	2016	2018	2017	2016	2018	2017	2016
Noninterest revenue	\$ (263)	\$ 1,085	\$ 938	\$ (1,877)	\$ (2,704) ^(b)	\$ (2,265)	\$ 53,970	\$ 50,608	\$ 50,486
Net interest income	135	55	(1,425)	(628)	(1,313)	(1,209)	55,059	50,097	46,083
Total net revenue	(128)	1,140	(487)	(2,505)	(4,017)	(3,474)	109,029	100,705	96,569
Provision for credit losses	(4)	–	(4)	–	–	–	4,871	5,290	5,361
Noninterest expense	902	501	462	–	–	–	63,394	59,515	56,672
Income/(loss) before income tax expense/(benefit)	(1,026)	639	(945)	(2,505)	(4,017)	(3,474)	40,764	35,900	34,536
Income tax expense/(benefit)	215	2,282	(241)	(2,505)	(4,017) ^(b)	(3,474)	8,290	11,459	9,803
Net income/(loss)	\$ (1,241)	\$ (1,643)	\$ (704)	\$ –	\$ –	\$ –	\$ 32,474	\$ 24,441	\$ 24,733
Average equity	\$ 79,222	\$ 80,350	\$ 84,631	\$ –	\$ –	\$ –	\$ 229,222	\$ 230,350	\$ 224,631
Total assets	771,787	781,478	799,426	NA	NA	NA	2,622,532	2,533,600	2,490,972
Return on equity	NM	NM	NM	NM	NM	NM	13%	10%	10%
Overhead ratio	NM	NM	NM	NM	NM	NM	58	59	59

(a) Segment results on a managed basis reflect revenue on a FTE basis with the corresponding income tax impact recorded within income tax expense/(benefit). These adjustments are eliminated in reconciling items to arrive at the Firm's reported U.S. GAAP results.

(b) Included \$375 million related to tax-oriented investments as a result of the enactment of the TCJA.

Note 32 – Parent Company

The following tables present Parent Company-only financial statements. Effective January 1, 2018, the Parent Company adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

Statements of income and comprehensive income^(a)

Year ended December 31, (in millions)	2018	2017	2016
Income			
Dividends from subsidiaries and affiliates:			
Bank and bank holding company	\$ 32,501	\$ 13,000	\$ 10,000
Non-bank ^(b)	2	540	3,873
Interest income from subsidiaries	216	72	794
Other interest income	–	41	207
Other income from subsidiaries:			
Bank and bank holding company	515	1,553	852
Non-bank	(444)	(88)	1,165
Other income	888	(623)	(846)
Total income	33,678	14,495	16,045
Expense			
Interest expense to subsidiaries and affiliates ^(b)	2,291	400	105
Other interest expense	4,581	5,202	4,413
Noninterest expense	1,793	(1,897)	1,643
Total expense	8,665	3,705	6,161
Income before income tax benefit and undistributed net income of subsidiaries	25,013	10,790	9,884
Income tax benefit	1,838	1,007	876
Equity in undistributed net income of subsidiaries	5,623	12,644	13,973
Net income	\$ 32,474	\$ 24,441	\$ 24,733
Other comprehensive income, net	(1,476)	1,056	(1,521)
Comprehensive income	\$ 30,998	\$ 25,497	\$ 23,212

Balance sheets^(a)

December 31, (in millions)	2018	2017
Assets		
Cash and due from banks	\$ 55	\$ 163
Deposits with banking subsidiaries	5,315	5,338
Trading assets	3,304	4,773
Advances to, and receivables from, subsidiaries:		
Bank and bank holding company	3,334	2,106
Non-bank	74	82
Investments (at equity) in subsidiaries and affiliates:		
Bank and bank holding company	449,628	451,713
Non-bank ^(b)	1,077	422
Other assets	10,478	10,426
Total assets	\$ 473,265	\$ 475,023
Liabilities and stockholders' equity		
Borrowings from, and payables to, subsidiaries and affiliates ^(b)	\$ 20,017	\$ 23,426
Short-term borrowings	2,672	3,350
Other liabilities	8,821	8,302
Long-term debt ^{(c)(d)}	185,240	184,252
Total liabilities^(d)	216,750	219,330
Total stockholders' equity	256,515	255,693
Total liabilities and stockholders' equity	\$ 473,265	\$ 475,023

Statements of cash flows^(a)

Year ended December 31, (in millions)	2018	2017	2016
Operating activities			
Net income	\$ 32,474	\$ 24,441	\$ 24,733
Less: Net income of subsidiaries and affiliates ^(b)	38,125	26,185	27,846
Parent company net loss	(5,651)	(1,744)	(3,113)
Cash dividends from subsidiaries and affiliates ^(b)	32,501	13,540	13,873
Other operating adjustments	(4,400)	4,635	(18,166)
Net cash provided by/(used in) operating activities	22,450	16,431	(7,406)
Investing activities			
Net change in:			
Proceeds from paydowns and maturities from available-for-sale securities	–	–	353
Other changes in loans, net	–	78	1,793
Advances to and investments in subsidiaries and affiliates, net	8,036	(280)	(51,967)
All other investing activities, net	63	49	114
Net cash provided by/(used in) investing activities	8,099	(153)	(49,707)
Financing activities			
Net change in:			
Borrowings from subsidiaries and affiliates ^(b)	(2,273)	13,862	2,957
Short-term borrowings	(678)	(481)	109
Proceeds from long-term borrowings	25,845	25,855	41,498
Payments of long-term borrowings	(21,956)	(29,812)	(29,298)
Proceeds from issuance of preferred stock	1,696	1,258	–
Redemption of preferred stock	(1,696)	(1,258)	–
Treasury stock repurchased	(19,983)	(15,410)	(9,082)
Dividends paid	(10,109)	(8,993)	(8,476)
All other financing activities, net	(1,526)	(1,361)	(905)
Net cash used in financing activities	(30,680)	(16,340)	(3,197)
Net decrease in cash and due from banks and deposits with banking subsidiaries	(131)	(62)	(60,310)
Cash and due from banks and deposits with banking subsidiaries at the beginning of the year	5,501	5,563	65,873
Cash and due from banks and deposits with banking subsidiaries at the end of the year	\$ 5,370	\$ 5,501	\$ 5,563
Cash interest paid	\$ 6,911	\$ 5,426	\$ 4,550
Cash income taxes paid, net ^(e)	1,782	1,775	1,053

(a) In 2016, in connection with the Firm's 2016 Resolution Submission, the Parent Company established the IHC, and contributed substantially all of its direct subsidiaries (totaling \$55.4 billion) other than JPMorgan Chase Bank, N.A., as well as most of its other assets (totaling \$160.5 billion) and intercompany indebtedness to the IHC. Total noncash assets contributed were \$62.3 billion. In 2017, the Parent Company transferred \$16.2 billion of noncash assets to the IHC to complete the contributions to the IHC.

(b) Affiliates include trusts that issued guaranteed capital debt securities ("issuer trusts"). For further discussion on these issuer trusts, refer to Note 19.

(c) At December 31, 2018, long-term debt that contractually matures in 2019 through 2023 totaled 13.1 billion, \$22.1 billion, \$20.3 billion, \$12.8 billion, and \$16.2 billion, respectively.

(d) For information regarding the Parent Company's guarantees of its subsidiaries' obligations, refer to Notes 19 and 27.

(e) Represents payments, net of refunds, made by the Parent Company to various taxing authorities and includes taxes paid on behalf of certain of its subsidiaries that are subsequently reimbursed. The reimbursements were \$1.2 billion, \$4.1 billion, and \$3.0 billion for the years ended December 31, 2018, 2017, and 2016, respectively.

