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Empirical evidence on the relationship between material deprivation and crime: an analysis of the case of Spain

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Abstract

Severe material deprivation affects approximately 3 million people in Spain, having experienced a significant increase after the economic crisis of 2008. This phenomenon is relevant in the context of the economic approach to crime, as it is considered to have a positive impact on the incidence of delinquency. Despite the social magnitude of this problem, the majority of international research has overlooked the non-monetary dimensions of inequality, focusing almost exclusively on income inequality. This study aims to fill this gap by examining how material deprivation influences delinquency in the specific case of Spain. To do so, an indicator representing material deprivation is used, and a differences-GMM estimator is employed for 16 Spanish regions covering the period 2013-2019. The results indicate that in Spain, material deprivation is a criminogenic factor that should be taken into account, particularly when it approaches the threshold of severe material deprivation. Furthermore, it is found that both improvements in economic conditions and deterrent public policies are key factors in reducing criminality.

Keywords: *material deprivation; economic crime; Spain.*

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Introduction

In recent decades, socioeconomic inequality has increased in numerous regions worldwide due to the effects of globalization, the absence of effective redistributive policies, and recent economic crises, among other factors (Wenger et al., 2019). As a result, it has become one of the central focal points in political agendas of various governments and one of the key Sustainable Development Goals of the United Nations.

The reason behind this is that the growth of inequality leads to increasingly pronounced socioeconomic differences, creating a gap between the most affluent segments of the population and those who are economically disadvantaged. Such disparities in the distribution of wealth and opportunities result in various negative consequences at both individual and collective levels, aspects that have been investigated in recent years. Undoubtedly, one of the topics that has received significant attention in academic literature is the relationship between inequality and crime (Kim et al., 2022).

From various theories such as economic approach to crime (Becker, 1968), strain theory (Merton, 1938), and social disorganization (Shaw and McKay, 1942), it has been traditionally established that economic deprivation and resource scarcity are criminogenic factors that positively correlate with crime. On one hand, this is because they lead to an increase in motivation and utility for engaging in criminal actions (Ehrlich, 1973). On the other hand, they contribute to social tension and the erosion of community cohesion (De Courson and Nettle, 2021; Wilkinson, 2004).

However, the vast majority of these studies have focused almost exclusively on income inequality, neglecting the non-monetary dimensions of inequality (Clément and Piaser, 2021). This has occurred despite the recognition that the lack of basic material needs is also considered a determinant of crime (Ouimet, 2012) and the possibility that aggregate economic measures may not fully capture the reality of social conditions across different population strata (Santos et al., 2018).

To overcome this limitation, in recent years, the use of indicators that represent material deprivation has been adopted as a more comprehensive way of analyzing the various dimensions of social exclusion and poverty (Nolan and Whelan, 2010). Material deprivation is understood as the involuntary lack, rather than a personal choice or lifestyle, of a series of items considered necessary for adequate living conditions (Israel, 2016). These items may include not being able to afford a one-week vacation per year, not being able to eat meat or fish at least every two days, or not having the ability to cover unexpected expenses, among other factors.

The main objective of this study is to analyze how material deprivation affects crime in a specific case study: Spain. Following the economic crisis of

2008, severe material deprivation nearly doubled within just five years, affecting 7.1% of the Spanish population in 2014 (approximately 3 million people in a state of severe vulnerability). However, during this period, crime did not increase but rather decreased by 5 points (Figure 1). Conversely, when the Spanish economy recovered between 2014-2019 and the percentage of the population experiencing severe material deprivation decreased to 4.7%, crime did increase during these years by 3.3 points.

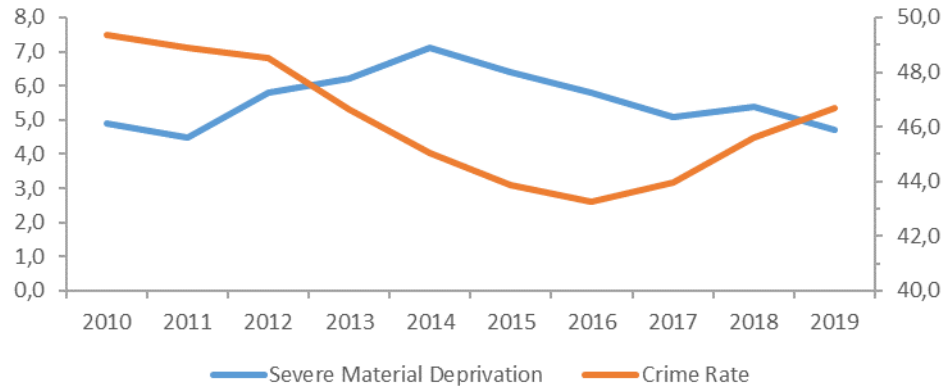

Figure 1. Crime Rate (right axis) and Percentage of Population in Severe Material Deprivation (left axis)

