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Title: Macroeconomic factors and crime rates

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Abstract

The main objective of this bachelor's thesis is to empirically demonstrate which economic factors affect crime rates. The methodology used in this research is a Panel model with robbery rates as the dependent variable.

After an extensive research on the existing literature and empirical evidence, I have chosen, as the regressors which could be significant on crime rates, unemployment rates, inflation rates and interest rates. Furthermore, to test the robustness of the model, this paper uses lags on both, dependent and independent variables and the Gini Coefficient, as an inequality indicator. As most of the research and articles addressing this issue focus on US data to estimate the impacts of macroeconomic factors on crime rates, I have used data from European countries with similar demographics and cultures for 20 years. Concretely, these countries are Spain, Italy, Germany, France, and Austria.

After using a Fixed-Effects Panel model, I have found that the only regressor significant to crime rates, even after all the variations done to test the robustness of regressors, is the inflation rate. This finding is consistent with most economists' results; the increase in prices raises the value of stolen goods and so the incentives to steal, so inflation affects positively the rise of crime rates.

Finally, this thesis also compares the empirical evidence found in published papers about the USA with the results found with real USA data, as well as comparing results from Europe and USA, which ultimately seem to share the same significant regressor: inflation rates.

Keywords

Fixed-Effects Panel Model, Inflation Rates, Interest Rates, Unemployment Rates, Crime Rates.

Abbreviations

ECB (European Central Bank)

WB (World Bank)

ECM (Error Correction Model)

FEM (Fixed-Effects Model)

OLS (Ordinary Least Squares)

US/USA (United States of America)

FRED (Federal Reserve Economic Data)

DW (Durbin-Watson)

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1 Introduction

To begin with, we can all agree how important are macroeconomic factors to our society, their fluctuations shape the economy we live in, and we are not exempt from its effects. As I previously state, macroeconomic factors, such as inflation rates or employment levels, are present in everyone's lives, therefore its impacts have been extensively studied, from different perspectives.

The aim of this bachelor thesis is to discover whether there exists a correlation between macroeconomic factors and changes in crime rates. The fact is that crime rates have been a common topic for research, particularly at the micro level; researchers try to discover which are the incentives that lead to individuals to engage in illegal activities. Nevertheless, in this thesis I want to study if exists a linkage between macroeconomic factors and crime rates, because it is reasonable to think that they might be related, as crime rates are not exempt from the effects of variations of the different macroeconomic factors. By doing some research on this topic I've found some existing literature which tries to address this issue. In brief, mostly all research papers agree on the existence of a correlation between the inflation and the increase of crime rates. After doing some exhaustive research on the topic, economists, having analysed several macroeconomic variables which could have an impact on the evolution of crime rates, they had found strong evidence on inflation. These findings are not surprising, as the effects of inflation are devastating for an economy, and as it is quoted in the research paper by Richard Rosenfeld and Aaron Levin (2016) "Inflation is the cruellest tax" - unknown.

The purpose of this paper is to deeply analyse, with real data, the effects of different macroeconomic factors, focusing on inflation, unemployment rates and interest rates set by the European Central Bank and how these affect crime in the European countries that constitute the monetary union. Also, to test evidence that these correlations exist.

Moreover, to discover if the United States and the European Union have the same effects on crime, due to the fact that most of the existing literature focuses on the USA to analyse this phenomenon- and at which level, inflation is statistically significant in the evolution of crime rates. Furthermore, to check for the robustness of the regressors and lastly to try to suggest policies to reduce crime and, depending on the findings we obtain with the different regressions, to find the right monetary and fiscal policies to help to decrease it.

The main tool this research uses are econometric models, specifically a panel model, and approximates it using a Fixed-Effects Panel model, working with the program Gretl. I have used panel data in order to avoid the necessity of an extensive data collection and to benefit from a better analysis of dynamic adjustments, in comparison with the limitations of cross-sectional data (P.Kennedy, 2008). Also, to perform robustness checks, this research uses OLS, in order to estimate the effects of macroeconomic factors on crime rates for the United States. Finally, this bachelor's thesis wants to prove, with real data, that different macroeconomic factors, concretely inflation, interest rates and unemployment rates, have a significant effect upon crime rates.

2 Theory

To begin with, I will do a brief review on the existing literature that relates crime rates with different macroeconomic factors. It is not surprising that this topic has been addressed frequently by economists, as Economics is a social science whose effects are decisive for society, they affect the population's behaviour, therefore it is crucial to study its effects.

Firstly, in Economics, society is composed of economic agents thus, criminals are found

inside this terminology. They also respond to the market stimulus and its conduct can be studied using an equilibrium study in an optimizing framework (Teles, Vladimir Kühl, 2004). Most economists have used as a baseline of its research the study on crime carried out by G. Becker (1968), and then they have tried to discover an economic model able to give an economic approach to criminal activity.

In the paper The Effects of Monetary and Fiscal Policies on Crime written by Vladimir Kühl Teles departs from the hypothesis that Monetary Policy can affect crime and that this relation should be studied according to the assumption that the government emits money to finance its deficit. To support his hypothesis, he considers a Sidrauski (1967) monetary growth model adding crime, as a diseconomy to production because it produces negative externalities, according to Becker's theory. Therefore, agents engage in criminal activities depending on the net gains from crime, considering income and punishment. Hence, its income function would remain as follows:

$$Y = f(k, o)[1 + \phi(k, o, \bar{o})] \tag{1}$$

where,

$$\phi(k, o, \bar{o}) = \begin{cases} 0 & \text{if } o = \bar{o} \\ > 0 & \text{if } o > \bar{o} \\ < 0 & \text{if } o < \bar{o} \end{cases} \tag{2}$$

Being Y income, $f(k, o)$ production function, being k capital stock and o number of hours spent on criminal activity. With $f_k > 0$, $f_o < 0$ and $\Phi(k, o, \bar{o})$ net income function of criminal activity where individuals choose the number of hours spent on criminal activity o, considering the average number hours of other agents $\bar{o}$.