Selected quarterly financial data (unaudited)

As of or for the period ended (in millions, except per share, ratio, headcount data and where otherwise noted)	2018				2017			
	4th quarter	3rd quarter	2nd quarter	1st quarter	4th quarter	3rd quarter	2nd quarter	1st quarter
Selected income statement data								
Total net revenue	\$ 26,109	\$ 27,260	\$ 27,753	\$ 27,907	\$ 24,457	\$ 25,578	\$ 25,731	\$ 24,939
Total noninterest expense	15,720	15,623	15,971	16,080	14,895	14,570	14,767	15,283
Pre-provision profit	10,389	11,637	11,782	11,827	9,562	11,008	10,964	9,656
Provision for credit losses	1,548	948	1,210	1,165	1,308	1,452	1,215	1,315
Income before income tax expense	8,841	10,689	10,572	10,662	8,254	9,556	9,749	8,341
Income tax expense	1,775	2,309	2,256	1,950	4,022	2,824	2,720	1,893
Net income	\$ 7,066	\$ 8,380	\$ 8,316	\$ 8,712	\$ 4,232 ^(g)	\$ 6,732	\$ 7,029	\$ 6,448
Earnings per share data								
Net income: Basic	\$ 1.99	\$ 2.35	\$ 2.31	\$ 2.38	\$ 1.08	\$ 1.77	\$ 1.83	\$ 1.66
Diluted	1.98	2.34	2.29	2.37	1.07	1.76	1.82	1.65
Average shares: Basic	3,335.8	3,376.1	3,415.2	3,458.3	3,489.7	3,534.7	3,574.1	3,601.7
Diluted	3,347.3	3,394.3	3,434.7	3,479.5	3,512.2	3,559.6	3,599.0	3,630.4
Market and per common share data								
Market capitalization	\$ 319,780	\$ 375,239	\$ 350,204	\$ 374,423	\$ 366,301	\$ 331,393	\$ 321,633	\$ 312,078
Common shares at period-end	3,275.8	3,325.4	3,360.9	3,404.8	3,425.3	3,469.7	3,519.0	3,552.8
Book value per share	70.35	69.52	68.85	67.59	67.04	66.95	66.05	64.68
TBVPS ^(a)	56.33	55.68	55.14	54.05	53.56	54.03	53.29	52.04
Cash dividends declared per share	0.80	0.80	0.56	0.56	0.56	0.56	0.50	0.50
Selected ratios and metrics								
ROE ^(b)	12%	14%	14%	15%	7%	11%	12%	11%
ROTCE ^{(a)(b)}	14	17	17	19	8	13	14	13
ROA ^(b)	1.06	1.28	1.28	1.37	0.66	1.04	1.10	1.03
Overhead ratio	60	57	58	58	61	57	57	61
Loans-to-deposits ratio	67	65	65	63	64	63	63	63
LCR (average) ^(c)	113	115	115	115	119	120	115	N/A
CET1 capital ratio ^(d)	12.0	12.0	12.0	11.8	12.2	12.5	12.5	12.4
Tier 1 capital ratio ^(d)	13.7	13.6	13.6	13.5	13.9	14.1	14.2	14.1
Total capital ratio ^(d)	15.5	15.4	15.5	15.3	15.9	16.1	16.0	15.6
Tier 1 leverage ratio ^(d)	8.1	8.2	8.2	8.2	8.3	8.4	8.5	8.4
SLR ^(e)	6.4	6.5	6.5	6.5	6.5	6.6	6.7	6.6
Selected balance sheet data (period-end)								
Trading assets	\$ 413,714	\$ 419,827	\$ 418,799	\$ 412,282	\$ 381,844	\$ 420,418	\$ 407,064	\$ 402,513
Investment Securities	261,828	231,398	233,015	238,188	\$ 249,958	263,288	263,458	281,850
Loans	984,554	954,318	948,414	934,424	\$ 930,697	913,761	908,767	895,974
Core loans	931,856	899,006	889,433	870,536	863,683	843,432	834,935	812,119
Average core loans	907,271	894,279	877,640	861,089	850,166	837,522	824,583	805,382
Total assets	2,622,532	2,615,183	2,590,050	2,609,785	2,533,600	2,563,074	2,563,174	2,546,290
Deposits	1,470,666	1,458,762	1,452,122	1,486,961	1,443,982	1,439,027	1,439,473	1,422,999
Long-term debt	282,031	270,124	273,114	274,449	284,080	288,582	292,973	289,492
Common stockholders' equity	230,447	231,192	231,390	230,133	229,625	232,314	232,415	229,795
Total stockholders' equity	256,515	258,956	257,458	256,201	255,693	258,382	258,483	255,863
Headcount	256,105	255,313	252,942	253,707	252,539	251,503	249,257	246,345
Credit quality metrics								
Allowance for credit losses	\$ 14,500	\$ 14,225	\$ 14,367	\$ 14,482	\$ 14,672	\$ 14,648	\$ 14,480	\$ 14,490
Allowance for loan losses to total retained loans	1.39%	1.39%	1.41%	1.44%	1.47%	1.49%	1.49%	1.52%
Allowance for loan losses to retained loans excluding purchased credit-impaired loans ^(f)	1.23	1.23	1.22	1.25	1.27	1.29	1.28	1.31
Nonperforming assets	\$ 5,190	\$ 5,034	\$ 5,767	\$ 6,364	\$ 6,426	\$ 6,154	\$ 6,432	\$ 6,826
Net charge-offs	1,236	1,033	1,252	1,335	1,264	1,265	1,204	1,654 ^(h)
Net charge-off rate	0.52%	0.43%	0.54%	0.59%	0.55%	0.56%	0.54%	0.76% ^(h)

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

- (a) TBVPS and ROTCE are non-GAAP financial measures. For further discussion of these measures, refer to Explanation and Reconciliation of the Firm's Use of Non-GAAP Financial Measures and Key Performance Measures on pages 57-59.
- (b) Quarterly ratios are based upon annualized amounts.
- (c) The percentage represents the Firm's reported average LCR per the U.S. LCR public disclosure requirements, which became LCR effective April 1, 2017.
- (d) Ratios presented are calculated under the Basel III Transitional rules and for the capital ratios represent the lower of the Standardized or Advanced approach. As of December 31, 2018, and September 30, 2018, the Firm's capital ratios were equivalent whether calculated on a transitional or fully phased-in basis. Refer to Capital Risk Management on pages 85-94 for additional information on Basel III.
- (e) Effective January 1, 2018, the SLR was fully phased-in under Basel III. The SLR is defined as Tier 1 capital divided by the Firm's total leverage exposure. Ratios prior to March 31, 2018 were calculated under the Basel III Transitional rules.
- (f) Excludes the impact of residential real estate PCI loans, a non-GAAP financial measure. For further discussion of these measures, refer to Explanation and Reconciliation of the Firm's Use of Non-GAAP Financial Measures and Key Performance Measures on pages 57-59, and the Allowance for credit losses on pages 120-122.
- (g) The Firm's results for the three months ended December 31, 2017, included a \$2.4 billion decrease to net income as a result of the enactment of the TCJA. For additional information related to the impact of the TCJA, refer to Note 24.
- (h) Excluding net charge-offs of \$467 million related to the student loan portfolio sale, the net charge-off rates for the three months ended March 31, 2017 would have been 0.54%.

Distribution of assets, liabilities and stockholders' equity; interest rates and interest differentials

Consolidated average balance sheet, interest and rates

Provided below is a summary of JPMorgan Chase's consolidated average balances, interest rates and interest differentials on a taxable-equivalent basis for the years 2016 through 2018. Income computed on a taxable-equivalent basis is the income reported in the Consolidated statements of income, adjusted to present interest income

and average rates earned on assets exempt from income taxes (i.e. federal taxes) on a basis comparable with other taxable investments. The incremental tax rate used for calculating the taxable-equivalent adjustment was approximately 24%, 37% and 38% in 2018, 2017 and 2016, respectively.