Source: Own elaboration based on data from the Ministry of Interior and the National Institute of Statistics

In Spain, severe material deprivation and delinquency have exhibited a seemingly contrasting trend over the past ten years, a phenomenon that initially contradicts theoretical premises. However, this apparent counterintuitive relationship does not automatically imply a negative correlation between these two variables. The observation of a divergent trend does not provide information about the direction and strength of the relationship between both variables, as additional factors and contextual complexities may influence this dynamic.

Therefore, it is essential to provide empirical evidence regarding the relationship between material deprivation and delinquency in the Spanish context to determine whether material deprivation serves as a potential criminological factor, as various theoretical premises suggest. This approach will contribute conclusions that effectively guide the management of this issue by public administrations.

This study represents a contribution to the existing literature for several reasons. Firstly, it examines the impact of non-monetary dimensions

of inequality on crime, an aspect that has not received sufficient attention thus far. Secondly, it is the first study on material deprivation and its effects on crime specifically for Spain, and one of the first at the European level. Lastly, it avoids the aggregation bias by not relying on a single decision model, but rather analyzes different types of criminal activities to account for the differences in the nature of these activities (Buonanno and Montolio, 2008).

To do so, a difference-GMM estimator is employed for 16 Spanish autonomous communities that covers the period 2013-2019. The intention of using this methodology is to control for possible endogeneity issues that may arise in models analyzing the influence of material deprivation on crime rates.

Theoretical framework is developed and a review of the issue is carried out. The methodology applied is discussed in the following section. The main results are presented in the fourth section, and finally, the conclusions of the research are summarized.

1. Theoretical Framework: The Economic Approach to Crime and Inequality as a Criminogenic Factor

The relationship between economics as the science of choice and its ability to analyze and design incentives that influence human behavior forms the basis on which the economic approach to crime has been built (Montero and Torres, 1998). This approach starts from the premise that criminals are rational individuals seeking to maximize their utility by engaging in criminal activities, as long as the potential gains outweigh the costs involved (Miceli, 2018).

In this manner, individuals assess the legal and illegal options available to them and choose the combination that maximizes their expected income, taking into account the costs they may face, such as detection or imprisonment (Ehrlich, 1973). A person obtains a utility U from their legitimate work, while if they decide to engage in criminal activity, they achieve a utility corresponding to the success of their action, U_s although it is conditioned by the disutility associated with punishment, U_f, considering the probability P of being apprehended (Kang, 2016).

$$(1 - P)U_s - PU_f > U$$

Thus, the relationship between economic conditions and crime is based on the hypothesis that worsening economic cycles will affect the motivation of potential offenders to engage in criminal activities due to an increase in the utility of such actions (U_s), as a result of difficulties in accessing the labor market (Becker, 1968).

At this point, Ehrlich (1973) asserts that income inequality also leads to an increase in the utility derived from engaging in criminal activities compared to that obtained from legitimate work. The reason behind this is that socioeconomic disparities not only raise the expected benefits of committing a crime but also create a stronger incentive among economically disadvantaged groups due to the presence of greater wealth in their surroundings compared to the low returns of the labor market (Tuttle, 2019).

Furthermore, the academic literature also establishes that socioeconomic inequality acts as a criminogenic factor that creates a fertile ground for an increase in criminal behavior (LaFree, 1999; McCall and Nieuwbeerta, 2007; Wilkinson, 2004): it amplifies social tension and the blocking of opportunities, diminishes the chances for certain segments of the population to achieve society's established goals, and reinforces social exclusion among the most disadvantaged population, among other consequences.

This occurs because affected segments of the population perceive the processes of wealth acquisition and distribution as unjust and inaccessible to them, which leads to two effects: (1) it weakens the belief promoted by more developed democracies that with effort and personal merit one can achieve a good social and economic position, and (2) it reinforces the idea that other external factors, such as being born into a well-positioned family, are key and determining factors (Jacobs and Richardson, 2008).