Afterwards, Teles uses Sidrauski's model in order to maximise the utility function of

individuals, including criminal activity, subject to a budget constraint where the income is divided between monetary and physical assets. The maximization problem is the following one:

$$\begin{aligned} &\underset{c,m,o}{\text{Max}} \int_0^\infty U(c,m,o)\ e^{-\rho t} dt \\ &\text{s.t.} \qquad k + m = Y - c + x - \pi m \end{aligned} \tag{3}$$

Where k is initial capital stock, m represents real monetary balances, c consumption, x government lump-sum transfers, ρ is the temporal preference rate, and π is the inflation rate.

At the end of his research, after having solved the maximisation problem, the author provides us with interesting findings which I can use to develop my research question; With the Sidrauski model we can observe that ultimately, the impact of monetary policy can be captured through inflation. We find that:

$$x \equiv \sigma m = \pi m \Rightarrow \sigma = \pi \tag{4}$$

Being σ rate of monetary growth.

According to Vladimir K. Teles (2004) criminal activity is directly related to an increase in an agent's consumption, taking into consideration his proposition: Monetary policy affects crime if the agents' utility function is not additively separable. This is due to the fact that if the nominal and real variables are no longer independent then inflation plays a role in determining the level of criminal activity for individuals. He concludes his research paper by explaining that money may help to reduce crime's costs because if we think in an economy without money, then criminals would have to transport and exchange the stolen goods instead of just stealing money.

Another interesting approach to study the evolution of crime rates, is considering that the fewer the opportunities to profit from legal activities are, such as having a job, the more probable that gains will be sought through illegal activities. Therefore, lack of employment opportunities as well as low-paid jobs will generate incentives to engage in criminal activities (Tarling, R. and Dennis, R., 2016). That is the reason why considering unemployment rates may be significant in order to predict what influences crime rates to increase. Unemployment has been frequently addressed as a cause of crime rates and there has been evidence that indeed that reasoning was consistent with reality. Nevertheless, other researchers have found that the important factor is not whether people are employed or not, but the salary they earn; people with low income have greater incentives than with high-income (Machin and Meghir, 2004).

Poverty and social deprivation are also hypothesised to be related to crime rates and Pratt and Cullen (2005) found poverty to be one of the strongest and most stable predictors of crime in the US. That is the reason why regressors such as unemployment rates and inequality indicators may be important in order to estimate a regression for crime. A very good inequality indicator is the Gini coefficient, that measures the extent to which the distribution of income within a country deviates from a perfectly equal distribution (EUROSTAT, 2021). In the following graph we can observe how indeed there is a positive correlation between a higher Gini coefficient -which indicates more inequality among citizens- and higher robbery rates.

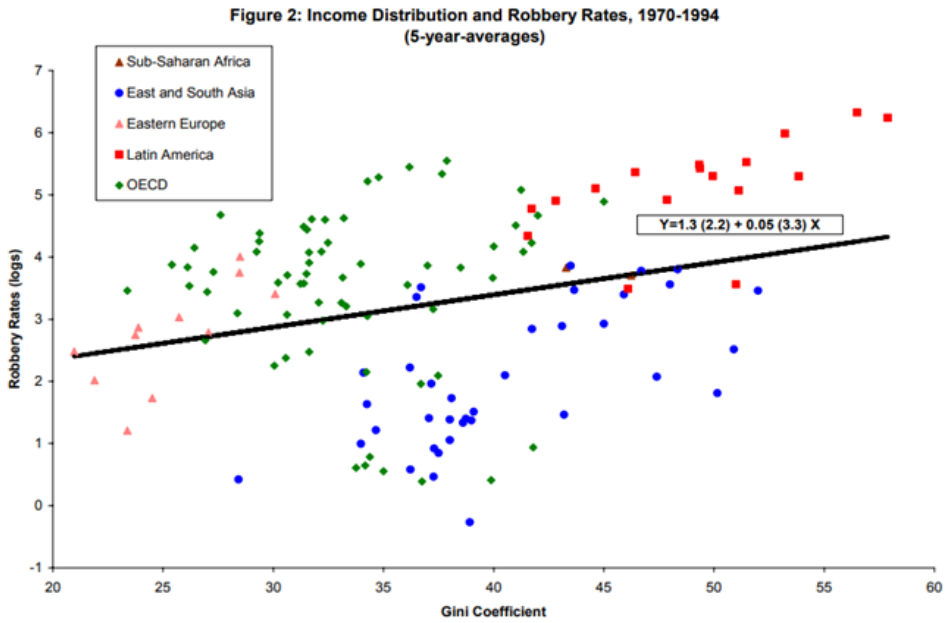

Figure 1: INEQUALITY AND VIOLENT CRIME* Pablo Fajnzylber Daniel Lederman Norman Loayza

3 Existing evidence

Despite that the aforementioned research has been certainly useful for understanding better the relation between criminal activities and macroeconomic factors, there have been several economists who have studied with real data the causality between these two factors, most of them -not to say all- have performed their research with US data.

In the paper Crime and Inflation in U.S cities written by Richard Rosenfeld, Matt Vogel and Timothy McCuddy they use a random coefficient linear panel model to estimate changes of inflation in acquisitive crime through time. Their initial hypothesis is that inflation has a significant and positive effect on city-level acquisitive crime rates.

The paper starts by explaining why they focus on inflation and no other macro-economic factors such as unemployment, and they explain, thanks to the contributions done in

this topic by Rosenfeld and Levin (2016), that inflation increases criminal activities due to the fact that the increase in prices raises the value of stolen goods. In other words, it becomes more attractive for consumers to steal products rather than buy them, as now they are more expensive than before. Moreover, with an increase in demand, it also boosts the incentives for thieves, robbers and burglars who provide stolen goods to underground marketplaces.

Firstly, the authors point out the differences between crime and commodity prices across states in the USA and explain that the national level data may differ to the local level. And they say that individual city studies can assist to fill in some of the remaining research gaps.