(Table continued on next page)

(Unaudited) Year ended December 31, (Taxable-equivalent interest and rates; in millions, except rates)	2018		
	Average balance	Interest ^(g)	Average rate
Assets			
Deposits with banks	\$ 405,514	\$ 5,907	1.46%
Federal funds sold and securities purchased under resale agreements	217,150	3,819	1.76
Securities borrowed	115,082	728	0.63
Trading assets - debt instruments	261,051	8,763	3.36
Taxable securities	194,232	5,653	2.91
Non-taxable securities ^(a)	42,456	1,987	4.68
Total investment securities	236,688	7,640	3.23 ⁽ⁱ⁾
Loans	944,885	47,796 ^(h)	5.06
All other interest-earning assets ^(b)	48,818	3,417	7.00
Total interest-earning assets	2,229,188	78,070	3.50
Allowance for loan losses	(13,269)		
Cash and due from banks	21,694		
Trading assets - equity instruments	101,872		
Trading assets - derivative receivables	60,734		
Goodwill, MSRs and other intangible assets	54,669		
Other assets	154,010		
Total assets	\$ 2,608,898		
Liabilities			
Interest-bearing deposits	\$ 1,060,605	\$ 5,973	0.56%
Federal funds purchased and securities loaned or sold under repurchase agreements	189,282	3,066	1.62
Short-term borrowings ^(c)	63,523	1,144	1.80
Trading liabilities - debt and all other interest-bearing liabilities ^{(d)(e)}	178,161	3,729	2.09
Beneficial interests issued by consolidated VIEs	21,079	493	2.34
Long-term debt	276,414	7,978	2.89
Total interest-bearing liabilities	1,789,064	22,383	1.25
Noninterest-bearing deposits	395,856		
Trading liabilities - equity instruments ^(e)	34,295		
Trading liabilities - derivative payables	43,075		
All other liabilities, including the allowance for lending-related commitments	91,137		
Total liabilities	2,353,427		
Stockholders' equity			
Preferred stock	26,249		
Common stockholders' equity	229,222		
Total stockholders' equity	255,471 ^(f)		
Total liabilities and stockholders' equity	\$ 2,608,898		
Interest rate spread			2.25%
Net interest income and net yield on interest-earning assets		\$ 55,687	2.50

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

- Represents securities that are tax-exempt for U.S. federal income tax purposes.
- Includes held-for-investment margin loans, which are classified in accrued interest and accounts receivable, and all other interest-earning assets, which are classified in other assets on the Consolidated balance sheets.
- Includes commercial paper.
- Other interest-bearing liabilities include brokerage customer payables.
- The combined balance of trading liabilities - debt and equity instruments were \$107.0 billion, \$90.7 billion and \$92.8 billion for the years ended December 31, 2018, 2017 and 2016, respectively.
- The ratio of average stockholders' equity to average assets was 9.8% for 2018, 10.0% for 2017, and 10.2% for 2016. The return on average stockholders' equity, based on net income, was 12.7% for 2018, 9.5% for 2017, and 9.9% for 2016.
- Interest includes the effect of related hedging derivatives. Taxable-equivalent amounts are used where applicable.
- Fees and commissions on loans included in loan interest amounted to \$1.2 billion in 2018, \$1.0 billion in 2017, and \$808 million in 2016.
- The annualized rate for securities based on amortized cost was 3.25% in 2018, 3.13% in 2017, and 2.99% in 2016, and does not give effect to changes in fair value that are reflected in AOCI.
- Negative interest income and yield is related to client-driven demand for certain securities combined with the impact of low interest rates; this is matched book activity and the negative interest expense on the corresponding securities loaned is recognized in interest expense and reported within trading liabilities - debt and all other interest-bearing liabilities.

Within the Consolidated average balance sheets, interest and rates summary, the principal amounts of nonaccrual loans have been included in the average loan balances used to determine the average interest rate earned on loans. For additional information on nonaccrual loans, including interest accrued, refer to Note 12.

(Table continued from previous page)

2017			2016		
Average balance	Interest ^(b)	Average rate	Average balance	Interest ^(b)	Average rate
\$ 439,663	\$ 4,238	0.96%	\$ 393,599	\$ 1,879	0.48%
191,820	2,327	1.21	205,367	2,265	1.10
95,324	(37) ⁽ⁱ⁾	(0.04)	102,964	(332) ⁽ⁱ⁾	(0.32)
237,206	7,714	3.25	215,565	7,373	3.42
223,592	5,534	2.48	235,211	5,538	2.35
45,086	2,769	6.14	44,176	2,662	6.03
268,678	8,303	3.09 ⁽ⁱ⁾	279,387	8,200	2.94 ⁽ⁱ⁾
906,397	41,296 ^(h)	4.56	866,378	36,866 ^(h)	4.26
41,504	1,844	4.44	38,344	859	2.24
2,180,592	65,685	3.01	2,101,604	57,110	2.72
(13,453)			(13,965)		
20,432			18,705		
115,913			95,528		
59,588			70,897		
53,999			53,752		
138,991			135,098		
\$ 2,556,062			\$ 2,461,619		
\$ 1,013,221	\$ 2,857	0.28%	\$ 925,270	\$ 1,356	0.15%
187,386	1,611	0.86	178,720	1,089	0.61
46,532	481	1.03	36,140	203	0.56
171,814	2,070	1.21	177,765	1,102	0.62
32,457	503	1.55	40,180	504	1.25
291,489	6,753	2.32	295,573	5,564	1.88
1,742,899	14,275	0.82	1,653,648	9,818	0.59
404,165			402,698		
21,022			20,737		
44,122			55,927		
87,292			77,910		
2,299,500			2,210,920		
26,212			26,068		
230,350			224,631		
256,562 ⁽ⁱ⁾			250,699 ⁽ⁱ⁾		
\$ 2,556,062			\$ 2,461,619		
		2.19%			2.13%
	\$ 51,410	2.36		\$ 47,292	2.25

Interest rates and interest differential analysis of net interest income - U.S. and non-U.S.

Presented below is a summary of interest rates and interest differentials segregated between U.S. and non-U.S. operations for the years 2016 through 2018. The segregation of U.S. and non-U.S. components is based on

the location of the office recording the transaction. Intercompany funding generally consists of dollar-denominated deposits originated in various locations that are centrally managed by Treasury and CIO.

(Table continued on next page)

(Unaudited) Year ended December 31, (Taxable-equivalent interest and rates; in millions, except rates)	2018		
	Average balance	Interest	Average rate
Interest-earning assets			
Deposits with banks:			
U.S.	\$ 305,117	\$ 5,703	1.87%
Non-U.S.	100,397	204	0.20
Federal funds sold and securities purchased under resale agreements:			
U.S.	102,144	2,427	2.38
Non-U.S.	115,006	1,392	1.21
Securities borrowed:			
U.S.	77,027	640	0.83
Non-U.S.	38,055	88	0.23
Trading assets - debt instruments:			
U.S.	141,134	5,068	3.59
Non-U.S.	119,917	3,695	3.08
Investment securities:			
U.S.	200,883	6,943	3.46
Non-U.S.	35,805	697	1.95
Loans:			
U.S.	864,149	45,395	5.25
Non-U.S.	80,736	2,401	2.97
All other interest-earning assets, predominantly U.S.	48,818	3,417	7.00
Total interest-earning assets	2,229,188	78,070	3.50
Interest-bearing liabilities			
Interest-bearing deposits:			
U.S.	816,305	4,562	0.56
Non-U.S.	244,300	1,411	0.58
Federal funds purchased and securities loaned or sold under repurchase agreements:			
U.S.	117,754	2,562	2.18
Non-U.S.	71,528	504	0.70
Trading liabilities - debt, short-term and all other interest-bearing liabilities: ^(a)			
U.S.	150,694	3,389	2.25
Non-U.S.	90,990	1,484	1.63
Beneficial interests issued by consolidated VIEs, predominantly U.S.	21,079	493	2.34
Long-term debt:			
U.S.	256,220	7,954	3.10
Non-U.S.	20,194	24	0.12
Intercompany funding:			
U.S.	(51,933)	(746)	—
Non-U.S.	51,933	746	—
Total interest-bearing liabilities	1,789,064	22,383	1.25
Noninterest-bearing liabilities ^(b)	440,124		
Total investable funds	\$ 2,229,188	\$ 22,383	1.00%
Net interest income and net yield:		\$ 55,687	2.50%
U.S.		50,236	2.91
Non-U.S.		5,451	1.09
Percentage of total assets and liabilities attributable to non-U.S. operations:			
Assets			24.7
Liabilities			22.3

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

(a) Includes commercial paper.

