
This is the **accepted version** of the journal article:

Ballabriga, Fernando; Davtyan, Karen. «Distributional impact of monetary policy in the UK : from conventional to unconventional policy». *Journal of Economic Policy Reform*, Vol. 25, Num. 4 (2022), p. 435-450 DOI 10.1080/17487870.2021.1949316

This version is available at <https://ddd.uab.cat/record/323274>

under the terms of the  ^{IN}COPYRIGHT license.

Distributional Impact of Monetary Policy in the UK: from Conventional to Unconventional Policy

Fernando Ballabriga^a and Karen Davtyan^{b,c}

^aGREF, Department of Economics, Finance and Accounting, ESADE Business School - Universitat Ramon Llull; ^bGREF, Department of Economics, Finance and Accounting, ESADE Business School - Universitat Ramon Llull; ^cDepartment of Statistics, University Carlos III of Madrid

ARTICLE HISTORY

25 June 2021

This is the accepted version of the article. The final published version is available at: <https://doi.org/10.1080/17487870.2021.1949316>

ABSTRACT

We evaluate the income distributional effect of monetary policy in the UK for the period 1993-2019, using a mixed frequency approach and a high frequency identification. Our results indicate that expansionary monetary policy increased income inequality during the unconventional policy subperiod 2009-2019. Looking at the income brackets, we find that this increase in inequality is primarily due to the positive impact of expansionary policy on the upper share of income distribution. Our counterfactual analysis reveals that unconventional monetary policy contributed to the increase in inequality, and that the response to COVID-19 is likely to do the same.

KEYWORDS

Monetary policy; identification; distribution channels; income inequality

JEL CLASSIFICATION

C32; D31; E52

Policy Highlights

- Expansionary monetary policy increases income inequality in the UK.
- The impact is stronger within the period of the implementation of unconventional monetary policy.
- The implementation of unconventional monetary policy in response to COVID-19 is likely to increase income inequality.

CONTACT Karen Davtyan. Email: karen.davtyan@uc3m.es

1. Introduction

Focus on the causes and negative consequences of increasing inequality has been on the rise during the last ten years (see, for example, OECD 2015, and Ostry, Loungani and Berg 2019). From the macroeconomic policy perspective, fiscal policy has been traditionally seen as the tool to tackle the problem via progressive taxation and welfare state spending programs. However, monetary policy has recently been added to the discussion after a decade playing a leading policy role in the uncharted territory of its unconventional version, namely Quantitative Easing (QE), first after the 2008-09 financial crisis and now in response to the Covid-19 disruption.

The recent literature reflects the increasing interest in the connection between monetary policy and inequality. On the theoretical side, one area of study has been the effect of monetary policy on inequality via its impact on inflation, another has explored the implications of the New Keynesian model. Regarding the former, Erosa and Ventura (2002) build a monetary growth model with the feature that the poor households hold more cash, claiming that the poor pay a relatively higher share of the inflation tax. Doepke and Schneider (2006) consider the effects of inflation via the changes in the value of nominal assets and find that inflation negatively affects rich and old households who are main bondholders, in comparison to young and middle-class households who own fixed rate mortgage debt. Albanesi (2007) considers a political economy model where distributional conflict in the determination of fiscal and monetary policies leads in equilibrium to a positive relation between inflation and income inequality.

Regarding New Keynesian studies, Gornemann, Kuester, and Nakajima (2016) build a New Keynesian business cycle model with household heterogeneity and find that contractionary monetary policy raises economic and wealth inequality. Kaplan, Moll, and Violante (2018) build a Heterogeneous Agents New Keynesian model, which generates a large fraction of agents with close to zero liquid net wealth. The consumption of these agents is highly sensitive to changes in disposable income but it is not sensitive to interest rate changes. Dolado, Motyovszki, and Pappa (2021) use a New Keynesian model with incomplete markets that feature capital-skill complementarity and labor market heterogeneity with asymmetric search and matching frictions. They find that expansionary monetary policy raises earnings inequality because it increases labor income for high skilled workers in comparison to labor income for low skilled workers.

On the empirical side, despite the QE policies being the trigger of this increasing interest in the connection with inequality, data availability has often turned the focus of the recent literature on the effects on inequality of the conventional version of monetary policy, i.e. that using as a main tool the adjustment of the central bank policy rate. Empirical results are mixed. At cross-country level studies, Furceri, Loungani, and Zdzienicka (2018) find that expansionary monetary policy lowers income inequality in a sample of 32 advanced and emerging economies. Similarly, Guerello (2018) shows that income inequality decreases in the euro area after expansionary monetary policy. At the single-country level, Coibion et al. (2017) find that contractionary monetary policy increases inequality in the USA. For the UK, Mumtaz and Theophilopoulou (2017) (hereafter MT) find that contractionary monetary policy raises economic inequality. Villarreal (2014) provides evidence that contractionary monetary policy reduces income inequality in Mexico.

As for the distributional impact of unconventional monetary policy (the QE), the Bank of England (2012) states that unconventional monetary policy increases

the prices of assets and, consequently, income inequality in the UK since the top 5% of households possesses 40% of the assets. Using microsimulation, O’Farrell and Rawdanowicz (2016) find that expansionary monetary policy reduces income inequality in Canada and the USA, while it increases inequality in the UK and leads to mixed results for euro area countries. Bunn, Pugh, and Yeates (2018) also implement a microsimulation analysis and find that the effects of unconventional monetary policy on income inequality were small in the UK during the period 2008-2014. Guerello (2018) looks at the distributional effects of unconventional measures and provides evidence that they increase income inequality in the euro area. Saiki and Frost (2014) find that unconventional monetary policy increases income inequality in Japan.

In this paper we revisit the UK case, a country that along with the US implemented the earliest QE response to the 2008-09 financial crisis, thus providing a good case study for the distributional impact of unconventional monetary policy. Historically, the UK monetary policy regime underwent significant shifts before the adoption of inflation targeting in 1992 (Howson 2004). After Bretton Woods (1948-1971) focus on fixed exchange rates, the UK monetary regime operated with a complete absence of a nominal anchor during the 1970s and with “high employment” as a prime objective, which was dropped and replaced for “inflation fighting” during the Margaret Thatcher’s mandate (1979-1990), when a monetarist regime with targets for money supply growth was adopted. A new reorientation of monetary policy took place in late 1990, when monetary targets were abandoned and replaced by a focus on “exchange rate stability” during the two years the UK held membership in the European Monetary System (EMS). Soon after withdrawing from the EMS in late 1992, the UK monetary policy regime shifted again toward price stability with the adoption of “inflation targeting”, which continues to be the prime objective of monetary policy nowadays.

The seminal macro work by MT looks at the sample 1969-2012 and concludes that contractionary monetary policy in the UK increases inequality, on average over the period. However, pooling together the post-Bretton Woods decades does not show significant differences across subsamples. On the other hand, due to their scarce data for the 2010s, MT just provide a preliminary and very limited look at the potential distributional effects of unconventional monetary policy during 2009 and 2010.