They have introduced the following parameters in order to carry out its regression: a measure of time of 11 five-year intervals and also socioeconomic and demographic indicators, which later have result to have a correlation among them ($\alpha = 0.74$) and have been combined into just one measure of socioeconomic disadvantage. Also, they assume that in this model, the parameters estimates are drawn from a random distribution common to the panels. Moreover, because the inspection of the pooled data indicated serial correlation (rho = .970, DW = .186), they added the first lag of the acquisitive crime rate to the explanatory variables, which seemed to solve the problems of the first-order serial correlation in the error term.

Notwithstanding the disparities in acquisitive crime levels, the cities show a similar pattern of acquisitive crime change across time. Also, one of the most crucial results obtained is that the lagged acquisitive crime rate and the inflation rate have significant effects on the change in the acquisitive crime rate, which supports the initial hypothesis. As we can observe in their results, a unit increase in inflation leads to 96.348 units increase in acquisitive crime per 100.000 population. Therefore, these results have been significant with the of objective of this bachelor's thesis, as they prove that macroeco-

nomic factors, specifically inflation, have an explanatory impact upon increases in crime rates. Nevertheless, this model goes beyond just studying the correlation between inflation and crime rates at national level, it also studies this phenomenon at the city level. Even though in my research I use different countries, I expect to have similar results as the ones in this study because it doesn't regress a linear regression model but a panel one, having different periods and different cities. So, these findings support the premise that rising prices cause customers to look for lower-cost alternatives. Stolen items are less expensive than those obtained legally and should be especially appealing to consumers in locations where average salaries fail to keep pace with inflation.

Another interesting article that studies what makes crime rates increase is the one done by Richard Rosenfeld and Aaron Levin titled Acquisitive Crime and Inflation in the United States: 1960–2012. The initial hypothesis follows similar patterns with the research paper explained before; inflation has an impact on crime rates, increasing them. The methodology used in this research paper is an error correction model to estimate the short- and long-run effects of economic conditions on crime rates. Also, they took into account the Akaike information criterion to choose the most robust and best-fitting models. They use a time-series data, as they just look for data for the US from 1960 to 2012. As the dependent variable they chose US robbery, burglary, larceny and motor vehicle theft rates with the name of "acquisitive crime index". And as the regressors, the authors of this paper choose unemployment, real median household income, real gross domestic product per capita (GDP), and an index of consumer sentiment (ICS). Also, their results have been that just inflation and consumer sentiment are statistically significant with acquisitive crime rates, expecting to have a raise of 49 crimes for 100.000 people for a one unit increase in the first difference of inflation.

This research paper uses ECMs to better analyse and separate short- and long-term effects of the variables to crime and the duration of the effects. By looking the results of

this research, we can observe that in all different types, except in robbery, inflation has a significant positive effect in short and long term, so the results of this regression model are consistent with the initial hypothesis. At the end, the authors give the conclusion that price changes impact crime rates through changing the incentives associated with the illicit purchase of consumer goods, according to rational choice theory. As inflation is more closely related to the price of stolen items than other economic variables, we expected that it would have a more robust effects on changes in acquisitive crime rates over time (Richard Rosenfeld, Aaron Levin 2016).

Furthermore, another interesting article which addresses this issue is the one done by Devine, Sheley, J. F., & Smith, M. D. titled Macroeconomic and Social-Control Policy Influences on Crime Rate Changes, 1948-1985. They use a time-series data for the United States that goes from 1948 to 1985, as they consider that this period experienced significant changes in crime rates. They use as independent variables unemployment rate, inflation, prison population rate and relief, as they are a combination of macroeconomic and socio-control factors. They use relief to express the quantity of public spending to aid families with unfavourable conditions. At the beginning of their analysis, they postulated that they expected a positive effect of inflation and unemployment rate for crime rates and a negative one for prison population rate and relief. They also introduce control variables, being the first, age structure of the population and the other one being criminal opportunity.

So, in order to find the estimates, they employed dynamic modelling techniques such as time-series difference equations to better observe how the changes in the independent variables affect changes in the dependent one, in this case crime rates. They used the first difference in crime rates as they expect that this data presents a high secular trend and they use three different dependent variables, homicide, robbery, and burglary rates, but I will just look at the last two as they are the ones which may have an economic

underlying reason. They run two different regressions; one with non-logged equations and the second one with log-transformed specifications, but results are quite similar, slightly better than the ones from the logged equations. First, they analyse the model with male unemployment, in order to control the age structure of the population and then they add the level of criminal opportunity. They found that their model, the one with non-logged equations, fit well robbery and burglary rates being all the regressors, except for changes in relief, statistically significant at 1%. Inflation is expected to have a positive impact, as well as male unemployment rates and the other a negative impact, as they predicted at the beginning of their research. When introducing the proportion of male population results also change: now inflation rate, in the case of burglary is not significant at any level and in the case of robbery just at a 5%. Unemployment remains as significant as before.

With the model with the level of opportunity, results are a little bit different; inflation is just significant at a 10%, in the case of burglary and a 5% in the case of crime rates whereas in the case of male unemployment rate in both cases still are significant at 1%.

They conclude their research by explaining that both, economic and social-control policy elements have an impact on crime rates, having different results for the different types of criminal activities. But the most relevant results for my thesis is that they found that an increase in unemployment motivates criminal activities and they explain that inflation is an issue that should be addressed in future research.

4 Empirical Model

4.1 Data description

To obtain the data necessary to approximate the model I have chosen the following variables: interest rates, unemployment rates and inflation rates. The dependent variable, obviously, was crime rates. Obtaining the useful and objective data was rather effortful, as in order to have a considerably large dataset I had to do exhaustive research. The sample I chose for this research are five countries with similar demographics, society, politics, and with comparable information, as evidently, all of them are countries which are members in the European Union, under the regulation of the Euro and the European Central Bank. These countries are Spain, Germany, France, Italy and Austria. The period of the panel data goes from 2001 to 2020.