(b) Represents the amount of noninterest-bearing liabilities funding interest-earning assets.

(c) Negative interest income and yield is related to client-driven demand for certain securities combined with the impact of low interest rates; this is matched book activity and the negative interest expense on the corresponding securities loaned is recognized in interest expense and reported within trading liabilities - debt, short-term and all other interest-bearing liabilities.

For further information, refer to the “Net interest income” discussion in Consolidated Results of Operations on pages 48-51.

(Table continued from previous page)

2017			2016		
Average balance	Interest	Average rate	Average balance	Interest	Average rate
\$ 366,814	\$ 4,093	1.12%	\$ 329,498	\$ 1,707	0.52%
72,849	145	0.20	64,101	172	0.27
90,879	1,360	1.50	112,901	1,166	1.03
100,941	967	0.96	92,466	1,099	1.19
68,110	(66) ^(c)	(0.10)	73,297	(341) ^(c)	(0.46)
27,214	29	0.11	29,667	9	0.03
128,293	4,186	3.26	116,211	3,825	3.29
108,913	3,528	3.24	99,354	3,548	3.57
223,140	7,490	3.36	216,726	6,971	3.22
45,538	813	1.79	62,661	1,229	1.97
832,608	39,439	4.74	788,213	35,110	4.45
73,789	1,857	2.52	78,165	1,756	2.25
41,504	1,844	4.44	38,344	859	2.24
2,180,592	65,685	3.01	2,101,604	57,110	2.72
776,049	2,223	0.29	703,738	1,029	0.15
237,172	634	0.27	221,532	327	0.15
115,574	1,349	1.17	121,945	773	0.63
71,812	262	0.37	56,775	316	0.56
138,470	1,271	0.92	133,788	86	0.06
79,876	1,280	1.60	80,117	1,219	1.52
32,457	503	1.55	40,180	504	1.25
276,750	6,745	2.44	283,169	5,533	1.95
14,739	8	0.05	12,404	31	0.25
(2,874)	(25)	—	(20,405)	10	—
2,874	25	—	20,405	(10)	—
1,742,899	14,275	0.82	1,653,648	9,818	0.59
437,693			447,956		
\$ 2,180,592	\$ 14,275	0.65%	\$ 2,101,604	\$ 9,818	0.47%
	\$ 51,410	2.36%		\$ 47,292	2.25%
	46,059	2.68		40,705	2.49
	5,351	1.15		6,587	1.42
		22.5			23.1
		21.1			20.7

Changes in net interest income, volume and rate analysis

The table below presents an attribution of net interest income between volume and rate. The attribution between volume and rate is calculated using annual average balances for each category of assets and liabilities shown in the table and the corresponding annual average rates (refer to pages 288-292 for more information on average balances and rates). In this analysis, when the change cannot be isolated to either volume or rate, it has been allocated to volume. The average annual rates include the impact of changes in market rates as well as the impact of any change in composition of the various products within each category of asset or liability. This analysis is calculated separately for each category without consideration of the relationship between categories (for example, the net spread between the rates earned on assets and the rates paid on liabilities that fund those assets). As a result, changes in the granularity or groupings considered in this analysis would produce a different attribution result, and due to the complexities involved, precise allocation of changes in interest rates between volume and rates is inherently complex and judgmental.

(Unaudited) Year ended December 31, (On a taxable-equivalent basis; in millions)	2018 versus 2017			2017 versus 2016		
	Increase/(decrease) due to change in:			Increase/(decrease) due to change in:		
	Volume	Rate	Net change	Volume	Rate	Net change
Interest-earning assets						
Deposits with banks:						
U.S.	\$ (1,141)	\$ 2,751	\$ 1,610	\$ 409	\$ 1,977	\$ 2,386
Non-U.S.	59	—	59	18	(45)	(27)
Federal funds sold and securities purchased under resale agreements:						
U.S.	267	800	1,067	(337)	531	194
Non-U.S.	173	252	425	81	(213)	(132)
Securities borrowed:						
U.S.	73	633	706	11	264	275
Non-U.S.	26	33	59	(4)	24	20
Trading assets - debt instruments:						
U.S.	459	423	882	396	(35)	361
Non-U.S.	341	(174)	167	308	(328)	(20)
Investment securities:						
U.S.	(770)	223	(547)	216	303	519
Non-U.S.	(189)	73	(116)	(303)	(113)	(416)
Loans:						
U.S.	1,710	4,246	5,956	2,043	2,286	4,329
Non-U.S.	212	332	544	(110)	211	101
All other interest-earning assets, predominantly U.S.	510	1,063	1,573	141	844	985
Change in interest income	1,730	10,655	12,385	2,869	5,706	8,575
Interest-bearing liabilities						
Interest-bearing deposits:						
U.S.	244	2,095	2,339	209	985	1,194
Non-U.S.	42	735	777	41	266	307
Federal funds purchased and securities loaned or sold under repurchase agreements:						
U.S.	46	1,167	1,213	(83)	659	576
Non-U.S.	5	237	242	54	(108)	(54)
Trading liabilities - debt, short-term and all other interest-bearing liabilities: ^(a)						
U.S.	276	1,842	2,118	45	1,140	1,185
Non-U.S.	180	24	204	(3)	64	61
Beneficial interests issued by consolidated VIEs, predominantly U.S.						
U.S.	(266)	256	(10)	(122)	121	(1)
Long-term debt:						
U.S.	(618)	1,827	1,209	(176)	1,388	1,212
Non-U.S.	6	10	16	2	(25)	(23)
Intercompany funding:						
U.S.	(704)	(17)	(721)	151	(186)	(35)
Non-U.S.	704	17	721	(151)	186	35
Change in interest expense	(85)	8,193	8,108	(33)	4,490	4,457
Change in net interest income	\$ 1,815	\$ 2,462	\$ 4,277	\$ 2,902	\$ 1,216	\$ 4,118

Effective January 1, 2018, the Firm adopted several new accounting standards. Certain of the new accounting standards were applied retrospectively and, accordingly, prior period amounts were revised. For additional information, refer to Note 1.

(a) Includes commercial paper.

Glossary of Terms and Acronyms

2018 Form 10-K: Annual report on Form 10-K for year ended December 31, 2018, filed with the U.S. Securities and Exchange Commission.

ABS: Asset-backed securities

AFS: Available-for-sale

ALCO: Asset Liability Committee

AWM: Asset & Wealth Management

AOI: Accumulated other comprehensive income/(loss)

ARM: Adjustable rate mortgage(s)

AUC: Assets under custody

AUM: “Assets under management”: Represent assets managed by AWM on behalf of its Private Banking, Institutional and Retail clients. Includes “Committed capital not Called.”

Auto loan and lease origination volume: Dollar amount of auto loans and leases originated.

Beneficial interests issued by consolidated VIEs: Represents the interest of third-party holders of debt, equity securities, or other obligations, issued by VIEs that JPMorgan Chase consolidates.

Benefit obligation: Refers to the projected benefit obligation for pension plans and the accumulated postretirement benefit obligation for OPEB plans.

BHC: Bank holding company

Card Services includes the Credit Card and Merchant Services businesses.