Our goal in this paper is to contribute to this existing empirical macro analysis on the effects of monetary policy on inequality, as well as to extend it to investigate the distributional effects of the unconventional monetary policy measures implemented by this country during the decade of 2010s. We do this by comparing the distributional impact of the conventional and unconventional monetary policy tools implemented during the last three decades (1993-2019), thus focusing on the inflation targeting regime (the UK longest of the post-WWII period). We make this choice in order to avoid the policy shifts of the 1970-1992 period, as a way to clear structural breaks from our path to monetary policy identification. The existence of a structural break in the UK macroeconomic data after 1992 relative to the 1971-1992 period has been statistically documented by Benati (2004).

A major obstacle in the empirical analysis of the distributional impact of monetary policy is that a credible identification of a monetary policy shock requires high frequency data, while consistently measured time series for income inequality are only available at annual frequency. To overcome this problem, we resort to a mixed frequency structural VAR model, which allows to combine annual inequality data with monthly macroeconomic indicators. We then identify the monetary policy shock using high frequency identification, and assess the impact of monetary policy on

the whole income distribution as well as on its different brackets. The look at the brackets allows us to explore the role of the income composition and the earnings heterogeneity as empirically relevant transmission channels of the distributional impact of monetary policy, and assessment that we complement by considering and extension of our baseline model that includes proxies for capital and labor income. Finally, since the UK applied the QE during the 2010s, we put special emphasis and zoom in on the distributional effects of unconventional monetary policy, one of its contentious consequences suggested by the Bank of England (2102), which has been debated in recent years and may need especial attention during the new QE wave implemented in response to COVID-19.

To summarize, our revisit of the UK macro evidence provides a fourfold contribution. First, it focuses on a sample generated under a single monetary policy regime in order to avoid identification issues associated with regime shifts. Second, it uses mixed frequency estimation in order to combine the annual comprehensive inequality data with the higher frequency macroeconomic series required to provide a credible identification of the monetary policy shock. Third, it resorts to the high frequency identification method. Four, it places the emphasis on the distributional impact during the unconventional monetary policy period (2009-2019).

Our results show that the effect of expansionary monetary policy on income inequality is non-conclusive or marginal during the conventional monetary policy period 1993-2008, a result that is consistent with MT. By contrast, we find that expansionary monetary policy increases income inequality once we extend the sample to include the first QE wave implemented by the Bank of England during the first half of the 2010s, an increase mainly due to its impact on the mid bracket of the income distribution. The effect on inequality is stronger if we include the second QE wave implemented during 2016-19 and focus exclusively on the unconventional monetary policy period (2009-19), when expansionary monetary policy increases inequality primarily due to its effect on the upper part of income distribution. The counterfactual analysis indicates that without unconventional monetary policy shocks, income inequality would have been lower. It also suggests that the QE measures implemented in response to COVID-19 will increase inequality.

The rest of the paper is organized as follows. Section 2 presents the empirical methodology and Section 3 describes the data. Section 4 presents the results and Section 5 provides concluding remarks.

2. Empirical methodology

For our analysis, we use the structural vector autoregression (VAR) methodology. Following the notation in Lütkepohl (2005), we write as follows our baseline VAR of order p :

$$Y_t = A_0 + A_1 Y_{t-1} + \dots + A_p Y_{t-p} + B X_t + u_t \quad (1)$$

where Y_t is a (4×1) vector of endogenous variables, X_t is a (2×1) vector of exogenous variables, A_0 is a (4×1) vector of constants, A_j s are (4×4) coefficient matrices, B is a (4×2) coefficient matrix, and u_t is a (4×1) vector of error terms. The latter is assumed to be a zero-mean independent white noise process with positive definite covariance matrix. The VAR model is estimated by ordinary least squares.

The vector of endogenous variables Y_t includes an indicator of real economic activity,

a price index, a monetary policy tool, and an income inequality measure. In the baseline model, the components of vector Y_t are the unemployment rate, the CPI, the one-year gilt rate, and the Gini index. We consider the unemployment rate and the CPI as controls in our model because monetary policy affects prices and real economic activity over a business cycle. Besides, the unemployment rate is considered as an indicator for labor earnings. To assess the distributional impact of monetary policy, we use the Gini index, which is a standard measure of income inequality.

Following Cesa-Bianchi, Thwaites, and Vicondoa (2020), we use the one-year gilt rate, which in contrast with the Bank of England policy rate preserved variation after the financial crisis, when the implementation of quantitative easing started. We also use as alternative indicator of monetary policy stance the shadow rate developed by Wu and Zhang (2019). We consider two extensions of the baseline endogenous vector: the addition of the nominal effective exchange rate as a potentially important determinant of the transmission of monetary policy, and the addition of share prices in order to fine-tune at a more detailed level the distributional impact through the income composition channel.

The vector of exogenous variables X_t contains the world commodity price index and the financial volatility index (VIX). In line with Cesa-Bianchi, Thwaites, and Vicondoa (2020), we include these exogenous variables in the model to control for global prices and financial uncertainty.

The reduced form innovations are linear combinations of underlying structural shocks:

$$u_t = B\varepsilon_t \tag{2}$$

where B is a (4×4) matrix of coefficients and ε_t is a (4×1) vector of structural innovations. A standard identification approach is the recursive Cholesky decomposition. For monetary policy identification, a common assumption in this approach is that monetary policy can react contemporaneously to real economic activity and prices but they are not simultaneously affected by policy (Christiano, Eichenbaum, and Evans 1996). It also assumes that income inequality has no contemporaneous impact on policy and the economy whereas they can have contemporaneous impact on inequality. Thus, the recursive ordering of the variables is the following: an indicator of real economic activity, a price index, a monetary policy tool, and an income inequality measure. The matrix B is lower-triangular and can be identified with the recursive decomposition. We use this identification method to recover the series of ε_t for our counterfactual analysis.

We use the high frequency identification as our main method for the identification of the monetary policy shock, an approach recently proposed by Gertler and Karadi (2015). This identification method does not impose such strong assumptions as in the previous case and it provides the estimates only for the column of matrix B associated with the monetary policy shock. Gertler and Karadi (2015) first use high frequency identification to compute exogenous monetary policy surprises, which are then used as external instruments in VAR models to identify monetary policy effects. In particular, they measure exogenous monetary policy surprises as the changes in financial instruments within a 30-minute window of the announcement of the monetary policy decision by Federal Open Market Committee. They use the time series of monetary policy surprises as an external instrument for the monetary policy shock in the estimation of impulse response functions.

Cesa-Bianchi, Thwaites, and Vicondoa (2020) use high frequency identification to

assess the effects of monetary policy for the UK over the period¹ 1992:M1–2015:M1. They construct a time series of monetary policy surprises for the UK over the period 1997:M6–2015:M1. In particular, they compose a series of monetary policy surprises for the second front contract of 3-month Sterling future and use it as an external instrument in their analysis. We take advantage of the availability of this series and use it as an external instrument for the identification of the monetary policy shock. Cesa-Bianchi, Thwaites, and Viccondoa (2020) use a longer sample than the available series of monetary policy surprises to estimate with better precision the coefficients and the residuals of the model. Following this approach as well as the research question of our paper, we also consider the estimation samples that are longer than the available series of monetary surprises.