2. The Effects of Inequality on Crime: A Review of the Issue

Academic literature has extensively examined the effect of inequality on crime, primarily focusing on the most violent criminal typologies. A significant portion of these investigations agrees that an increase in inequality is positively correlated with the rise in violent crimes (Constantini et al., 2018; Fajnzylber et al., 2002; Goda and García, 2019; Kang, 2016; Rowhani-Rahbar et al., 2019). Among these studies, those that assert that countries or societies with high levels of inequality tend to have a higher homicide rate stand out (Blau and Blau, 1982; Enamorado et al., 2016; Li et al., 2019; Nivette, 2011; Ouimet, 2012; Santos et al., 2018; Torres Téllez, 2022; Wilkins et al., 2019).

There are also studies that claim that the effect of inequality on homicides is not as clear as it may seem, as the correlations they establish are

not statistically significant or even negative (Hu et al., 2015; Neumayer, 2003; Pridemore, 2011; Rogers and Pridemore, 2022; Stamatel, 2016). This has also been argued for other violent crimes, as determined by Allen (1996) or Bourguignon et al. (2003).

Socioeconomic inequality has also been presented as a criminogenic factor that positively influences various property crime typologies (Atems, 2020; Chiu and Madden, 1998; Choe, 2008; Constantini et al., 2018; Cortez and Eternod, 2021; Demombynes and Ozler, 2005; Stucky et al., 2015; Whitworth, 2012). In this regard, Wu and Wu (2012) assert that income inequality is an explanatory variable for crimes motivated by economic gain, while crimes lacking this element do not exhibit significant relationships.

Similarly to what occurs with violent crime, there are also studies that obtain contrasting results in relation to property crimes, as they find no effect when examining the impact of inequality (Allen, 1996; Bourguignon et al., 2003; Kelly, 2000; Neumayer, 2005) or even a negative effect (Brush, 2007; Kang, 2016).

2.1 Material deprivation as a representation of inequality

The vast majority of these investigations share a common focus on income inequality or a representation thereof, which is evident in a significant portion of the academic literature on this topic (Hicks and Hicks, 2014). To examine income inequality, various measures are employed, such as the Gini coefficient, the Thiel index, the Atkinson index, or the 20/80 income ratio of individuals or households (Robert and Willits, 2015).

Santos et al. (2018) suggest that aggregated economic measures may not fully capture the reality of social conditions across different population strata, particularly higher levels of social exclusion or the risk of falling into it. Ayllón and Gabós (2015) also emphasize this issue, as other variables used, such as per capita GDP or infant mortality, are likely to only represent the average wealth of a society and conceal the actual prevalence of material deprivation.

In recent years, attempts have been made to address these limitations in other branches of knowledge. Different indices have been used to capture the economic hardships individuals face and the relative deprivations they experience. Notably, material deprivation indicators have emerged, which, according to Nolan and Whelan (2010), help capture the multidimensionality of social exclusion and poverty. These indicators aim to provide a more comprehensive understanding of the lived experiences of individuals and the

various dimensions of deprivation they may face beyond purely economic measures.

Material deprivation is an indicator that is conceptualized based on the involuntary lack, rather than personal choice or lifestyle, of a series of elements considered necessary for adequate living conditions (Israel, 2016). Depending on which sphere of an individual's life it affects, it can be distinguished between basic lifestyle deprivation (lack of food, clothing, etc.), secondary lifestyle deprivation (inability to acquire a car or a phone), or housing facility deprivation (inability to afford housing-related bills, payment delays, etc.) (Achdut et al., 2021).

The importance of material deprivation lies in its potential to be considered as a precursor to poverty, particularly when the income of a family or an affected individual continues to decrease or when societal inequality widens (Ayllón and Gábos, 2015). In this way, a portion of individuals facing economic difficulties may go through this process before falling into poverty definitively, which generates tension and erodes social cohesion (De Courson and Nettle, 2021).

Although the impact of material deprivation on other factors such as health, well-being, and mortality has been studied (Blázquez et al., 2013; Cheung and Lucas, 2016; Gunnarsdottir et al., 2015; Osborne et al., 2015), there are relatively few investigations that examine how material deprivation affects crime rates in a country. Only two studies have been found on this topic: the study by Kujala et al. (2019), which found a positive relationship between material deprivation and fear of crime, and the study by Sun and Chen (2022), which concluded that multidimensional material deprivation is positively correlated with self-reported violent victimization among children.

Thus, this document aims to fill this gap by exploring how material deprivation impacts crime levels for the period 2013-2019 and, therefore, provide empirical evidence in this regard.

3. Methodology and data

Econometric models used to analyze the socioeconomic determinants of crime rates sometimes suffer from methodological errors that invalidate the obtained results (Atems, 2020). Among the most common issues is the problem of endogeneity, which, when present and not properly addressed, leads to poor specifications and biased estimations compared to the actual values (Bun et al., 2020).