CB: Commercial Banking

CBB: Consumer & Business Banking

CCAR: Comprehensive Capital Analysis and Review

CCB: Consumer & Community Banking

CCO: Chief Compliance Officer

CCP: “Central counterparty” is a clearing house that interposes itself between counterparties to contracts traded in one or more financial markets, becoming the buyer to every seller and the seller to every buyer and thereby ensuring the future performance of open contracts. A CCP becomes counterparty to trades with market participants through novation, an open offer system, or another legally binding arrangement.

CDS: Credit default swaps

CEO: Chief Executive Officer

CET1 Capital: Common equity Tier 1 capital

CFTC: Commodity Futures Trading Commission

CFO: Chief Financial Officer

CFP: Contingency funding plan

Chase Bank USA, N.A.: Chase Bank USA, National Association

CIB: Corporate & Investment Bank

CIO: Chief Investment Office

Client assets: Represent assets under management as well as custody, brokerage, administration and deposit accounts.

Client deposits and other third-party liabilities: Deposits, as well as deposits that are swept to on-balance sheet liabilities (e.g., commercial paper, federal funds purchased and securities loaned or sold under repurchase agreements) as part of client cash management programs.

CLO: Collateralized loan obligations

CLTV: Combined loan-to-value

Collateral-dependent: A loan is considered to be collateral-dependent when repayment of the loan is expected to be provided solely by the underlying collateral, rather than by cash flows from the borrower’s operations, income or other resources.

Commercial Card: provides a wide range of payment services to corporate and public sector clients worldwide through the commercial card products. Services include procurement, corporate travel and entertainment, expense management services, and business-to-business payment solutions.

Core loans: Represents loans considered central to the Firm’s ongoing businesses; core loans excludes loans classified as trading assets, runoff portfolios, discontinued portfolios and portfolios the Firm has an intent to exit.

Credit cycle: A period of time over which credit quality improves, deteriorates and then improves again (or vice versa). The duration of a credit cycle can vary from a couple of years to several years.

Credit derivatives: Financial instruments whose value is derived from the credit risk associated with the debt of a third-party issuer (the reference entity) which allow one party (the protection purchaser) to transfer that risk to another party (the protection seller). Upon the occurrence of a credit event by the reference entity, which may include, among other events, the bankruptcy or failure to pay its obligations, or certain restructurings of the debt of the reference entity, neither party has recourse to the reference entity. The protection purchaser has recourse to the protection seller for the difference between the face value of the CDS contract and the fair value at the time of settling the credit derivative contract. The determination as to whether a credit event has occurred is generally made by the relevant International Swaps and Derivatives Association (“ISDA”) Determinations Committee.

Criticized: Criticized loans, lending-related commitments and derivative receivables that are classified as special mention, substandard and doubtful categories for regulatory purposes and are generally consistent with a

Glossary of Terms and Acronyms

rating of CCC+/Caa1 and below, as defined by S&P and Moody's.

CRO: Chief Risk Officer

CRSC: Conduct Risk Steering Committee

CTC: CIO, Treasury and Corporate

CVA: Credit valuation adjustment

Debit and credit card sales volume: Dollar amount of card member purchases, net of returns.

Deposit margin/deposit spread: Represents net interest income expressed as a percentage of average deposits.

Distributed denial-of-service attack: The use of a large number of remote computer systems to electronically send a high volume of traffic to a target website to create a service outage at the target. This is a form of cyberattack.

Dodd-Frank Act: Wall Street Reform and Consumer Protection Act

DRPC: Board of Directors' Risk Policy Committee

DVA: Debit valuation adjustment

EC: European Commission

Eligible LTD: Long-term debt satisfying certain eligibility criteria

Embedded derivatives: are implicit or explicit terms or features of a financial instrument that affect some or all of the cash flows or the value of the instrument in a manner similar to a derivative. An instrument containing such terms or features is referred to as a "hybrid." The component of the hybrid that is the non-derivative instrument is referred to as the "host." For example, callable debt is a hybrid instrument that contains a plain vanilla debt instrument (i.e., the host) and an embedded option that allows the issuer to redeem the debt issue at a specified date for a specified amount (i.e., the embedded derivative). However, a floating rate instrument is not a hybrid composed of a fixed-rate instrument and an interest rate swap.

ERISA: Employee Retirement Income Security Act of 1974

EPS: Earnings per share

ETD: "Exchange-traded derivatives": Derivative contracts that are executed on an exchange and settled via a central clearing house.

EU: European Union

Fannie Mae: Federal National Mortgage Association

FASB: Financial Accounting Standards Board

FCA: Financial Conduct Authority

FCC: Firmwide Control Committee

FDIA: Federal Depository Insurance Act

FDIC: Federal Deposit Insurance Corporation

Federal Reserve: The Board of the Governors of the Federal Reserve System

FFELP: Federal Family Education Loan Program

FFIEC: Federal Financial Institutions Examination Council

FHA: Federal Housing Administration

FHLB: Federal Home Loan Bank

FICC: The Fixed Income Clearing Corporation

FICO score: A measure of consumer credit risk provided by credit bureaus, typically produced from statistical models by Fair Isaac Corporation utilizing data collected by the credit bureaus.

Firm: JPMorgan Chase & Co.

Forward points: Represents the interest rate differential between two currencies, which is either added to or subtracted from the current exchange rate (i.e., "spot rate") to determine the forward exchange rate.

FRC: Firmwide Risk Committee

Freddie Mac: Federal Home Loan Mortgage Corporation

Free standing derivatives: a derivative contract entered into either separate and apart from any of the Firm's other financial instruments or equity transactions. Or, in conjunction with some other transaction and is legally detachable and separately exercisable.

FSB: Financial Stability Board

FTE: Fully taxable equivalent

FVA: Funding valuation adjustment

FX: Foreign exchange

G7: Group of Seven nations: Countries in the G7 are Canada, France, Germany, Italy, Japan, the U.K. and the U.S.

G7 government bonds: Bonds issued by the government of one of the G7 nations.

Ginnie Mae: Government National Mortgage Association

GSE: Fannie Mae and Freddie Mac

GSIB: Global systemically important banks

Headcount-related expense: Includes salary and benefits (excluding performance-based incentives), and other noncompensation costs related to employees.

HELOAN: Home equity loan

HELOC: Home equity line of credit

Home equity – senior lien: Represents loans and commitments where JPMorgan Chase holds the first security interest on the property.

Home equity – junior lien: Represents loans and commitments where JPMorgan Chase holds a security interest that is subordinate in rank to other liens.

Glossary of Terms and Acronyms

Households: A household is a collection of individuals or entities aggregated together by name, address, tax identifier and phone number.

HQLA: High quality liquid assets

HTM: Held-to-maturity

ICAAP: Internal capital adequacy assessment process

IDI: Insured depository institutions

IHC: JPMorgan Chase Holdings LLC, an intermediate holding company

Impaired loan: Impaired loans are loans measured at amortized cost, for which it is probable that the Firm will be unable to collect all amounts due, including principal and interest, according to the contractual terms of the agreement. Impaired loans include the following:

- All wholesale nonaccrual loans
- All TDRs (both wholesale and consumer), including ones that have returned to accrual status

Investment-grade: An indication of credit quality based on JPMorgan Chase's internal risk assessment system. "Investment grade" generally represents a risk profile similar to a rating of a "BBB-"/"Baa3" or better, as defined by independent rating agencies.

ISDA: International Swaps and Derivatives Association

JPMorgan Chase: JPMorgan Chase & Co.

JPMorgan Chase Bank, N.A.: JPMorgan Chase Bank, National Association

JPMorgan Clearing: J.P. Morgan Clearing Corp.

JPMorgan Securities: J.P. Morgan Securities LLC

Loan-equivalent: Represents the portion of the unused commitment or other contingent exposure that is expected, based on historical portfolio experience, to become drawn prior to an event of a default by an obligor.