The above identification strategies are only plausible with high frequency data. Since income inequality data have annual frequency, we resort to a mixed frequency approach in order to implement our identification of the model. That is, following Foroni and Marcellino (2016), we model jointly variables with different frequencies (monthly and annual in our case) treating the income inequality measure as a monthly variable with missing observations, which is then estimated. This approach requires to represent the VAR model in a state space form and applies the Kalman filter to estimate the model by the maximum likelihood method. Afterwards, the estimated inequality data are used alongside with the other series to estimate the standard VAR model and identify the monetary policy shock by the methods described above.

3. Data

Our empirical analysis focuses on the inflation targeting period in the UK, which started in 1993. First, we look at the conventional monetary policy period 1993:M1–2008:M4. Next, we analyze the combined period of conventional and unconventional monetary policies 1993:M1–2015:M1, including the first QE wave. Finally, we zoom in on the period 2009:M1–2019:M12, including the two waves of unconventional monetary policy implemented in the UK during the 2010s.

The scarcity of data on income inequality is one of the main difficulties for the empirical analyses of the distributional effects of monetary policy. Usually, the data come from different sources and the series are discontinuous. Therefore, we take especial care about selecting for our analysis consistently measured and comparable data on income inequality. Our choice is the Solt’s (2020) Standardized World Income Inequality Database (SWIID), which, although only with annual frequency, provides standardized continuous time series for the Gini index over the entire study period. The Gini index is based on total disposable income, i.e. after taxes and transfers, which provides a control for the distributional effects of fiscal policy.

In SWIID, the definition of total income is in line with Luxembourg Income Study and includes the following income components: income from labor, capital, pensions, public social benefits, and private transfers. From the point of view of the current analysis, it is important to emphasize that total income includes income from capital. That is, it includes income from financial assets. Due to lack of data for capital income, we resort to the index of total share prices as a proxy in the evaluation of the distribution channels of monetary policy. Although we acknowledge that the pass-through from the increase in share prices to capital gains is not potentially direct, the proxy provides a nice complementary support to our main analysis.

The OECD database is the source for the index of total share prices and for

our macroeconomic variables: the harmonized unemployment rate and the CPI, both seasonally adjusted. The index of the nominal (narrow) effective exchange rate is from the BIS database, with a rise indicating an appreciation. All the indices are scaled to the base year of 2010. The Bank of England is the source for the effective one-year gilt yield. The shadow rate is from Wu and Zhang (2019), and reflects large scale asset purchases and forward guidance. The source for the indicator of financial uncertainty VIX is the Chicago Board Options Exchange (CBOE). The commodity price index is from the IMF database.

4. Distributional impact of monetary policy

As discussed in Section 2, the baseline VAR model includes the following variables: the unemployment rate (UR)², the CPI (CPI10L), the one-year rate (OYR), and the Gini index (GINI). The variables are in levels with log transformation for the CPI. The analysis in levels allows for implicit cointegration relations (Sims, Stock, and Watson 1990).

The VAR model is specified with 2 lags, with the objective of having a parsimonious model. Nevertheless, the results are robust to alternative lag specifications³. Besides, this specification coincides with the lag order of the monthly VAR model considered by Cesa-Bianchi, Thwaites and Vicondoa (2020), and Gambacorta, Hofmann and Peersman (2014) for assessing the macroeconomic effects of monetary policy. For our analysis, we estimate impulse response functions (IRFs), which display the responses of the variables to one percentage point reduction in the monetary policy indicator. Since the one-year gilt rate or the shadow rate (as an alternative measure) are considered as a monetary policy indicator, the monetary policy shock is expansionary. We report 68% confidence bands, which are based on wild bootstrap with 1000 replications. The IRFs are presented over 24 periods.

4.1. *Conventional monetary policy period (1993–2008)*

First, we evaluate the distributional impact of monetary policy for the conventional monetary policy period 1993:M1–2008:M1, in order to check the compatibility of our results with those of MT. As discussed in Section 2, we identify the monetary policy shock with the high frequency method, using the Cesa-Bianchi, Thwaites, and Vicondoa (2020) series of monetary policy surprises as an instrument for the policy shock in the VAR model.

The claim in MT that contractionary monetary policy increases inequality comes from their analysis of the sample 1969–2012, which we know pools together two very different periods in terms of monetary policy and economic behavior, once we recognize the existence of a structural brake in UK’s macroeconomic indicators post-1992 (Benati 2004). In fact, in the earlier work of Mumtaz and Theophilopoulou (2015), the authors recognize this and separate their analysis between the pre-1993 and post-1992 subsamples, concluding that monetary policy effect on income inequality is marginal or non-significant for the post-1992 period, while it is significant for the pre-1993 sample. When they pool both periods together, the latter sample dynamics dominates over the first and its result hold on average for the whole sample in MT. However, this does not show the different statistical behavior of both subsamples.

So the starting point of our analysis is an evaluation of the distributional impact of monetary policy which is comparable with the analysis⁴ in Mumtaz and

Theophilopoulou (2015). In this earlier working paper version of their analysis, the authors consider the sub-sample 1993–2008, given the switch to inflation targeting in 1993. To match their specification, we include the nominal effective exchange rate (NEER10L) in the model. The estimation results are provided in Appendix.

Figure A1 (in Online Appendix⁵) provides the results of the estimated IRFs⁶. Following the expansionary monetary policy shock, the unemployment rate decreases by around 0.2 percentage points. The shock increases prices by around 0.25 percent on impact. After the expansion, the exchange rate depreciates up to 6 percent. The shock increases the Gini index on impact and then reduces it, leading to a small significant decrease. Thus, the effect of the shock on inequality is inconclusive for this period.

To increase the comparability and compatibility of our results with the ones obtained by Mumtaz and Theophilopoulou (2015), we use their identification approach, imposing sign restrictions (on impact) to identify the monetary policy shock. Analogously⁷ to Mumtaz and Theophilopoulou (2015), we specify an expansionary monetary policy shock as the one that reduces the interest rate, the unemployment rate, and leads to the depreciation of the exchange rate while it increases prices. The resulting IRFs are provided in Figure 1. As we can see, the dynamic of the responses of the macro variables are similar to the IRFs of the previous case. However, the response of the Gini index is not significant. Thus, our results show that the distributional impact of monetary policy is generally inconclusive during the conventional monetary policy period from 1993 to 2008, and they are similar to the ones obtained by Mumtaz and Theophilopoulou (2015).

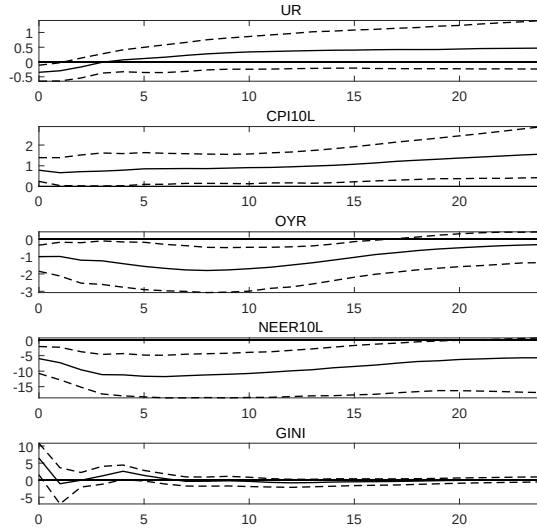


Figure 1. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Exchange Rate).