Such endogeneity occurs because in these models, there is often a correlation between the crime variable and the error term for various reasons, including the following (Ihlanfeldt and Mayock, 2010):

1.- Reverse causality: Crime and some of the explanatory variables are determined simultaneously, meaning there is a reverse causal relationship between these two variables.

2.- Omitted variable bias: This occurs when two conditions are simultaneously met: (1) the omitted regressor is correlated with one or more of the explanatory variables in the regression, and (2) the omitted variable is a determinant factor in the dependent variable (Wooldridge, 2012).

3.- Inertia effect: Crime exhibits a certain degree of persistence, meaning that the commission of a criminal act can act as an inertia factor in the occurrence of subsequent criminal offenses (Glaeser et al., 1996; Fajnzylber et al., 2000). As a result, lagged crime rates are often included as explanatory variables in the analysis. However, this introduces further endogeneity issues since the lagged variable is correlated with itself, even if the idiosyncratic component of the error term is not serially correlated (Buonanno and Montolio, 2008).

One way to address these problems is to apply a lagged dynamic econometric model that includes instrumental variables to control for model endogeneity. Therefore, the use of dynamic generalized method of moments (GMM) estimators is common in analyzing the determinants of crime (Anser et al., 2020; Bun et al., 2020; Sugiharti et al., 2022; Zimmerman, 2014).

The Generalized Method of Moments (GMM) is an estimator that utilizes the dynamic properties of the data to generate instrumental variables based on the lags of the explanatory variables in order to correct for weak endogeneity in the model (Roodman, 2009). In other words, it employs internal instruments from the variables used, which reduces the difficulty of finding suitable and valid external instruments (Zimmerman, 2014).

Furthermore, thanks to the use of internal instrumental variables, the employed model allows for the inclusion of the lagged dependent variable as an explanatory variable (Muryani et al., 2021), controlling for the persistence exhibited by crime. It is also noteworthy that GMM requires weaker assumptions about the initial conditions of the data generation process and is robust to autocorrelation and heteroscedasticity (Bun et al., 2020).

3.1. The Difference GMM

The commonly prevalent dynamic GMM estimators are the Difference GMM and the System GMM (Roodman, 2009). In this case, the Arellano-Bond Difference GMM estimator (1991) is applied, which allows for proper modeling of crime and its explanatory factors, as will be demonstrated below.

One advantage of using the Difference GMM estimator instead of the System GMM, even though the latter may be more efficient at times, is that it

is less restrictive in terms of model assumptions (Baltagi, 2008). This allows for parameter estimation in a broader range of models, including those with weak exogeneity assumptions, as is the case in this study. This is because the Difference GMM does not require errors to be independently and identically distributed, enabling parameter estimation in a wider range of models (Roodman, 2008).

It is important to note that inference with dynamic GMM estimators is affected by the number of instruments included in the model (Roodman, 2008; 2009). The precision of inference using dynamic GMM estimators decreases in finite samples as the number of instruments approaches the sample size, which can bias the results obtained (Zimmerman, 2014). In the case of System GMM, part of its efficiency is achieved by using additional instruments, which can lead to a larger number of instruments (Wooldridge, 2012). Given the temporal dimension and the units of observation in this research, the Difference GMM estimator has been chosen in order to reduce the number of instruments and achieve precise inference.

The main idea behind GMM in differences is to use the first differences of variables over time to identify the parameters of the model. This is achieved by constructing a set of moment conditions, which are equations that relate the differences in variables to the model parameters. The GMM estimator then finds the parameters that minimize the difference between the sample moments and the population moments (Wooldridge, 2012).

By transforming the data into first differences, the invariant effects at the regional level are eliminated, as by construction the unobserved fixed effects remain constant over time (if the fixed effect does not vary, the changes in y_{it} are solely due to changes in the explanatory variables and errors). This allows for controlling the specific heterogeneity of each territory, thus avoiding the problem of omitted variables in the model (Baltagi, 2008).

The model estimated using this estimator is as follows:

$$\Delta lny_{it} = \alpha \Delta lny_{it-1} + \beta \Delta X'_{it} + \Delta \varepsilon_{it}$$

Where the index *i* corresponds to the region and *t* to the year; $y_{i,t}$ refers to the crime rate; $X'_{i,t}$ is the vector of explanatory variables, and finally, the error term is represented by $\varepsilon_{i,t}$.

To ensure the correctness of the developed GMM, it is necessary to check whether the parameters obtained from this estimator are consistent. This depends on whether the instrumental variables used are valid

instruments in the estimated regression. Two different specification tests are conducted for this purpose:

1.- The Sargan test checks the validity of the instruments used. Its aim is to identify overidentifying restrictions, that is, it is a chi-square test to determine if the residuals are correlated with the instrumental variables (Farzanegan and Gholipour, 2016).