LCR: Liquidity coverage ratio

LDA: Loss Distribution Approach

LGD: Loss given default

LIBOR: London Interbank Offered Rate

LLC: Limited Liability Company

LOB: Line of business

LOB CROs: Line of Business and CTC Chief Risk Officers

Loss emergence period: Represents the time period between the date at which the loss is estimated to have been incurred and the ultimate realization of that loss.

LTIP: Long-term incentive plan

LTV: "Loan-to-value": For residential real estate loans, the relationship, expressed as a percentage, between the principal amount of a loan and the appraised value of the

collateral (i.e., residential real estate) securing the loan.

Origination date LTV ratio

The LTV ratio at the origination date of the loan. Origination date LTV ratios are calculated based on the actual appraised values of collateral (i.e., loan-level data) at the origination date.

Current estimated LTV ratio

An estimate of the LTV as of a certain date. The current estimated LTV ratios are calculated using estimated collateral values derived from a nationally recognized home price index measured at the metropolitan statistical area ("MSA") level. These MSA-level home price indices consist of actual data to the extent available and forecasted data where actual data is not available. As a result, the estimated collateral values used to calculate these ratios do not represent actual appraised loan-level collateral values; as such, the resulting LTV ratios are necessarily imprecise and should therefore be viewed as estimates.

Combined LTV ratio

The LTV ratio considering all available lien positions, as well as unused lines, related to the property. Combined LTV ratios are used for junior lien home equity products.

Managed basis: A non-GAAP presentation of Firmwide financial results that includes reclassifications to present revenue on a fully taxable-equivalent basis. Management also uses this financial measure at the segment level, because it believes this provides information to enable investors to understand the underlying operational performance and trends of the particular business segment and facilitates a comparison of the business segment with the performance of competitors.

Master netting agreement: A single agreement with a counterparty that permits multiple transactions governed by that agreement to be terminated or accelerated and settled through a single payment in a single currency in the event of a default (e.g., bankruptcy, failure to make a required payment or securities transfer or deliver collateral or margin when due).

Measurement alternative: Measures equity securities without readily determinable fair values at cost less impairment (if any), plus or minus observable price changes from an identical or similar investment of the same issuer.

MBS: Mortgage-backed securities

MD&A: Management's discussion and analysis

Merchant Services: is a business that primarily processes transactions for merchants.

MMDA: Money Market Deposit Accounts

Moody's: Moody's Investor Services

Mortgage origination channels:

Glossary of Terms and Acronyms

Retail – Borrowers who buy or refinance a home through direct contact with a mortgage banker employed by the Firm using a branch office, the Internet or by phone. Borrowers are frequently referred to a mortgage banker by a banker in a Chase branch, real estate brokers, home builders or other third parties.

Correspondent – Banks, thrifts, other mortgage banks and other financial institutions that sell closed loans to the Firm.

Mortgage product types:

Alt-A

Alt-A loans are generally higher in credit quality than subprime loans but have characteristics that would disqualify the borrower from a traditional prime loan. Alt-A lending characteristics may include one or more of the following: (i) limited documentation; (ii) a high CLTV ratio; (iii) loans secured by non-owner occupied properties; or (iv) a debt-to-income ratio above normal limits. A substantial proportion of the Firm's Alt-A loans are those where a borrower does not provide complete documentation of his or her assets or the amount or source of his or her income.

Option ARMs

The option ARM real estate loan product is an adjustable-rate mortgage loan that provides the borrower with the option each month to make a fully amortizing, interest-only or minimum payment. The minimum payment on an option ARM loan is based on the interest rate charged during the introductory period. This introductory rate is usually significantly below the fully indexed rate. The fully indexed rate is calculated using an index rate plus a margin. Once the introductory period ends, the contractual interest rate charged on the loan increases to the fully indexed rate and adjusts monthly to reflect movements in the index. The minimum payment is typically insufficient to cover interest accrued in the prior month, and any unpaid interest is deferred and added to the principal balance of the loan. Option ARM loans are subject to payment recast, which converts the loan to a variable-rate fully amortizing loan upon meeting specified loan balance and anniversary date triggers.

Prime

Prime mortgage loans are made to borrowers with good credit records who meet specific underwriting requirements, including prescriptive requirements related to income and overall debt levels. New prime mortgage borrowers provide full documentation and generally have reliable payment histories.

Subprime

Subprime loans are loans that, prior to mid-2008, were offered to certain customers with one or more high risk characteristics, including but not limited to: (i) unreliable or poor payment histories; (ii) a high LTV ratio of greater than 80% (without borrower-paid mortgage insurance); (iii) a high debt-to-income ratio; (iv) an occupancy type for the

loan is other than the borrower's primary residence; or (v) a history of delinquencies or late payments on the loan.

MSA: Metropolitan statistical areas

MSR: Mortgage servicing rights

Multi-asset: Any fund or account that allocates assets under management to more than one asset class.

NA: Data is not applicable or available for the period presented.

NAV: Net Asset Value

Net Capital Rule: Rule 15c3-1 under the Securities Exchange Act of 1934.

Net charge-off/(recovery) rate: Represents net charge-offs/(recoveries) (annualized) divided by average retained loans for the reporting period.

Net mortgage servicing revenue: Includes operating revenue earned from servicing third-party mortgage loans which is recognized over the period in which the service is provided, changes in the fair value of MSRs and the impact of risk management activities associated with MSRs.

Net production revenue: Includes fees and income recognized as earned on mortgage loans originated with the intent to sell; the impact of risk management activities associated with the mortgage pipeline and warehouse loans; and changes in the fair value of any residual interests held from mortgage securitizations. Net production revenue also includes gains and losses on sales of mortgage loans, lower of cost or fair value adjustments on mortgage loans held-for-sale, changes in fair value on mortgage loans originated with the intent to sell and measured at fair value under the fair value option, as well as losses recognized as incurred related to repurchases of previously sold loans.

Net revenue rate: Represents Card Services net revenue (annualized) expressed as a percentage of average loans for the period.

Net interchange income includes the following components:

- **Interchange income:** Fees earned by credit and debit card issuers on sales transactions.
- **Rewards costs:** The cost to the Firm for points earned by cardholders enrolled in credit card rewards programs.
- **Partner payments:** Payments to co-brand credit card partners based on the cost of loyalty program rewards earned by cardholders on credit card transactions.

Net yield on interest-earning assets: The average rate for interest-earning assets less the average rate paid for all sources of funds.

NM: Not meaningful

NOL: Net operating loss

Nonaccrual loans: Loans for which interest income is not

Glossary of Terms and Acronyms

recognized on an accrual basis. Loans (other than credit card loans and certain consumer loans insured by U.S. government agencies) are placed on nonaccrual status when full payment of principal and interest is not expected, regardless of delinquency status, or when principal and interest have been in default for a period of 90 days or more unless the loan is both well-secured and in the process of collection. Collateral-dependent loans are typically maintained on nonaccrual status.

Nonperforming assets: Nonperforming assets include nonaccrual loans, nonperforming derivatives and certain assets acquired in loan satisfaction, predominantly real estate owned and other commercial and personal property.

NOW: Negotiable Order of Withdrawal

OAS: Option-adjusted spread

OCC: Office of the Comptroller of the Currency

OCI: Other comprehensive income/(loss)

OPEB: Other postretirement employee benefit

ORMF: Operational Risk Management Framework

OTTI: Other-than-temporary impairment

Over-the-counter (“OTC”) derivatives: Derivative contracts that are negotiated, executed and settled bilaterally between two derivative counterparties, where one or both counterparties is a derivatives dealer.

Over-the-counter cleared (“OTC-cleared”) derivatives: Derivative contracts that are negotiated and executed bilaterally, but subsequently settled via a central clearing house, such that each derivative counterparty is only exposed to the default of that clearing house.

Overhead ratio: Noninterest expense as a percentage of total net revenue.