Note: The Bayesian VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), the nominal effective exchange rate (NEER10L), and the Gini index (GINI). The shock is identified using the following sign restrictions (on impact): $-UR$, $+CPI10L$, $-OYR$ and $-NEER10L$. The 68% confidence bands of the posterior distribution are provided. The VAR model is estimated in levels with 4 lags and a constant.

4.2. Combined period (1993–2015)

Next, we evaluate the distributional impact of monetary policy for the combined period of conventional and unconventional monetary policies 1993:M1–2015:M1. This period includes the first wave of the QE implemented by the Bank of England during the period 2009–2015. We start the analysis with the evaluation of the distributional impact of monetary policy in the baseline case. Then, the results serve as a basis for further analysis and robustness checks.

The estimated IRFs of the baseline model are reported in Figure 2. As can be observed, the expansionary monetary policy shock leads to a significant drop in the unemployment rate of around 0.12 percentage points. The shock significantly increases the CPI up to 0.2 percent, so the response does not feature the “price puzzle” (Christiano, Eichenbaum, and Evans 1996). These effects of monetary policy are analogous to those found by Cesa-Bianchi, Thwaites, and Vicendoa (2020) for the UK over the same period. As can also be seen from the figure, the monetary policy shock significantly raises the Gini index by around 0.1 percentage points.

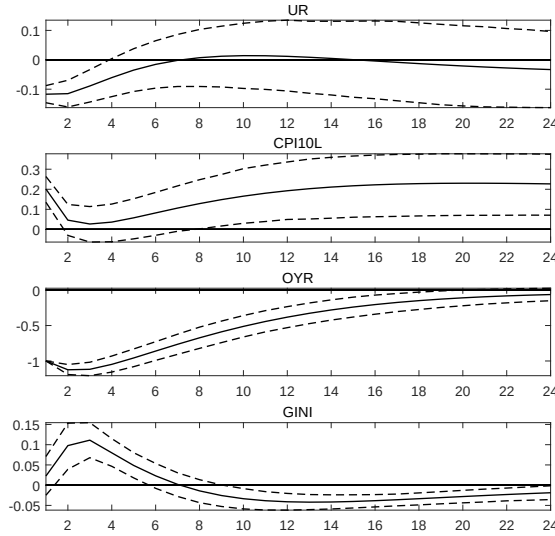


Figure 2. IRFs to a 1% Expansionary Monetary Policy Shock (The Baseline Model).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

The fact that our results for 1993–2015 are the opposite to the results of MT for 1969–2012 can be explained by the differences in the macro context facing policymakers in pre-1993 and post-1992. During the 1970s and 1980s large supply shocks were a main source of macro variability, and these shocks force monetary policy to face trade-offs between inflation and growth, since they have a positive impact on inflation and a negative impact on growth. The focus of UK monetary policy on inflation was gaining ground since 1975, after the first OPEC oil shock, and became the main focus during the Thatcher premiership (1979–1990). When policymakers respond to these shocks with a contractionary monetary policy to tame inflation, they are inflicting an additional negative impact on unemployment and income on top of the supply shock impact itself, which can lead to negative impact on income inequality, as MT find.

The macro evolution of the post-1992 was different from the preceding period. Being dominated by benign demand shocks until 2008-2009 crisis, the period 1993–2007 has been termed the “Great Moderation”, a period characterized by steady growth and low inflation in advanced economies. For the UK in particular, average growth and inflation were 3% and 1.6%, respectively, during this period. Monetary policy does not face a tradeoff between inflation and growth when reacting to demand shocks, since both indicators move in the same direction, and if they are mild shocks the contribution of monetary policy to macro variability may be low or insignificant. In particular, Mumtaz and Theophilopoulou (2015) analysis concludes that monetary policy contribution to income inequality variability is inconclusive for the period 1993–2008, as we do. The Great Recession and the “aggressive” unconventional monetary response have changed the picture, and our results here show that in a context of large demand shock, monetary policy reaction can lead to a worsening of income inequality. This impact is even stronger when we turn the focus exclusively on the unconventional monetary policy period in Section 4.3 below.

In order to examine the robustness of the results with regard to the monetary policy indicator, we replace the one-year gilt rate with the shadow rate (SR) in the VAR model. The resulting IRFs are presented in Figure B1. As can be seen from the figure, an expansionary monetary policy shock again decreases the unemployment rate and raises prices. It again significantly increases the Gini index by approximately 0.1 percentage points.

As an additional robustness check, we augment the baseline model with the nominal effective exchange rate. The results are provided in Figures B2. The dynamics and trends of the responses of the unemployment rate and prices to an expansionary monetary policy shock are similar to the corresponding results from the previous estimations. Besides, following the expansion, the exchange rate depreciates up to 6 percent. The figure also reveals that the shock increases the Gini index by around 0.4 percentage points. Thus, the response of income inequality is even larger than in the baseline case.

In order to disentangle the elements involved in the income composition channel of the distributional impact of monetary policy, we consider its impact on the top, the mid, and the bottom 20% income shares⁸. The results are provided in Figures B3, B4, and B5. As can be seen, following the expansionary monetary policy shock, the top 20% income share decreases. After the shock, the mid 20% income share grows while the bottom 20% income share initially declines and then it increases. Thus, expansionary monetary policy raises income inequality by predominantly effecting the mid part of income distribution.

4.3. *Unconventional monetary policy period (2009–2019)*

To confront the global financial crisis, the Bank of England has implemented an aggressive unconventional monetary policy. This policy has been useful in dealing with the crisis, but quantitative easing can boost capital markets, increasing asset prices and yields, and consequently income inequality. We explore this question by examining the effects of monetary policy during the unconventional monetary policy period in the UK for the period 2009:M1–2019:M12. This period includes the two waves of the QE implemented by the Bank of England during the 2010s (2009-2015 and 2016-17), and, as we can see below, the results reinforce our findings.

As in the previous case, we start our analysis using the baseline model. The

estimated IRFs are provided in Figure 3. As can be observed, an expansionary monetary policy shock reduces the unemployment rate up to 1.5 percentage points, which is larger than in the case of the combined period. The shock raises the CPI by around 1.8 percent. The response of prices is larger too in this case. The shock significantly increases the Gini index by approximately 0.5 percentage points. The magnitude of the response of income inequality is also larger during the unconventional monetary policy period.

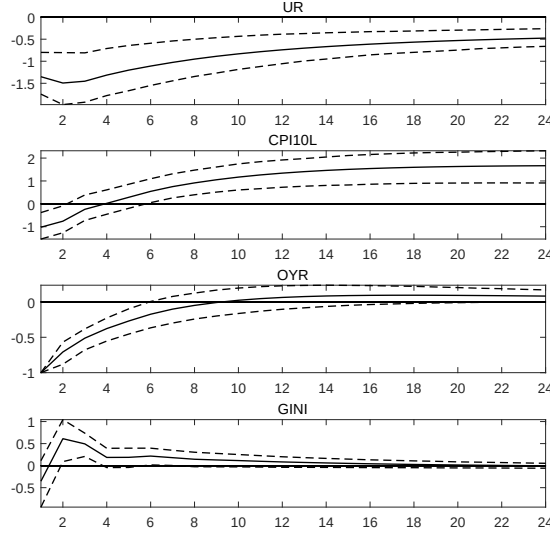


Figure 3. IRFs to a 1% Expansionary Monetary Policy Shock (The Baseline Model).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the shadow rate (SR), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

We check the robustness of the results by replacing the one-year rate with the shadow rate. Figure C1 presents the corresponding results. The dynamics of expansionary monetary policy shock effects on the unemployment rate and prices are similar to the baseline case. Analogously, the Gini index increases but its magnitude is lower in this case. It only increases up to 0.2 percentage points.