Interest rate is a very relevant variable which can give me valuable information to help me develop the purpose of this bachelor thesis, as it is one of the main tools the European Central Bank uses in order to control the quantity of money circulating in a monetary area. It is a fundamental tool to regulate other variables such as inflation or unemployment. Because the sampling countries are members of a monetary union all of them follow the interest rates set by the European Central Bank, whose main aim is to keep prices stable, they have the same values for 20 years. Thanks to the European Central Bank website I have been able to obtain the interest rates for this panel data from 2001 to 2020. I have used the data from the marginal lending facility rate which offers overnight credit to banks from the Eurosystem. I have computed the annual values by doing an average of the different values of each month, in order to order the data for the panel regression.

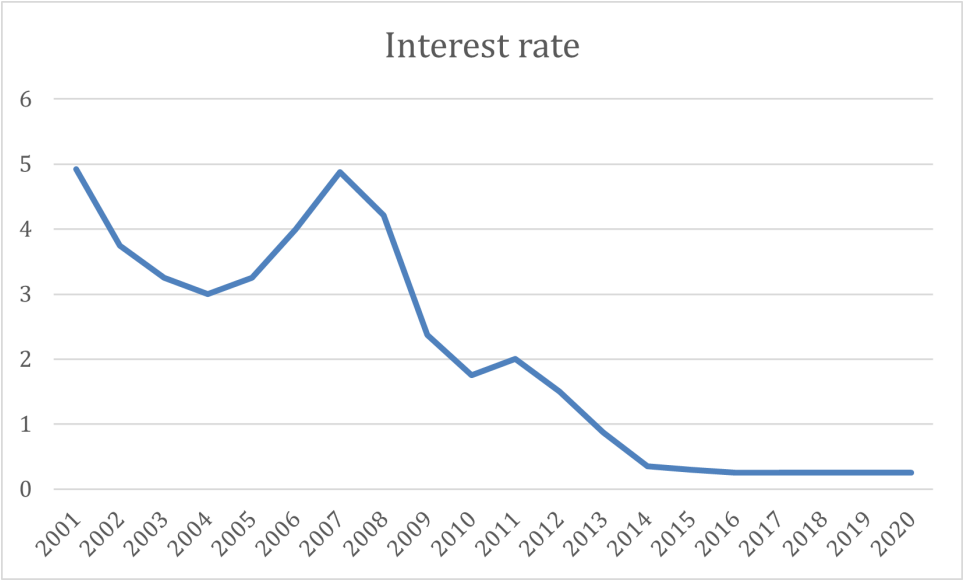

Figure 2: Marginal lending facility rate. Source: ECB

By looking at Figure 2, we can see how interest rates have decreased considerably with respect to previous years. We can observe that the highest values were reached in 2001 and 2007, achieving almost a 5% .

These values are not surprising as when central banks lower interest rates, it is less expensive to borrow, offering cheap liquidity. The ECB lowered official interest rates after the 2007-2008 financial crisis, in order to decrease tensions in capital markets.

Afterwards, as for the unemployment rates I have used data from the EUROSTAT - the home of high-quality statistics and data on Europe - named "Unemployment by sex and age". The unit of this variable is expressed in % of population in the labour force, from 15 to 74 years. The rationale behind the election of this variable is that an increase in unemployment rates might have a positive impact on crime rates, they might increase. People after losing their job might have more incentive to steal and that's why I believe that the effects of this variable on the dependent one can be significant. By looking at Figure 3, we can see that since after the financial crisis, 2007-2008, except for Germany, all countries have experienced an increase in its unemployment rates, being

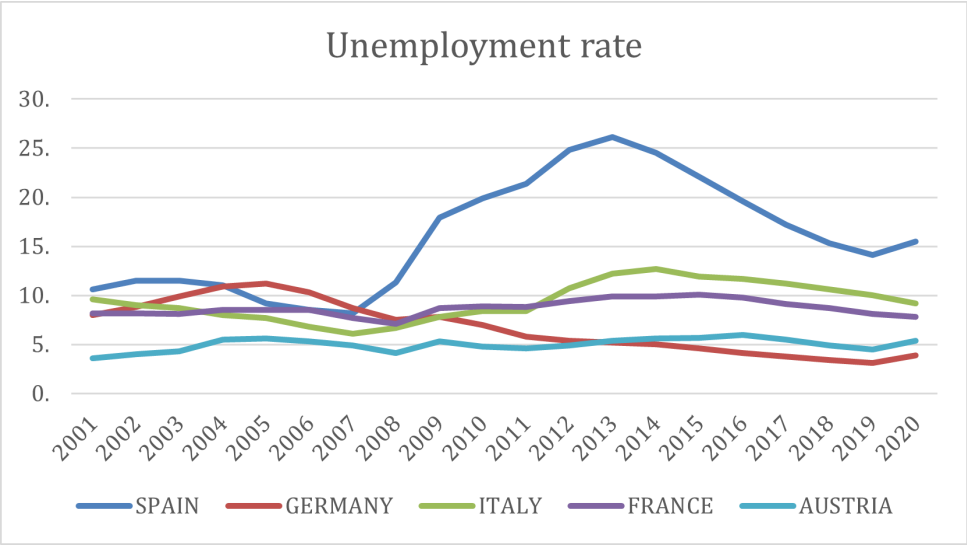

Figure 3: Unemployment rate (in %) Source: EUROSTAT

Spain the country with higher unemployed people expressed in % of population in the labour force.

As for the inflation rates, I have used the inflation rates from the World Bank, expressed in annual %. This data reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly (WB). This variable is heavily linked with interest rates, as during a period of high inflation a tool of CB is to also raise interest rates in order to slow the overheated economy. So, it wouldn't be surprising if there exists a correlation between interest rates and inflation. Thanks to Figure 4, we can observe how all five countries follow a similar trend; they reached a peak in 2007-2008 and another one in 2011-2012, and a minimum in 2009, 2015-2016. We can also see how Spain is the country with the most volatile and extreme values, arriving at a 4% of inflation in 2008 and a -0.5% in 2015.