Parent Company: JPMorgan Chase & Co.

Participating securities: Represents unvested share-based compensation awards containing nonforfeitable rights to dividends or dividend equivalents (collectively, “dividends”), which are included in the earnings per share calculation using the two-class method. JPMorgan Chase grants RSUs to certain employees under its share-based compensation programs, which entitle the recipients to receive nonforfeitable dividends during the vesting period on a basis equivalent to the dividends paid to holders of common stock. These unvested awards meet the definition of participating securities. Under the two-class method, all earnings (distributed and undistributed) are allocated to each class of common stock and participating securities, based on their respective rights to receive dividends.

PCA: Prompt corrective action

PCI: “Purchased credit-impaired” loans represents certain loans that were acquired and deemed to be credit-impaired on the acquisition date in accordance with the guidance of the FASB. The guidance allows purchasers to aggregate

credit-impaired loans acquired in the same fiscal quarter into one or more pools, provided that the loans have common risk characteristics (e.g., product type, LTV ratios, FICO scores, past due status, geographic location). A pool is then accounted for as a single asset with a single composite interest rate and an aggregate expectation of cash flows.

PD: Probability of default

PRA: Prudential Regulatory Authority

Pre-provision profit/(loss): Represents total net revenue less noninterest expense. The Firm believes that this financial measure is useful in assessing the ability of a lending institution to generate income in excess of its provision for credit losses.

Pretax margin: Represents income before income tax expense divided by total net revenue, which is, in management’s view, a comprehensive measure of pretax performance derived by measuring earnings after all costs are taken into consideration. It is one basis upon which management evaluates the performance of AWM against the performance of their respective competitors.

Principal transactions revenue: Principal transactions revenue is driven by many factors, including the bid-offer spread, which is the difference between the price at which the Firm is willing to buy a financial or other instrument and the price at which the Firm is willing to sell that instrument. It also consists of realized (as a result of closing out or termination of transactions, or interim cash payments) and unrealized (as a result of changes in valuation) gains and losses on financial and other instruments (including those accounted for under the fair value option) primarily used in client-driven market-making activities and on private equity investments. In connection with its client-driven market-making activities, the Firm transacts in debt and equity instruments, derivatives and commodities (including physical commodities inventories and financial instruments that reference commodities).

Principal transactions revenue also includes certain realized and unrealized gains and losses related to hedge accounting and specified risk-management activities, including: (a) certain derivatives designated in qualifying hedge accounting relationships (primarily fair value hedges of commodity and foreign exchange risk), (b) certain derivatives used for specific risk management purposes, primarily to mitigate credit risk, foreign exchange risk and commodity risk, and (c) other derivatives.

PSU(s): Performance share units

REIT: “Real estate investment trust”: A special purpose investment vehicle that provides investors with the ability to participate directly in the ownership or financing of real-estate related assets by pooling their capital to purchase and manage income property (i.e., equity REIT) and/or mortgage loans (i.e., mortgage REIT). REITs can be publicly or privately held and they also qualify for certain favorable tax considerations.

Glossary of Terms and Acronyms

Receivables from customers: Primarily represents held-for-investment margin loans to brokerage customers that are collateralized through assets maintained in the clients' brokerage accounts, as such no allowance is held against these receivables. These receivables are reported within accrued interest and accounts receivable on the Firm's Consolidated balance sheets.

Regulatory VaR: Daily aggregated VaR calculated in accordance with regulatory rules.

REO: Real estate owned

Reported basis: Financial statements prepared under U.S. GAAP, which excludes the impact of taxable-equivalent adjustments.

Retained loans: Loans that are held-for-investment (i.e., excludes loans held-for-sale and loans at fair value).

Revenue wallet: Proportion of fee revenue based on estimates of investment banking fees generated across the industry (i.e., the revenue wallet) from investment banking transactions in M&A, equity and debt underwriting, and loan syndications. Source: Dealogic, a third-party provider of investment banking competitive analysis and volume-based league tables for the above noted industry products.

RHS: Rural Housing Service of the U.S. Department of Agriculture

Risk-rated portfolio: Credit loss estimates are based on estimates of the probability of default ("PD") and loss severity given a default. The probability of default is the likelihood that a borrower will default on its obligation; the loss given default ("LGD") is the estimated loss on the loan that would be realized upon the default and takes into consideration collateral and structural support for each credit facility.

ROA: Return on assets

ROE: Return on equity

ROTCE: Return on tangible common equity

RSU(s): Restricted stock units

RWA: "Risk-weighted assets": Basel III establishes two comprehensive approaches for calculating RWA (a Standardized approach and an Advanced approach) which include capital requirements for credit risk, market risk, and in the case of Basel III Advanced, also operational risk. Key differences in the calculation of credit risk RWA between the Standardized and Advanced approaches are that for Basel III Advanced, credit risk RWA is based on risk-sensitive approaches which largely rely on the use of internal credit models and parameters, whereas for Basel III Standardized, credit risk RWA is generally based on supervisory risk-weightings which vary primarily by counterparty type and asset class. Market risk RWA is calculated on a generally consistent basis between Basel III Standardized and Basel III Advanced.

S&P: Standard and Poor's 500 Index

SAR(s): Stock appreciation rights

Scored portfolio: The scored portfolio predominantly includes residential real estate loans, credit card loans and certain auto and business banking loans where credit loss estimates are based on statistical analysis of credit losses over discrete periods of time. The statistical analysis uses portfolio modeling, credit scoring and decision-support tools.

SEC: Securities and Exchange Commission

Seed capital: Initial JPMorgan capital invested in products, such as mutual funds, with the intention of ensuring the fund is of sufficient size to represent a viable offering to clients, enabling pricing of its shares, and allowing the manager to develop a track record. After these goals are achieved, the intent is to remove the Firm's capital from the investment.

Single-name: Single reference-entities

SLR: Supplementary leverage ratio

SMBS: Stripped mortgage-backed securities

SPES: Special purpose entities

Structural interest rate risk: Represents interest rate risk of the non-trading assets and liabilities of the Firm.

Structured notes: Structured notes are financial instruments whose cash flows are linked to the movement in one or more indexes, interest rates, foreign exchange rates, commodities prices, prepayment rates, or other market variables. The notes typically contain embedded (but not separable or detachable) derivatives. Contractual cash flows for principal, interest, or both can vary in amount and timing throughout the life of the note based on non-traditional indexes or non-traditional uses of traditional interest rates or indexes.

Taxable-equivalent basis: In presenting results on a managed basis, the total net revenue for each of the business segments and the Firm is presented on a tax-equivalent basis. Accordingly, revenue from investments that receive tax credits and tax-exempt securities is presented in managed basis results on a level comparable to taxable investments and securities; the corresponding income tax impact related to tax-exempt items is recorded within income tax expense.

TBVPS: Tangible book value per share

TCE: Tangible common equity

TDR: "Troubled debt restructuring" is deemed to occur when the Firm modifies the original terms of a loan agreement by granting a concession to a borrower that is experiencing financial difficulty.

TLAC: Total Loss Absorbing Capacity

U.K.: United Kingdom

Unaudited: Financial statements and information that have

Glossary of Terms and Acronyms

not been subjected to auditing procedures sufficient to permit an independent certified public accountant to express an opinion.

U.S.: United States of America

U.S. GAAP: Accounting principles generally accepted in the U.S.

U.S. government-sponsored enterprises (“U.S. GSEs”) and U.S. GSE obligations: In the U.S., GSEs are quasi-governmental, privately held entities established by Congress to improve the flow of credit to specific sectors of the economy and provide certain essential services to the public. U.S. GSEs include Fannie Mae and Freddie Mac, but do not include Ginnie Mae, which is directly owned by the U.S. Department of Housing and Urban Development. U.S. GSE obligations are not explicitly guaranteed as to the timely payment of principal and interest by the full faith and credit of the U.S. government.