2.- The Arellano-Bond test aims to check if the error term is serially correlated, which would invalidate the instrumental variables used. It is necessary for the first differences to be correlated at the first order since if this is not the case, it indicates the absence of dynamic effects. However, the differenced error term should not be serially correlated at the second order (Wooldrige, 2012).

3.2 Data

To analyze how material deprivation affects crime levels in Spain, this research has employed a balanced panel dataset with annual observations for 16 regions (autonomous communities[1]) covering the period 2013-2019.

By using regional-level data, the possibility of conducting more disaggregated estimations, which is common in other studies (Wenger, 2019), is foregone. The justification for this limitation is rooted in the objective of capturing the effects of material deprivation on the crime rate in Spain in order to draw conclusions that can inform more focused investigations. Additionally, the availability of neighborhood-level crime and inequality data in Spain is very limited and difficult to access, which makes it impossible to narrow down the study beyond a regional perspective.

The dependent variable used in this research is the crime rate per 1,000 inhabitants in its logarithmic form, and the data for this variable has been obtained from the Ministry of Interior. In addition, various subcategories of crimes are employed to examine whether material deprivation affects different types of crimes differently. These subcategories are collected by the Ministry of Interior in absolute terms, but they have been normalized per thousand inhabitants based on the population of the corresponding region using census figures published by the National Institute of Statistics.

[1] Spain is composed of 17 regions (autonomous communities) and two autonomous cities. However, its administrative and police structure is not homogeneous throughout the territory, which hinders the collection of statistical information. For this reason, the region of the Basque Country has not been included, as its autonomous police force does not provide certain data to the Ministry of the Interior (MIR), which is responsible for collecting information related to crime in Spain. The autonomous cities of Melilla and Ceuta have also been excluded due to the lack of information on certain variables used in the study.

The analyzed types of crimes are grouped into two categories: violent crimes and property crimes. Violent crimes include the subcategories of *injury* (which involves intentionally causing harm to another person through any means or procedure that impairs physical or mental integrity or health) and *homicides*. The second category consists of total property crimes (the sum of all crimes against property according to the Spanish Penal Code), *robbery with force* (which involves taking someone else's movable property by using force to access or leave the place where the property is located), and *theft* (which involves illegally taking or obtaining another person's property without their consent but without the use of force, threat, or violence).

The main explanatory variables of interest for this research come from the material deprivation indicator, which is derived from the Survey on Income and Living Conditions. Material deprivation is a relatively new criterion to reflect social exclusion and guide social policies in the European Union (EU). Its inclusion was established in 2009 with the aim of providing a clearer visualization of the different living standards within the EU after the accession of new countries (Verbunt and Guio, 2019).

The indicator of material deprivation determines that individuals experience material deprivation if they encounter at least three out of the following nine problems: (1) being unable to afford a one-week annual vacation, (2) being unable to have meat or fish at least every two days, (3) being unable to adequately heat their home, (4) being unable to afford a car, (5) being unable to have a telephone, (6) being unable to have a television, (7) being unable to have a washing machine, (8) lacking the capacity to handle unexpected expenses, or (9) experiencing delays in paying expenses related to their main residence in the past twelve months.

Two variables are used, namely "lack_2" and "lack_3," which represent the percentage of the population in each region experiencing deprivation of two or three of the aforementioned concepts. An additional variable called "lack_4" is included as well, as the Europe 2020 Strategy sets a threshold of four items for material deprivation to be considered severe deprivation (an indicator of severe vulnerability). The use of these three variables allows for an evaluation of at what point material deprivation becomes a factor influencing crime.

Other control variables that, according to the academic literature, may influence the crime rate have also been included. Table 1 presents all the variables, which were obtained from the INE, except for the rate of solved crimes, which is extracted from the MIR.