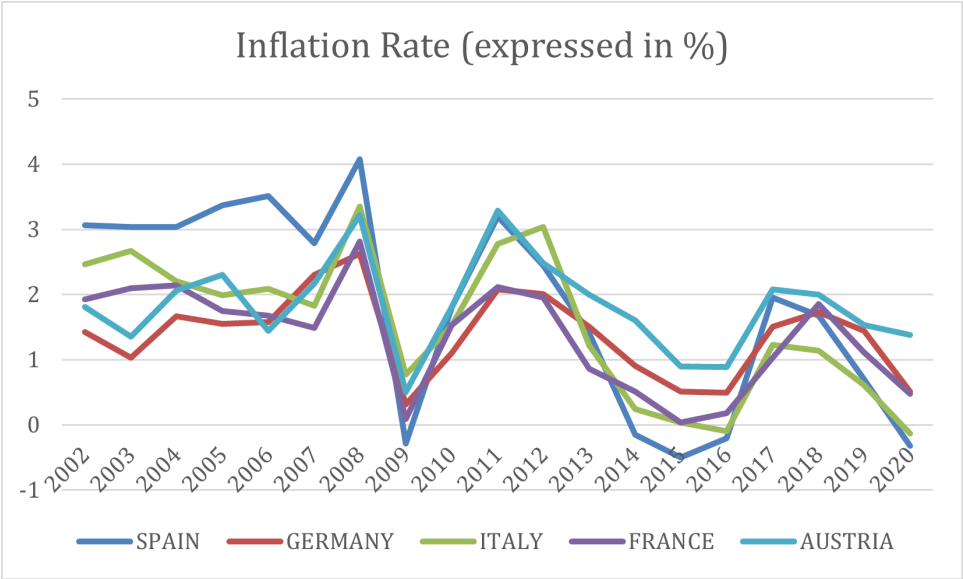

Figure 4: Inflation Rate (in %) Source: WB

And finally, as the dependent variable I have used crime rates, collecting the data from EUROSTAT as well. I have worked with the data from Crimes recorded by the police by offense category choosing as the kind of crime, robbery, as is the one which might have economic reasons behind it. The unit of these crimes was the number of robberies recorded each year, so in order to make it a rate I had to divide it by the population the country had each year -obtained from the World Bank- and afterwards multiply it by 100.000 people. So, by looking at Figure 5, we can see how it seems that crime rates are decreasing in all five countries. We can differentiate two types of trends, the countries which have had throughout the years a stable and low crime rate -Austria and Germany-, and the countries which had experienced more nonstationary data in crime rates – Spain, Italy and France-. Also, I have computed the increase in crime rates in order to study if there is a trend in the data. In order to obtain the increase, I have used the following formula ($\frac{crimerate_t - crimerate_{t-1}}{crimerate_{t-1}}$).

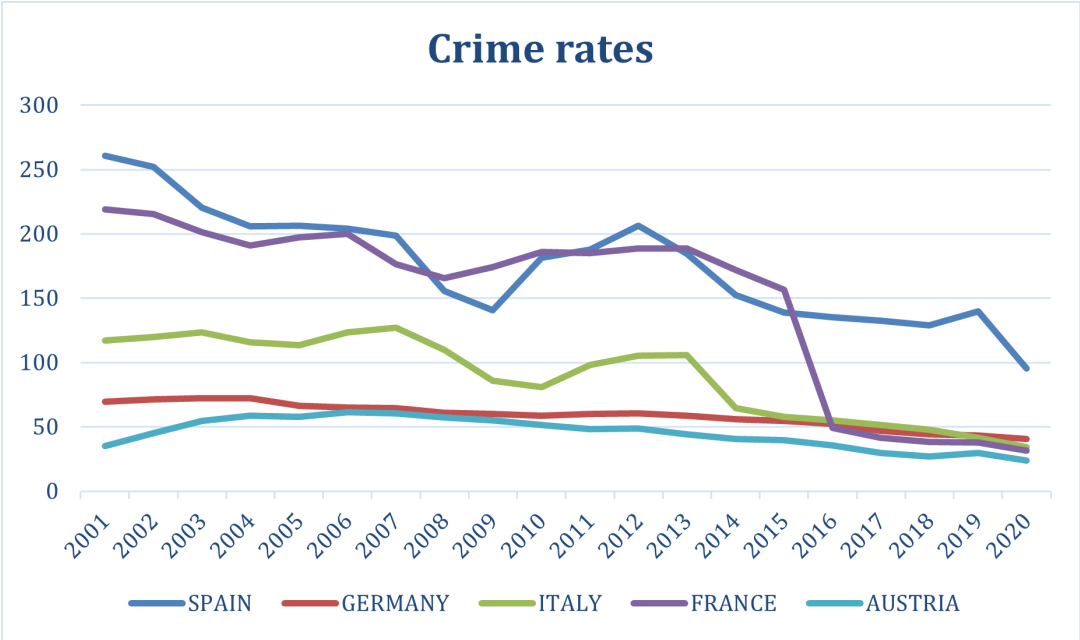

Figure 5: Robbery rate per 100000 people. Source: EUROSTAT

4.2 Model

To estimate this panel data, I have used a Fixed-Effects panel model with robust standard errors since using this model allows me to control for unobserved heterogeneity between nations and concentrate on how observable factors like inflation rates, interest rates, and unemployment rates are connected to crime rates in each country. The fixed-effects in this model represent the constant-time disparities in crime rates between nations, whereas the regression coefficients estimate the influence of the regressors on the crime rate within each country. The model I have based my research is the following one:

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + u_{it} \tag{5}$$

Being,

Crime Rate= Y

Inflation Rate= X_1

Unemployment Rate = X_2

Interest Rate= X_3

5 Results

5.1 Main results

After regressing my model, I have obtained the following results:

Table 1: Fixed-effects panel model with crime rates as the dependent variable.