We next extend the baseline model with the nominal effective exchange rate. The results are presented in Figure C2. Following the expansionary monetary policy shock, the responses of the unemployment rate and the CPI have analogous dynamics to the baseline case. Following the expansion, the exchange rate depreciates by approximately 12 percent. The shock also raises the Gini index by around 0.4 percentage points.

Thus, the distributional impact of monetary policy is stronger and more persistent during the unconventional monetary policy period.

The effect of monetary policy on different parts of the income distribution is also more pronounced during unconventional monetary policy period. As can be observed from Figures C3, C4, and C5, the expansionary monetary policy shock raises the top 20% income share while it reduces the mid and the bottom 20% income shares. At the same time, the effect on the top 20% income share is relatively stronger. Thus, following expansionary monetary policy, the increase in income inequality is mainly due to the effect of monetary policy on the top 20% income share.

4.4. *Monetary policy impact on the stock market*

As further supportive evidence to disentangle the elements involved in the income composition channel of the distributional impact of monetary policy, we now extend the model with total share prices (TSP10L). We emphasize that total share prices might not be a precise proxy for capital income, as we discussed in Section 3. However, we find interesting results to illustrate the impact of monetary policy on the stock market as complementary to our main analysis and as indirectly supportive of the widespread suspicion that the QE impacted inequality through the stock market.

We first focus on our combined period. Figure D1 contains the resulting IRFs. As can be seen from the figure, an expansionary monetary policy shock leads to responses of the unemployment rate, the CPI, and the exchange rate similar to the previous cases. In addition, the shock significantly increases share prices by approximately 5 percent on impact, and also raises the Gini index up to 0.3 percentage points, weaker than in our analysis of the unconventional period in Subsection 4.3.

Figure D2 contains the IRFs for the unconventional period. As in the previous case, an expansionary monetary shock lowers the unemployment rate and raises prices. However, the shock increases total shares prices by approximately 20 percent, which is substantially larger than it is in the case of the combined period. The impact of the shock on income inequality is approximately 0.5 percentage points, also larger than in the case of the combined period and similar to the result in our baseline models for the unconventional period. Thus, the stronger impact on the stock market supports our finding that the increase in inequality in the unconventional period is mainly because of the dominating effect of expansionary monetary policy on the top 20% share relative to the low and the mid 20% shares of the income distribution.

4.5. *Counterfactual analysis*

A complementary question of interest is what the dynamics of income inequality would have been if unconventional monetary policy had not been implemented. To address this question, we carry out a counterfactual analysis by switching off all the realizations of the expansionary monetary policy shock during the unconventional policy period. We use the baseline model for the unconventional monetary policy period, removing the cumulative contribution of the expansionary monetary policy shock from the evolution of the Gini index while keeping the remaining structural shocks in the model. Because the reasons discussed in Section 2, we apply the recursive identification to recover the series of the monetary policy shock and to compute its cumulative contribution.

Figure 4 provides the counterfactual series of the Gini index together with its actual series for the unconventional monetary policy period. As can be observed from the figure, the Gini index would have been lower without the cumulative realizations of the expansionary monetary policy shock during the unconventional policy period. For instance, the Gini index would have been 33.1 percent instead of 33.5 percent in 2010. On average, the Gini index would have been 0.34 percentage points lower over the period from 2009 to 2019.

As a response to the crisis caused by COVID-19, the Bank of England implemented the third wave of quantitative easing during 2020. The magnitude of this quantitative easing amounts to about 85% of the quantitative easing during the period from 2008 to 2019. Given our counterfactual result that unconventional monetary policy increased the Gini index by 0.34 percentage points on average, we can make a rough projection

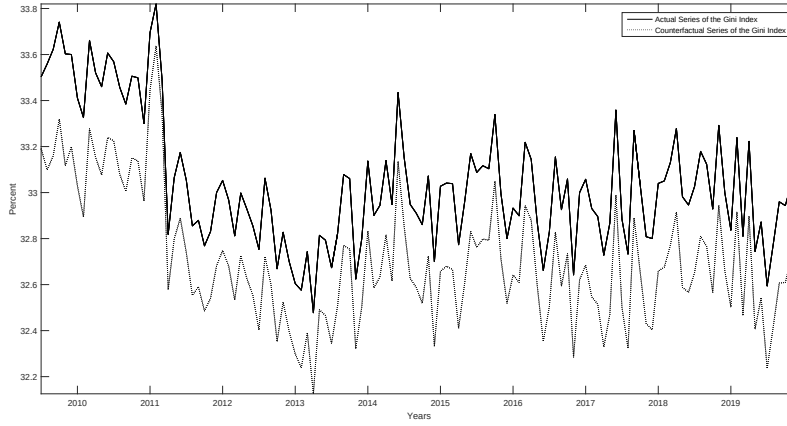


Figure 4. The Gini Index with and without Cumulative Effect of an Expansionary Monetary Policy Shock (The Baseline Model).

Note: A monetary policy shock is identified using the recursive method with the following ordering of the variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), and the Gini index (GINI). The VAR model also includes the commodity price index and the volatility index as exogenous variables.

for 2020. Following the COVID-19 crisis, the Gini index might have increased by approximately 0.29 percentage points.

5. Conclusion

This paper evaluates the distributional impact of monetary policy in the UK during the inflation targeting period (1993-2019). We consider different sub-periods. In particular, we zoom in on the period of unconventional monetary policy. Since income inequality data are only available annually, a mixed frequency approach is used in the analysis. We identify the monetary policy shock with the high frequency method.

Our results show that expansionary monetary policy increases income inequality. Moreover, the effect of monetary policy on income inequality is stronger during the unconventional policy period when inequality raises mainly because of its effect on the upper part of income distribution. Using counterfactual analysis, we find that income inequality would have been lower in the absence of unconventional policy measures during the 2010s, and that the measures of quantitative easing implemented in response to COVID-19 during 2020 are likely to do the same.

Notes

1. Cesa-Bianchi, Thwaites, and Viccondoa (2020) consider the period 1993:M1–2015:M1 in the working paper version of their analysis. We think it is safer to consider this period because the policy of inflation targeting was adopted in the UK in 1993:M10. Therefore, we consider the period 1993:M1–2015:M1 in our analysis.
2. In parentheses, the abbreviations of the variables are indicated as they are used in the empirical analysis. The last letter L in the abbreviations indicates the natural logarithmic transformation.