Table 1. Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev.
Lack_2	31.137	56.800	11.900	10.864
Lack_3	13.751	30.100	4.100	5.740
Lack_4	5.085	15.000	0.300	2.668
Male 16-19	1.917	2.402	1.422	0.220
Unemployment	18.815	36.220	8.240	6.316
Educartion	34.962	53.400	22.600	7.130
GDP	0.416	6.664	-2.160	4.239
Homicide	0.021	0.054	0.007	0.008
Theft	12.479	31.058	3.974	6.002
Injury	2.148	3.569	1.236	0.451
Property	28.921	55.388	15.507	10.633
Robbery with force	6.151	13.125	1.856	2.407
Total crime	38.908	67.564	23.535	11.918
Clearance rate for homicides	95.723	186.667	62.500	11.159
Clearance rate for theft	19.367	33.076	9.615	4.757
Clearance rate for injury	82.971	94.284	47.981	7.470
Clearance rate for property crime	20.479	29.181	12.802	3.798
Clearance rate for robbery with force	17.505	30.645	7.380	4.569
Clearance rate for total crime	38.558	49.927	23.907	6.698
Observations	112			

The percentage of the male population aged 16 to 19 is used, as criminal activity emerges and increases during the early stages of adolescence and then begins to decline as individuals mature (Loeber et al., 2011). Consistent with this notion, it has been argued that young males are the ones who commit the most crimes (Grogger, 1998; Witte and Witt, 2002). Additionally, the percentage of the adult population aged 25 to 64 who have completed 1st and 2nd cycle of higher education and doctorate degrees is included as a protective factor, as higher levels of education are associated with greater returns in the labor market, thus increasing the costs of engaging in delinquency (Buonanno and Montolio, 2009).

The deterrent efforts by public authorities to increase the disutility of criminal actions and discourage the motivation of offenders are represented by the rate of crimes cleared per 1,000 criminal offenses (when there is full identification of the perpetrator, verified confession, or conclusive evidence; or when the investigation shows that no offense occurred) for each analyzed

subcategory. Economic theory suggests that the higher the probability of being apprehended, the higher the opportunity cost of committing a crime, and the lower the incentive to engage in such behavior (Becker, 1968). In this sense, if more crimes are solved, the chances of being apprehended increase.

Finally, two variables have been included to control for the impact of economic conditions on different types of crimes: the growth rate of the Gross Domestic Product (GDP), which can be considered as an indicator of the prosperity level of a territory, and the unemployment rate, which is also commonly used as a proxy variable for economic performance (Altheimer, 2008; Lin, 2007).

4. Results

The first approach is to analyze how material deprivation affects the overall level of delinquency (Table 2). For this purpose, three regressions are estimated, each including a different degree of material deprivation: in the first case, the absence of two items, then the lack of three items, and finally, severe material deprivation (four items). The objective is to determine from how many elements material deprivation can become a criminogenic factor that positively influences the crime rate.

The results shown in Table 2 indicate that material deprivation of two items has no influence on delinquency. However, it is when individuals experience up to three material deprivations that an increase in criminality occurs (with an elasticity of 0.05). Severe material deprivation also has a positive impact on delinquency levels, as a 10% increase in severe deprivation would lead to a 0.2% increase in overall delinquency.

Table 2. Analysis of the impact of material deprivation on the total crime rate

	Total crime		
Total crime (-1)	0.456	0.489	0.539
	[0.069]***	[0.092]***	[0.091]***
Lack_2	0.002		
	[0.036]		
Lack_3		0.046	
		[0.014]***	
Lack_4			0.023
			[0.005]***
Male 16-19	1.288	1.550	1.534
	[0.307]***	[0.282]***	[0.301]***
Unemployment	0.124	0.132	0.127
	[0.048]***	[0.042]***	[0.049]***
Education	0.196	0.323	0.228
	[0.276]	[0.125]***	[0.154]
Clearance rate	-0.110	-0.146	-0.103
	[0.115]*	[0.073]**	[0.064]*
GDP	-0.005	-0.006	-0.005
	[0.002]***	[0.002]***	[0.002]***
Sargan test	0.22	0.33	0.37
Instrument delay order	2	2	2
Serial correlation AR(1)	0.09	0.09	0.06
Serial correlation AR(2)	0.474	0.72	0.303

The standard errors, reported in parentheses, are robust to heteroscedasticity and autocorrelation (Arellano, 1987). ***, **, and * indicate a coefficient significant at the 1%, 5%, and 10% levels, respectively. First-difference transformation is used. All variables are instrumented using lag t – 1. All variables are in their logarithmic form except for GDP.

The remaining variables used generally align with expectations. Firstly, the inertia factor of crime shows a positive and statistically significant relationship in all three regressions. Secondly, the deterrent factor is crucial for reducing crime, as a 10% increase in cleared crimes is associated with a decrease in the crime rate of up to 1.5%. Thirdly, economic improvement is crucial for reducing overall crime levels in Spain: unemployment shows a positive relationship, while GDP is negatively correlated in all three regressions (with a reduction of up to 0.5%).

To further explore how the incidence of material deprivation affects crime and gain a better understanding of this relationship, the association between material deprivation and specific crimes within the categories of property crimes and violent crimes has also been analyzed.