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Constant	58.5640 *	−8.03847	−9.31822	−93.7704	−60.9217	−90.0596
Inflation Rate	8.38800 *	4.64202 **	4.54631 **	7.24853	4.66053 ***	4.42746 *
Inflation Rate t-1			1.15141			1.38018
Unemployment Rate	0.755978	0.722527	0.665836	0.843045	0.59063	0.689316
Unemployment Rate t-1			0.11985			−0.233326
Interest Rate	11.9459 *	1.66909	1.15966	14.0739	2.00745 *	2.90275
Interest Rate t-1			0.353576			−1.11776
Crime Rates t-1		0.867518 ***	0.859243 ***		0.86272 ***	0.871876 ***
Gini Coefficient				4.61696	1.65572	0.184645
Gini Coefficient t-1						2.34184

(1): Main model, section 4.2
(2): Model with lags on dependent variable
(3): Model with lags on dependent and independent variables.
(4): Model with Gini coefficient as a regressor.
(5): Model with Gini Coefficient and lags on dependent variable.
(6): Model with Gini Coefficient and lags on dependent and independent variables.

$p < 0.01 * **$
$p < 0.05 * *$
$p < 0.1*$

If we look at column (1), we can observe that the two regressors which are statistically significant, concretely at 10%, are inflation and interest rate. Therefore, for this model unemployment rate is not a macroeconomic factor which has an effect on crime rates, as I find that it is not statistically significant at any significance level. By looking at the sign of the coefficients of the significant regressors – inflation and interest rates- we can see how both regressors affect positively to the increase in crime rates. To be more precise, with this model, an increase of 1% in inflation expects to increase crime rates in 8.388 crimes per 100.000 people and an increase of 1% in interest rates expects to increase crime rates in 11.945 crimes per 100.000 people.

5.2 Robustness Checks

In the previous section we found that the relevant factors that affect crime rates are inflation and interest rates, which seem to increase crime rates. Nevertheless, we should study whether the results found before are robust or not. That is why I have introduced some variations in the model in order to check if, after all the modifications these regressors are still significant or not.

Firstly, this Model can present some autocorrelation problems as crime rates or other variables such as inflation may be influenced by past values, trends may have an influence on this regression model and also, I believe that there may be a delay in accommodating macroeconomic fluctuations and therefore, for period t, the relevant values may be the ones from one period before, t-1. That is the reason why I have introduced a lag structure, obtaining the following model:

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 Y_{it-1} + u_{it} \tag{6}$$

Being,

Crime Rate= Y

Inflation Rate= X_1

Unemployment Rate = X_2

Interest Rate= X_3

Indeed, we can observe in the following table, concretely in column (2), that a one period lagged crime rate is statistically significant at all levels, therefore, in the model seen before we can expect a bias. Going back to the model, an increase in one crime at t-1 expects to raise crime rates at t in 0.868 crimes by 100000 people. With this model we can observe that now interest rate is not significant anymore, but inflation rate is significant at 10% and 5%. So, we can say that with an increase of 1% in inflation we can expect an increase of 4.64 crimes per 100000 people. Moreover, we could include one lag on the regressors, to study whether or not we could have autocorrelation issues with the models seen before. With the introduction of the lagged regressors we can observe that the results are approximately the same as before, column (3), crime rates at t-1 are statistically significant at all levels and inflation rates are statistically significant at 10% and 5%. Therefore, with these findings we can answer most of our initial hypothesis: there exist a positive relation between crime rates and inflation, in all three models, therefore with our empirical model we can back up the finding of the existing literature on this topic and it seems that interest rates are not significant anymore. Moreover, we can observe that indeed there's an influence of past crime rates on current ones, as when we introduced crime rates t-1, this regressor is statistically significant at all levels, in both, column (2) and (3). Also, with this model we can add that monetary policy variables are the only ones that are significant on crime rates due to the fact that in any model unemployment is significant on crime rates but interest rates and inflation rates are.

In order to check the importance of inflation in order to predict crime rates, I have computed different regressions to verify the robustness of this regressor. By doing more research on this topic, I have found another potential regressor which could be included in the panel model to test what leads to changes in crime rates, the Gini coefficient. So, we can understand a little bit better the reason behind crime thanks to the research done by Becker (1968) and Kelly (2000) who conclude that crime rates depend on potential gains and opportunity costs, identifying income inequality as an indicator between the gains from criminal activities and its opportunity cost . Therefore, here we have a plausible causal of criminal activities: Inequality rates. That is the reason why I have also run a Fixed-Effects panel model with the Gini coefficient -with the same data as in Model 1 - and to test if the significant variables, concretely inflation, are still relevant when we add more regressors, to test the robustness of them. The model is the following one:

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + u_{it} \tag{7}$$

Being,

Crime Rate= Y

Inflation Rate= X_1

Unemployment Rate = X_2

Interest Rate= X_3

Gini Coefficient= X_4

By looking at the results -Table 1, column (4), (5) and (6)- we can observe that in the estimation without lags none of the regressors is significant. Nevertheless, when we introduce lags, results change; as we can see in the estimation including crime rates t-1, we find that inflation rates and crime rates are significant at 10%, 5% and 1%

and interest rate is significant at 10%. Furthermore, when we also introduce lags in the independent variables, we still obtain that inflation is statistically significant – now just at 10 and 5%- and crime rates at t-1. So, by doing some changes in the initial model we still have that as inflation rate increases, we can expect crime rates to increase. Moreover, we can say that crime rates are also heavily influenced by crime rates at t-1. As for the Gini coefficient is concerned, we don't find that is statistically significant for crime, this may be because when we plot the Gini coefficient evolution for the different countries we find that, more or less, they have the same values and they don't fluctuate a lot through time whereas crime rates, as we can see in the Graph 4 in the previous section, they fluctuate more and they differ across countries.