3. The results with different lag specifications are available on request.
4. Mumtaz and Theophilopoulou (2015) use quarterly data in their analysis.
5. The capital letter in the number of the figure indicates that the figure is provided in Online Appendix.
6. Unless otherwise stated, the VAR model is estimated in levels with 2 lags and a constant, and the monetary policy shock is identified using the series of monetary policy surprises as an external instrument for the policy shock.
7. Mumtaz and Theophilopoulou (2015) consider a contractionary monetary policy shock while we keep the shock as expansionary for the comparability across our results. In these estimations, we assume a symmetry in the responses to the contractionary and the expansionary monetary policy shock.
8. The income shares are from the World Inequality Database. Though the data are based on pretax income, they are still informative for the evaluation of the effect of monetary policy on the different parts of income distribution.

Acknowledgments

We thank the editor, Judith Clifton, the associate editors, Philip Arestis and Salvador Perez-Moreno, and the two anonymous referees for their detailed comments and recommendations. We also gratefully acknowledge helpful comments and suggestions from Juan Dolado, Helmut Lütkepohl, and the participants of the SAEe symposium in Alicante, the Eighth ECINEQ Meeting in Paris School of Economics, and the Workshop in Time Series Econometrics at the University of Zaragoza.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by Universitat Ramon LLull under Grant 2018-URL-IR2nQ-040 and Banco Sabadell.

ORCID

Fernando Ballabriga ORCID ID: 0000-0003-1266-1757

Karen Davtyan ORCID ID: 0000-0001-8766-0922

References

- [1] Albanesi, S. 2007. "Inflation and Inequality." *Journal of Monetary Economics* 54 (4): 1088–1114.
- [2] Bank of England. 2012. "The Distributional Effects of Asset Purchases." *Quarterly Bulletin* 3: 254-266.

- [3] Benati, L. 2004. "Evolving post-World War II UK economic performance." *Journal of Money, Credit and Banking* 36(4): 691-717.
- [4] Bunn, P., A. Pugh, and C. Yeates. 2018. "The distributional impact of monetary policy easing in the UK between 2008 and 2014." Bank of England Staff Working Paper 720.
- [5] Cesa-Bianchi, A., G. Thwaites, and A. Vicendoa. 2020. "Monetary Policy Transmission in the United Kingdom: A High Frequency Identification Approach," *European Economic Review* 123: 103-375.
- [6] Christiano, L., M. Eichenbaum, and C. Evans. 1996. "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds." *The Review of Economics and Statistics* 78 (1): 16-34.
- [7] Coibion, O., Y. Gorodnichenko, L. Kueng, and J. Silvia. 2017. "Innocent Bystanders? Monetary Policy and Inequality in the U.S." *Journal of Monetary Economics* 88: 70-89.
- [8] Doepke, M., and M. Schneider. 2006. "Inflation and the Redistribution of Nominal Wealth." *Journal of Political Economy* 114(6): 1069-1097.
- [9] Dolado, J., G. Motyovszki, and E. Pappa. 2021. "Monetary Policy and Inequality under Labor Market Frictions and Capital-Skill Complementarity." *American Economic Journal: Macroeconomics*, forthcoming.
- [10] Erosa, A. and G. Ventura. 2002. "On Inflation as a Regressive Consumption Tax." *Journal of Monetary Economics* 49(4): 761-795.
- [11] Foroni, C. and M. Marcellino. 2016. "Mixed Frequency Structural VARs." *Journal of the Royal Statistical Society, Series A* 179 (2): 403-425.
- [12] Furceri, D., P. Loungani, and A. Zdzienicka. 2018. "The effects of monetary policy shocks on inequality." *Journal of International Money and Finance* 85: 168-186.
- [13] Gambacorta, L., B. Hofmann, and G. Peersman. 2014. "The Effectiveness of Unconventional Monetary Policy at the Zero Lower Bound: A Cross-Country Analysis." *Journal of Money, Credit and Banking* 46 (4): 615-642.
- [14] Gertler, M. and P. Karadi. 2015. "Monetary Policy Surprises, Credit Costs, and Economic Activity." *American Economic Journal: Macroeconomics* 7 (1): 44-76.
- [15] Gornemann, N., K. Kuester, and M. Nakajima. 2016. "Doves for the Rich, Hawks for the Poor? Distributional Consequences of Monetary Policy." Manuscript.
- [16] Guerello, C. 2018. "Conventional and unconventional monetary policy vs. households income distribution: An empirical analysis for the Euro Area." *Journal of International Money and Finance* 85: 187-214.
- [17] Howson, S. 2004. "Chapter 6 - Money and monetary policy since 1945." In the *Cambridge Economic History of Modern Britain*, Edited by Roderick Floud R. and P. Johnson: 134-166.
- [18] Kaplan, G., B. Moll, and G. Violante. 2018. "Monetary Policy According to HANK." *American Economic Review* 108(3): 697-743.
- [19] Lütkepohl, H. 2005. *New Introduction to Multiple Time Series Analysis*. Springer: Berlin.
- [20] Mumtaz, H. and A. Theophilopoulou. 2015. "Monetary Policy and Inequality in the UK." Queen Mary University- School of Economics and Finance, WP 738.
- [21] Mumtaz, H. and A. Theophilopoulou. 2017. "The Impact of Monetary Policy on Inequality in the UK. An Empirical Analysis." *European Economic Review* 98: 410-423.
- [22] OECD. 2015. "Why Less Inequality Benefit All." In *It Together*.
- [23] O'Farrell, R. and L. Rawdanowicz. 2017. "Monetary policy and inequality: Financial channels." *International Finance* 20 (2): 174-188.

- [24] Ostry, J., P. Loungani, and A. Berg. 2019. “Confronting Inequality.” Columbia University Press.
- [25] Saiki, A. and J. Frost. 2014 “How Does Unconventional Monetary Policy Affect Inequality? Evidence from Japan.” *Journal of Applied Economics* 46 (36): 4445-4454.
- [26] Sims, C., J. Stock, and M. Watson. 1990. “Inference in Linear Time Series Models with Some Unit Roots.” *Econometrica* 58 (1): 113-144.
- [27] Solt, F. 2020. “Measuring Income Inequality Across Countries and Over Time: The Standardized World Income Inequality Database.” *Social Science Quarterly* 101 (3), SWIID Version 9.0.
- [28] Uhlig, H. 2005. “What Are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure.” *Journal of Monetary Economics* 52 (2): 381-419.
- [29] Villarreal, F. 2014. “Monetary Policy and Inequality in Mexico.” MPRA Paper 57074.
- [30] Wu, J. and J. Zhang. 2019. “Global Effective Lower Bound and Unconventional Monetary Policy.” *Journal of International Economics* 118: 200–216.

Online Appendix

Unless otherwise stated, the VAR model is estimated in levels with 2 lags and a constant, and the monetary policy shock is identified using the series of monetary policy surprises as an external instrument for the policy shock.