U.S. LCR: Liquidity coverage ratio under the final U.S. rule.

U.S. Treasury: U.S. Department of the Treasury

VA: U.S. Department of Veterans Affairs

VaR: “Value-at-risk” is a measure of the dollar amount of potential loss from adverse market moves in an ordinary market environment.

VCG: Valuation Control Group

VGF: Valuation Governance Forum

VIEs: Variable interest entities

Warehouse loans: Consist of prime mortgages originated with the intent to sell that are accounted for at fair value and classified as trading assets.

Board of Directors

Linda B. Bammann⁴

Retired Deputy Head of Risk Management
JPMorgan Chase & Co.
(Financial services)

James A. Bell¹

Retired Executive Vice President
The Boeing Company
(Aerospace)

Stephen B. Burke^{2,3}

Chief Executive Officer
NBCUniversal, LLC
(Television and entertainment)

Todd A. Combs^{4,5}

Investment Officer
Berkshire Hathaway Inc.
(Conglomerate)

James S. Crown⁴

Chairman and
Chief Executive Officer
Henry Crown and Company
(Diversified investments)

James Dimon

Chairman and
Chief Executive Officer
JPMorgan Chase & Co.
(Financial services)

Timothy P. Flynn^{1,5}

Retired Chairman and
Chief Executive Officer
KPMG
(Professional services)

Melody Hobson^{1,5}

President
Ariel Investments, LLC
(Investment management)

Laban P. Jackson, Jr.¹

Chairman and Chief Executive Officer
Clear Creek Properties, Inc.
(Real estate development)

Michael A. Neal⁴

Retired Vice Chairman
General Electric Company;
Retired Chairman and
Chief Executive Officer
GE Capital
(Industrial and financial services)

Lee R. Raymond^{2,3}

Lead Independent Director
JPMorgan Chase & Co.;
Retired Chairman and
Chief Executive Officer
Exxon Mobil Corporation
(Oil and gas)

William C. Weldon^{2,3}

Retired Chairman and
Chief Executive Officer
Johnson & Johnson
(Healthcare products)

Member of:

- 1 Audit Committee
- 2 Compensation & Management Development Committee
- 3 Corporate Governance & Nominating Committee
- 4 Directors' Risk Policy Committee
- 5 Public Responsibility Committee

Operating Committee

James Dimon

Chairman and
Chief Executive Officer

Daniel E. Pinto

Co-President and
Chief Operating Officer;
CEO, Corporate & Investment Bank

Gordon A. Smith

Co-President and
Chief Operating Officer;
CEO, Consumer & Community Banking

Ashley Bacon

Chief Risk Officer

Lori Beer

Chief Information Officer

Mary Callahan Erdoes

CEO, Asset & Wealth Management

Stacey Friedman

General Counsel

Marianne Lake

Chief Financial Officer

Robin Leopold

Head of Human Resources

Douglas B. Petno

CEO, Commercial Banking

Peter L. Scher

Head of Corporate Responsibility;
Chairman of the Mid-Atlantic Region

Other Corporate Officers

Molly Carpenter

Secretary

Joseph M. Evangelisti

Corporate Communications

Nicole Giles

Firmwide Controller

Lou Rauchenberger

General Auditor

Jason R. Scott

Investor Relations

Regional Chief Executive Officers

Asia Pacific

Nicolas Aguzin

Europe/Middle East/Africa

Viswas Raghavan

Latin America/Canada

Martin G. Marron

Senior Country Officers and Location Heads

Asia Pacific

Australia and New Zealand

Paul Uren

China

Mark Leung

Hong Kong

Filippo Gori

Japan

Steve Teru Rinoie

Korea

Tae Jin Park

South and South East Asia

Kalpana Morparia

Indonesia

Haryanto T. Budiman

Malaysia

Steve R. Clayton

Philippines

Carlos Ma. G Mendoza

Singapore

Edmund Y. Lee

Thailand

M.L. Chayotid Kridakon

Taiwan

Carl K. Chien

Vietnam

Van Bich Phan

Europe/Middle East/Africa

Africa, Central & Eastern Europe, Kazakhstan, Middle East, Pakistan, Russia and Turkey

Sjoerd Leenart

Bahrain, Egypt and Lebanon

Ali Moosa

Kazakhstan and Russia

Yan L. Tavrovsky

Middle East and North Africa

Khaled Hobballah

Karim Tannir

Saudi Arabia

Bader A. Alamoudi

Sub-Saharan Africa

Marc J. Hussey

Kevin G. Latter

Turkey

Mustafa Bagriacik

Austria, Germany, Ireland, Israel, Nordics and Switzerland

Dorothee Blessing

Austria

Anton J. Ulmer

Ireland

Carin Bryans

Israel

Roy Navon

Switzerland

Nick Bossart

Belgium, France, Greece,

Iberia, Italy and the Netherlands

Kyril Courboin

Belgium

Tanguy A. Piret

Iberia

Ignacio de la Colina

Italy

Francesco Cardinali

The Netherlands

Peter A. Kerckhoffs

Luxembourg

Pablo Garnica

Latin America/Caribbean

Andean, Caribbean and Central America

Moises Mainster

Colombia

Angela Hurtado

Argentina

Facundo D. Gomez Minujin

Brazil

José Berenguer

Chile

Alfonso Eyzaguirre

Mexico

Felipe Garcia-Moreno

North America

Canada

David E. Rawlings

JPMorgan Chase Vice Chairs

Phyllis J. Campbell

John L. Donnelly

Jacob A. Frenkel

Mark S. Garvin

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*Ex-officio

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jpmorganchase.com

Annual Report on Form 10-K

The Annual Report on Form 10-K of JPMorgan Chase & Co. as filed with the U.S. Securities and Exchange Commission will be made available without charge upon request to:

Office of the Secretary
JPMorgan Chase & Co.
4 New York Plaza
New York, NY 10004-2413

Stock listing

New York Stock Exchange

The New York Stock Exchange ticker symbol for the common stock of JPMorgan Chase & Co. is JPM.

Financial information about JPMorgan Chase & Co. can be accessed by visiting the Investor Relations website at jpmorganchase.com. Additional questions should be addressed to:

Investor Relations
JPMorgan Chase & Co.
277 Park Avenue, Floor 43
New York, NY 10172-0003
Telephone: 212-270-7325

Directors

To contact any of the Board members or committee chairs, the Lead Independent Director or the non-management directors as a group, please mail correspondence to:

JPMorgan Chase & Co.
Attention (Board member(s))
Office of the Secretary
4 New York Plaza
New York, NY 10004-2413

The Corporate Governance Principles of the Board, the charters of the principal Board committees, the Code of Conduct, the Code of Ethics for Finance Professionals and other governance information can be accessed by visiting our website at jpmorganchase.com and clicking on "Governance" under the "About us" tab.

Transfer agent and registrar

Computershare
480 Washington Boulevard
Jersey City, NJ 07310-2053
Telephone: 800-758-4651
www.computershare.com/investor

Investor Services Program

JPMorgan Chase & Co.'s Investor Services Program offers a variety of convenient, low-cost services to make it easier to reinvest dividends and buy and sell shares of JPMorgan Chase & Co. common stock. A brochure and enrollment materials may be obtained by contacting the Program Administrator, Computershare, by calling 800-758-4651, by writing to the address indicated above or by visiting its website at www-us.computershare.com/investor.

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For information about direct deposit of dividends, please contact Computershare.

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Contact Computershare:

By telephone:

Within the United States, Canada and Puerto Rico: 800-758-4651 (toll free)

From all other locations:
201-680-6862 (collect)

TDD service for the hearing impaired within the United States, Canada and Puerto Rico: 800-231-5469 (toll free)

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If you receive duplicate mailings because you have more than one account listing and you wish to consolidate your accounts, please write to Computershare at the address above.

Independent registered public accounting firm

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300 Madison Avenue
New York, NY 10017

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