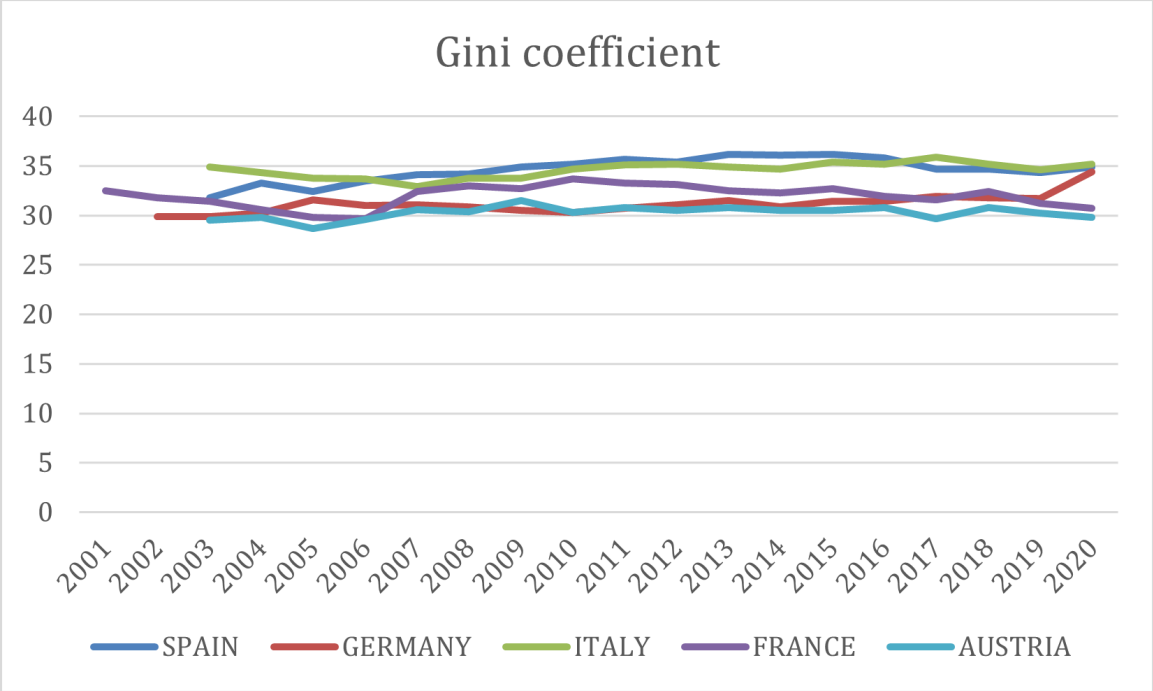

Figure 6: Gini coefficient. Source WB

Moreover, I have regressed the same panel model but having changes in crime rates as the dependent variable having obtained the following results:

Table 2: Fixed-Effects panel model with changes in crime rates as the dependent variable

	(2)	(1)
Variable	Coefficient	Coefficient
Constant	−14.5578 *	−16.9125 ***
Inflation	3.18435	3.99343**
Inflation t-1		0.35047
Unemployment	0.469457	0.195368
Unemployment t-1		0.334312
Interest Rate	0.879539	−0.901714
Interest Rate t-1		1.12283

(1): Model without lags.
(2): Model with lags on independent variables.

Now, if we look at Table 2, a Fixed-Effects panel model with increase in crime rates as the dependent variable, we can say that results are quite similar. In the model without any lagged variable, there are no significant regressors, just the constant. But when

we also introduce the lagged independent variables then we find that the inflation rate at t is statistically significant at 10% and 5%. With this model, an increase of 1% in inflation is expected to increase crime rates to 3.99 crimes per 100000 people. So, we can see that the values are quite similar to the ones found in Table 2 with lagged dependent and independent variables, without the Gini Coefficient.

Moreover, I want to check with data obtained from different official sources, the effects of macroeconomic factors on crime rates from the United States of America and compare them with the results obtained before for European countries. By doing these different regression models I want to observe whether or not inflation is still significant at any level, or if we should pay attention to any other macroeconomic factor. I have put my attention to inflation instead of any other variable as it is the regressor which has more significance in the different models seen before.

The data taken to run a regression for the US was the following one:

- Interest rates: Real Interest Rate, % Source: WB.
- Unemployment Rate: Unemployment Rate, Percent, Annual, Seasonally Adjusted. Source: FRED St.Louis
- Inflation Rate: Inflation, consumer prices (annual %) Source: World Bank.
- Crime Rate: Robbery Rate per 100000 inhabitants. Source: FBI website.

In order to obtain more reliable results, I have used the period that goes from 1985 to 2020, as it is easier to obtain a large quantity of data for just one country rather than for five. The model for crime rates in the US is the following linear regression:

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + u_t \tag{8}$$

and being,

Crime Rate= Y

Inflation Rate= X_1

Unemployment Rate = X_2

Interest Rate= X_3

After running an OLS, the results from the US are the following ones:

Table 3: Crime Rates in USA, OLS. Crime rates as the dependent variable

	(1)	(2)	(3)
Variable	Coefficient	Coefficient	Coefficient
Constant	−51.8358	−13.4683	−16.6595
Inflation Rate	20.2291 ***	5.71948 **	3.90346 *
Inflation Rate t-1			6.04834 ***
Unemployment Rate	14.9592 ***	0.783115	−0.518962
Unemployment Rate t-1			1.58415
Interest Rate	18.0517 ***	−0.0334442	−0.541010
Interest Rate t-1			0.67587
Crime rates t-1		0.942658 ***	0.879861 ***

(1): Model with lags on independent variables.
(2): Model with lags on dependent variable.
(3): Model without lags

First, by looking at the model without any lags, (1), we can observe that all three regressors are statistically significant at all levels, so we could say that for the USA, unemployment rate also affects crime rates, not only interest and inflation rates. Concretely, it says that all three regressors affect positively; an increase in 1% in interest rate expects to increase crimes in 18.05 crimes per 100.000 inhabitants, an increase in 1% in inflation 20.22 crimes and a 1% increase in unemployment rates 14.95 crimes per 100.000 inhabitants.