Appendix A. Conventional Policy Period (1993:M1–2008:M12)

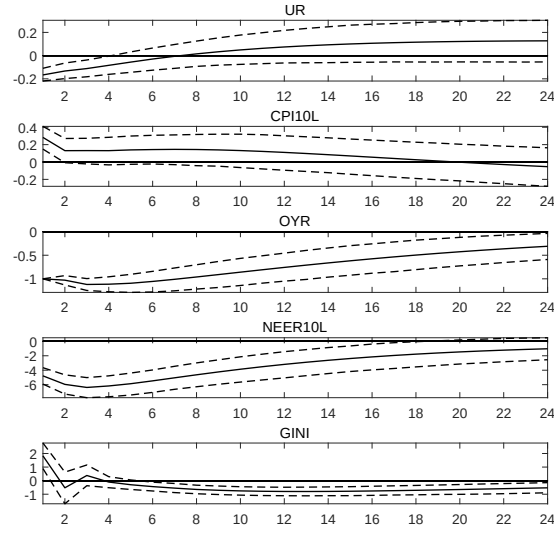


Figure A1. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Exchange Rate).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), the nominal effective exchange rate (NEER10L), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

Appendix B. Combined Period (1993:M1–2015:M1)

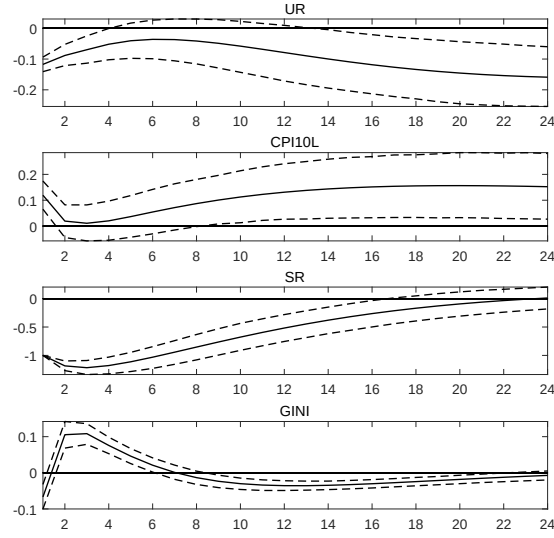


Figure B1. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Shadow Rate).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the shadow rate (SR), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

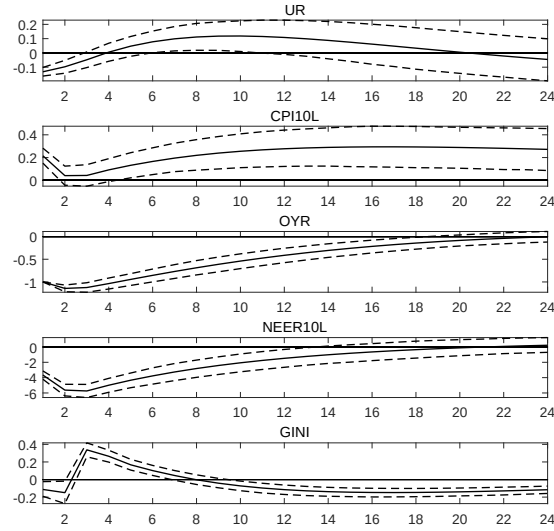


Figure B2. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Exchange Rate).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), the nominal effective exchange rate (NEER10L), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

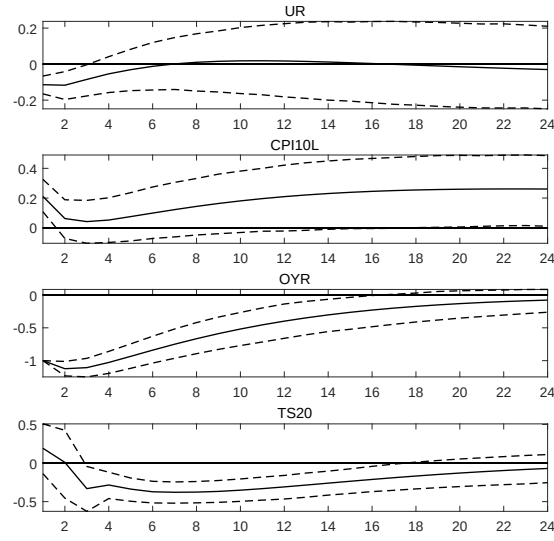


Figure B3. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Top 20% Income Share).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), and the income share of the top 20% (TS20). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

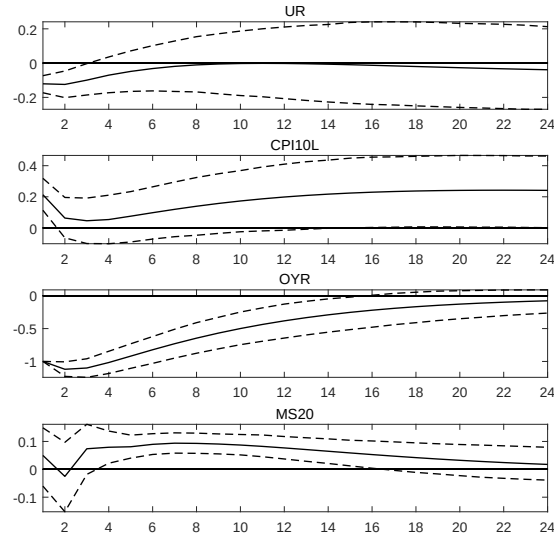


Figure B4. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Mid 20% Income Share).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), and the income share of the mid 20% (MS20). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

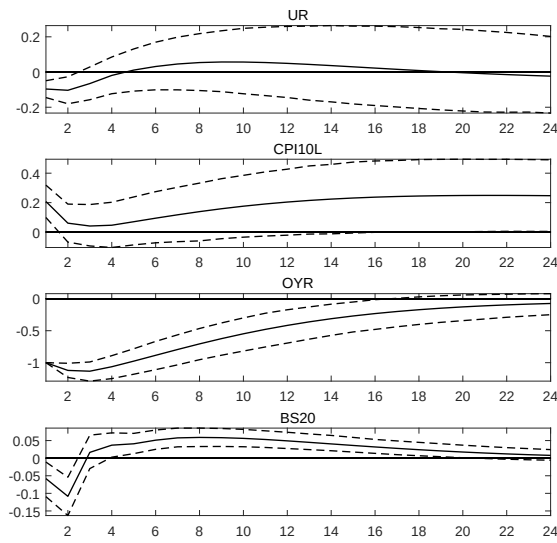


Figure B5. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Bottom 20% Income Share).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), and the income share of the bottom 20% (BS20). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

Appendix C. Unconventional Policy Period (2009:M1–2019:M12)

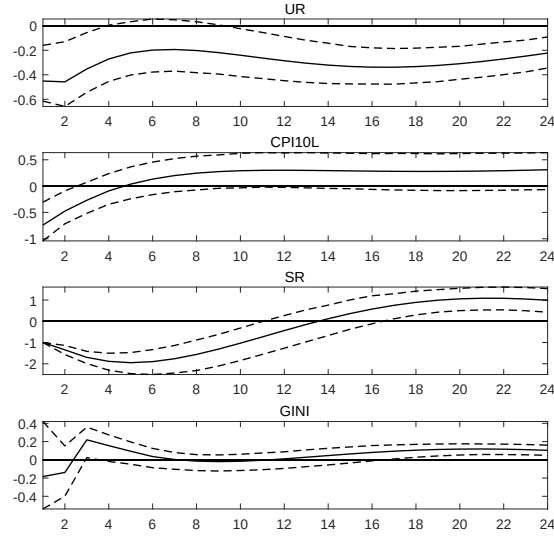


Figure C1. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Shadow Rate).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the shadow rate (SR), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