Table 3. Analysis of the impact of material deprivation on property crimes

	Property Crimes								
	Total	Total	Total	Theft	Theft	Theft	Robbery with force	Robbery with force	Robbery with force
Crime (-1)	0.511	0.544	0.506	0.267	0.309	0.247	0.511	0.531	0.545
	[0.092]***	[0.091]***	[0.100]***	[0.121]**	[0.107]***	[0.094]***	[0.099]***	[0.086]***	[0.090]***
Lack_2	-0.021			0.005			0.017		
	[0.039]			[0.017]			[0.037]		
Lack_3		0.016			-0.015			0.004	
		[0.010]			[0.018]			[0.051]	
Lack_4			0.016			0.003			0.033
			[0.008]*			[0.008]			[0.015]**
Male 16-19	1.392	1.300	1.379	-0.080	-0.215	0.123	1.257	1.184	1.529
	[0.665]**	[0.313]***	[0.480]***	[0.297]	[0.243]	[0.233]	[0.460]***	[0.468]***	[0.453]***
Unemployment	0.176	0.137	0.144	0.082	0.069	0.111	0.258	0.228	0.248
	[0.096]*	[0.052]***	[0.076]**	[0.074]	[0.071]	[0.026]***	[0.029]***	[0.058]***	[0.050]***
Education	0.033	0.067	0.062	-0.363	-0.333	-0.381	-0.276	-0.482	-0.386
	[0.302]	[0.120]	[0.222]	[0.151]***	[0.162]**	[0.158]***	[0.171]*	[0.501]	[0.272]
Clearance rate	-0.244	-0.275	-0.229	-0.106	-0.094	-0.158	-0.113	-0.080	-0.101
	[0.077]***	[0.032]***	[0.048]***	[0.061]*	[0.071]*	[0.077]**	[0.032]***	[0.064]	[0.034]***
GDP	-0.002	-0.002	-0.003	-0.012	-0.013	-0.011	-0.003	-0.001	-0.002
	[0.005]	[0.002]	[0.003]	[0.003]***	[0.003]***	[0.003]***	[0.003]	[0.005]	[0.003]
Sargan test	0.23	0.16	0.24	0.33	0.31	0.42	0.12	0.12	0.162
Instrument delay order	2	2	2	5	5	5	2	2	2
Serial correlation AR(1)	0.051	0.054	0.042	0.01	0.005	0.042	0.067	0.054	0.054
Serial correlation (2)	0.431	0.342	0.987	0.385	0.385	0.552	0.121	0.133	0.13

Regarding total property crimes, material deprivation does not have any effect until individuals experience severe material deprivation (four items). A 10% increase in material deprivation would lead to a 2% increase in the rate of property crimes.

When analyzing subcategories of property crimes, there are substantial differences that seem to correspond to the severity of the specific crime. In the case of burglaries, material deprivation is not a determining factor until it reaches a severe level (0.3% increase). However, this is not the case for thefts,

as material deprivation is not a determining factor for this type of crime under any circumstances.

The inertial factor in property crimes also establishes a positive relationship, resulting in a 0.5% increase in this type of crime, similar to the findings of Buonanno and Montolio (2009). This holds true for both thefts and burglaries, as the inertial effect leads to a 0.3% increase in thefts and a 0.5% increase in burglaries in all regressions. Additionally, deterrence once again proves to be crucial for all three analyzed crime categories. However, GDP growth is not determinative for burglaries but is significant for thefts and the overall property crime rate.

Table 4. Analysis of the incidence of material deprivation on violent crimes

	Violent crime					
	Injury	Injury	Injury	Homicides	Homicides	Homicides
Crime (-1)	0.111	0.036	0.120	0.017	0.010	0.051
	[0.069]*	[0.065]	[0.064]**	[0.145]	[0.124]	[0.133]
Lack_2	0.016			-0.140		
	[0.024]			[0.118]		
Lack_3		0.054			-0.092	
		[0.025]**			[0.067]	
Lack_4			0.024			-0.059
			[0.010]**			[0.043]
Male 16-19	0.616	0.610	0.527	-0.725	-0.682	-0.792
	[0.327]**	[0.331]**	[0.331]*	[5.402]	[4.972]	[6.029]
Unemployment	-0.287	-0.062	-0.045	-1.289	-1.262	-1.406
	[0.058]	[0.059]	[0.053]	[0.785]*	[0.726]*	[0.871]*
Education	0.009	-0.003	0.017	-0.990	-1.085	-1.029
	[0.126]	[0.113]	[0.159]	[0.558]*	[0.521]**	[0.512]**
Clearance rate	-0.035	-0.033	-0.031	0.147	0.127	0.164
	[0.066]	[0.059]	[0.097]	[0.320]	[0.290]	[0.279]
GDP	-0.006	-0.008	-0.007	-0.024	-0.020	-0.024
	[0.002]***	[0.002]***	[0.002]***	[0.020]	[0.017]	[0.021]
Sargan test	0.32	0.33	0.3	0.37	0.35	0.33
Instrument delay order	2	2	2	3	3	3
Serial correlation AR(1)	0.03	0.08	0.1	0.041	0.016	0.019
Serial correlation AR(2)	0.343	0.381	0.413	0.663	0.576	0.705
Observations.	112	112	112	112	112	112