Nevertheless, when we include a lag on crime rates, in order to check if there is a trend in the regressor, we find that, as in Europe, crime rates in the past influenced actual crime

rates, as the regressor is statistically significant at all levels as well. Now, results change slightly, interest and unemployment rates are no longer significant whereas inflation rate is still significant but now at 10 and 5%. Moreover, when we introduce a lag on all regressors, we find that results don't change that much compared to those in model (2). The important variables in which we should pay attention are inflation rate -including the lag- and crime rate at t-1. It seems that inflation rate at t-1 has more impact on crime rate in t than inflation rate at t, it might be due to the fact that it takes time to accommodate changes in macroeconomic factors. A 1% increase in inflation rate at t-1 expects to increase 6.04 crimes in t per 100.000 people, and a 1% increase in inflation rate at t predicts to raise 3.90 crimes per 100.000 inhabitants. Also, this regression shows that crime rates at t-1 influences positively crime rates at t.

Therefore, we can say that results for the USA are quite similar to the ones for the European countries studied before; the most significant regressors are inflation rates and lagged crime rates.

Besides, it would be interesting to compare results seen before with the ones found by different economist and observe if results are similar and then be able to obtain more robust conclusions about the macroeconomic factors which affect crime rates.

I will take as reference the model that appears in the article "Crime and Inflation in US cities" done by Rosenfeld, Vogel and McCuddy, which I briefly explained in section 3. In their table of results, we can see that they also take into account the lag on acquisitive crimes. In their regression they use as a dependent variable the residual change in acquisitive crimes and as regressors inflation, income, social disadvantage and age 15-24, and they estimated two different models in which both include (b) the unstandardized regression coefficients and (β) the standardized one. In Model 1 they find that a one unit increase in inflation produces approximately 96 additional acquisitive crimes per 100.000 population. Also, they find that just the significant

regressors are inflation and the lag in acquisitive crimes.

Furthermore, in the article "Acquisitive crime in the US" also revised in the section 3, the results found are also consistent with my findings for crime rates in Europe and with the ones I found for the US. By doing ECMs, they find that the most influential variables for crime are inflation and imprisonment rates. Their results are the following ones: A one unit increase in the first difference of inflation produces an increase of 49 acquisitive crimes per 100.000 population. The results we find for Europe, are that – for example the FEM with lags in crime- an increase of 1% in inflation we can expect an increase of 4.64 crimes per 100.000 people.

So, as for the US is concerned, we can say that the existing evidence matches the results found with the OLS regression seen in Table 3. At the end, the only significant regressors are inflation rates and lagged crime rates. They both affect crime rates positively, meaning that, as they increase so does crime rates.

Now comparing the US with the European countries studied, we can see how inflation has a robust implication in crime rates, at it is significant for both models as well as crime rates at t-1. The other macroeconomic factors seem to not be related to crime rates.

6 Discussion and conclusion

We can obtain the robust conclusion that, by assessing different macroeconomic factors, inflation is the only one which is significant to the increase in crime rates. After having analysed with real data what affects the increase in criminal activities, concretely robbery rates, we can say that inflation rate is the only variable which seems to affect it, as it is the only one that throughout the different models has remained significant. Moreover, we can say that the models used in this thesis fit fairly well the findings and the evidence shown in the theory framework explained at the beginning of this thesis; the increase in prices raises the value of stolen goods and so the incentives to steal, so inflation affects positively the increase of crime rates. Despite the fact that I found similar results in inflation, when regressing my model, I did not find any significant effect for unemployment rates and very weak significances for interest rates. Also, another interesting finding of this research is that crime rates present some trend in the data so, criminal activities are not an isolated number which changes each year but an increasing percentage depending on the past, people are really influenced by previous years' criminal situation when they decide to engage in criminal activities. So, we can think that reducing, year by year the amount of crimes can imply a major reduction of crime rates in the near future.

Therefore, policy makers should focus on inflation in order to decrease criminal activities. In order to reduce the inflation levels in the economy they should implement contractionary monetary policies; Firstly, to use a tightening monetary policy in order to make borrowing more costly and consequently a reduction in prices leading to a decrease in inflation. Also, they could try to decrease the amount of money circulating in the economy by increasing the Reserve Requirements for banks as well as increasing the open market operations, selling government securities to commercial banks and the

public. Also, after this research we could think that an expansionary monetary policy could have the opposite effect on crime rates, increasing them, therefore in order to appease this problem policy makers should try to avoid this type of strategies. Obviously, it is not an easy task to modify macroeconomic factors without affecting others, and changes have to be addressed in the short and long run, having in mind that not all countries have the same characteristics, therefore, results might differ. There is not a magic formula, but we can think of different ways to ease and solve some imbalances.

I would like to end this research by trying to forecast, with the findings of this thesis, what will be the present and near future of criminal activities, concretely in Spain. Nowadays, after having been through a pandemic and a European war, society and the economy have been through a lot of turbulent times. Inflation is a recurrent topic among politicians, the CPI has increased drastically and households are going through really hard times. Thus, we can expect that this year and in a short-time future criminal activities, specifically robbery rates, will increase. So, politicians should act now in order to solve problems that can appear in the near future. Since this project has some limitation, it would be interesting, for future steps, to check if this model can be also applied to other countries with different demographics, culture, and politics, like in South America or Asia; to check if there exist some economic factors that affect crime rates regarding of the country. Also to check if applying contractionary monetary policies it is true that crime rates decrease, as it is predicted in this thesis.

To close up everything that has been stated so far, with the results of this research we can answer some of the questions and unknowns presented at the very beginning of the paper; we can expect inflation to have devastating effects upon crime rates, and we can expect a reduction in crime when implementing contractionary monetary policies.

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