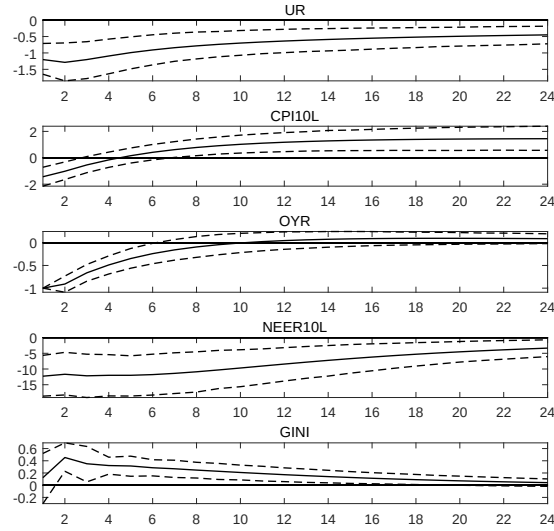


Figure C2. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Exchange Rate).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), the nominal effective exchange rate (NEER10L), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

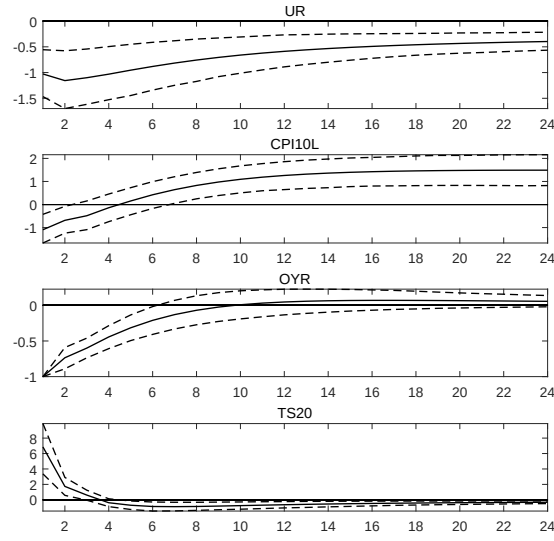


Figure C3. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Top 20% Income Share).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), and the income share of the top 20% (TS20). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

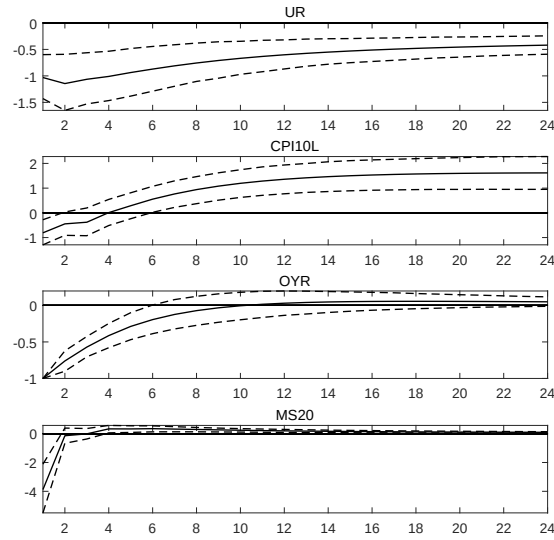


Figure C4. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Mid 20% Income Share).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), and the income share of the mid 20% (MS20). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.)

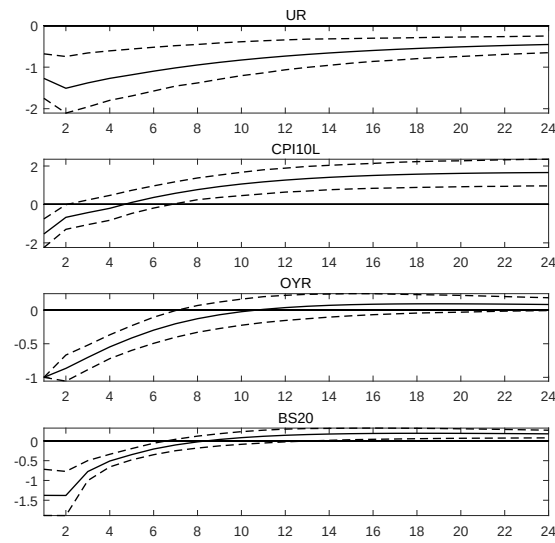


Figure C5. IRFs to a 1% Expansionary Monetary Policy Shock (The Model with the Bottom 20% Income Share).

Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), and the income share of the bottom 20% (BS20). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

Appendix D. Results with Share Prices

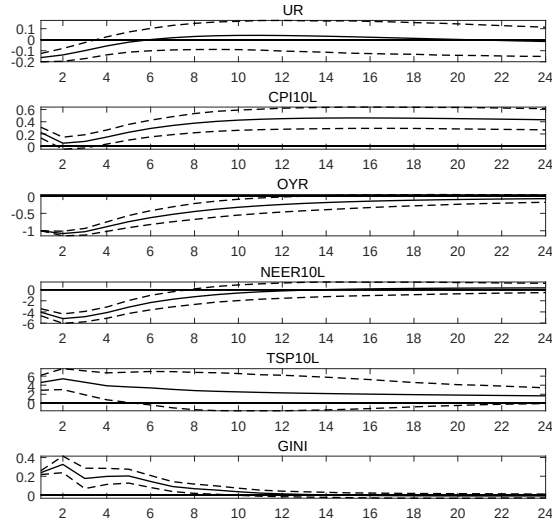


Figure D1. IRFs to a 1% Expansionary Monetary Policy Shock (Combined Period, 1993:M1–2015:M1).
Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), the nominal effective exchange rate (NEER10L), total share prices (TSP10L), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.

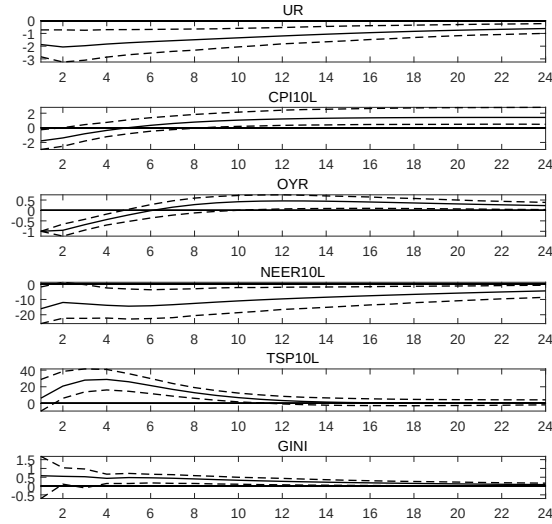


Figure D2. IRFs to a 1% Expansionary Monetary Policy Shock (Unconventional Monetary Policy Period, 2009:M1–2019:M12).
Note: The VAR model includes the following variables: the unemployment rate (UR), CPI (CPI10L), the one-year rate (OYR), the nominal effective exchange rate (NEER10L), total share prices (TSP10L), and the Gini index (GINI). The VAR model also incorporates the commodity price index and the volatility index as exogenous variables. The 68% confidence bands are provided.