The standard errors, reported in parentheses, are robust to heteroscedasticity and autocorrelation (Arellano, 1987). ***, **, and * indicate a coefficient significant at the 1%, 5%, and 10% levels, respectively. First-difference transformation is used. All variables are instrumented using lag t – 1. All variables are in their logarithmic form except for GDP.

In the case of violent crimes, material deprivation increases the incidence of injury by 0.02%-0.05% when experiencing deprivation of at least three items. In this type of crime, the percentage of males aged 16 to 19 is a key variable, justified by the fact that it is an age characterized by impulsivity,

less self-control mechanisms, and increased engagement in nighttime leisure activities (Loeber et al., 2011). Additionally, in this case, the deterrent factor does not have any effect, as these crimes often occur impulsively or in unplanned situations, and the penalties associated with them are relatively low, making it possible for anyone to commit this type of offense.

For the homicide rate, none of the three levels of material deprivation have any impact on it, which aligns with the findings of studies conducted by Pridemore (2011) and Hu et al. (2015). Thus, except for unemployment and the educational attainment of the population, which both reduce the homicide rate by 1.25% and 1% respectively, the remaining variables are not significant in explaining the variation in the homicide rate.

5. Conclusions

The objective of this study has been to analyze the impact of material deprivation on crime in Spain during the period 2013-2019, aiming to provide empirical evidence on this relationship. This research represents one of the first studies at the European level and the first comprehensive analysis for the Spanish case. The most notable findings obtained are as follows.

Firstly, it is observed that the impact of material deprivation on crime becomes significant when individuals experience up to three different forms of deprivation. This indicates that deprivation becomes a crucial factor in the crime rate. Moreover, severe material deprivation, characterized by the absence of four items, is identified as a criminogenic factor that has a positive influence on the levels of crime in Spain.

Secondly, material deprivation is found to increase the crime rate in four out of the six types of crimes analyzed. In the case of property crimes, it does not have an effect until severe material deprivation is present, indicating a significant vulnerability. This suggests that the growth of material deprivation plays a differential role depending on the severity of the crime and the potential economic reward available to the offender (typically, robberies yield higher profits than thefts). On the other hand, material deprivation has no effect on homicides, and its effect on assault is relatively small. These findings are consistent with existing literature, which suggests that socioeconomic variables have a stronger explanatory power in crimes driven by economic gain (Wu and Wu, 2012).

In conclusion, these results indicate that material deprivation in Spain is a criminogenic factor that should be taken into account. However, it becomes a significant issue for levels of security when it approaches the threshold of severe material deprivation. Therefore, public policies should aim

to prevent individuals from crossing this threshold in order to avoid not only the social gravity associated with it but also increases in crime rates.

Furthermore, the improvement of economic conditions is found to be crucial as it reduces crime in all analyzed types of offenses, except for homicides. Public policies aimed at deterrence also prove to be key in reducing criminality, except in the case of theft, where it is possible that the penalty, not being sufficiently deterrent, fails to discourage the commission of such offenses. Thus, these results align with the economic approach to crime and the premises established by Becker (1968) and Ehrlich (1973).

Nevertheless, it is crucial to bear in mind that the relationship between material deprivation and delinquency is not straightforward and may vary significantly depending on the region or city under analysis. The reason for this lies in the existence of highly relevant mediating variables, such as the magnitude of socioeconomic disparities or social cohesion, which can either amplify or diminish this relationship. Thus, it appears necessary for future lines of research to concentrate on the interaction between social differences and material deprivation in order to strengthen the results of this study. This, in turn, can contribute to a more targeted approach in the implementation of public policies aimed at addressing these issues.

Finally, one limitation of this study, which also suggests potential avenues for future research, is that the regional-level analysis lacks specific information and associations that directly impact cities and neighborhoods. This is crucial for developing targeted local policies to address this issue.

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