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Child material deprivation: within region disparities by degree of urbanization

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Abstract

This paper analyzes the impact of the degree of urbanization on child material deprivation by region in Spain. Using the EU-SILC 2009 and 2014 special module on material deprivation, we find that living in a city or town, with respect to a village, increases child material deprivation to a larger extent than household material deprivation and income. The effect of income becomes larger only among households with the largest deprivation (top quintile). Differentiating by needs, children's basic needs provision does not respond to household material deprivation, income or degree of urbanization, whereas educational/leisure needs provision does. Finally, our results support the idea that regions with sufficiently high densely populated areas increase children's material deprivation. Our findings might be of help for politicians and policymakers to design more effective policies intended to alleviate the incidence of child material deprivation that go beyond income-related programs.

Keywords: Child and household material deprivation, hierarchical data, degree of urbanization, regional disparities.

JEL-Codes: C30, I32, R20

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1. Introduction

Child material deprivation and social exclusion are a widespread and persistent problem in most developed countries and have become a relevant issue on the political agenda of the majority of governments in the last few decades. It has usually been assumed that children and adults within the same household have similar deprivation levels and needs. However, recent studies have demonstrated that the needs and living standards of children can differ from those of adults although they live in the same household (see, for instance, Grodem, 2008; Bárcena-Martín et al., 2017b; Guio et al., 2018, 2020). Fighting child poverty and investing in children's well-being has featured on the European Union (EU) agenda for many years as reflected in the Europe 2020 strategy. In particular, among other goals, the EU Recommendation calls on Member States to "(reinforce) statistical capacity [. . .] where needed and feasible, particularly concerning child deprivation." These goals were also taken up again in the 2030 Agenda for Sustainable Development and the European Pillar of Social Rights (11th goal "Childcare and support to children").[1]

At the same time, numerous countries have experienced a substantial change in urbanization levels in the last decades. It is expected that more than 70% of the population will live in urban areas in the near future (United Nations, 2018). The European Union has been promoting different initiatives and programs to advance urban development (i.e., the URBAN Initiative of 1994–2006 and European Cohesion Policy initiatives since 2007) and enhance economic development and social integration in deprived neighborhoods of medium-sized and large cities. This goal also appears in the 2030 Agenda (11th goal "Make cities and human settlements inclusive, safe, resilient and sustainable"). Cities are disproportionately wealthy and associated with poverty. Thus, urbanization and the reduction of poverty and deprivation are relevant to achieve sustainable development, which should be considered not only on a national scale, but also on a regional level (Liddle, 2017; Chen et al., 2019).

In this paper, we contribute to the literature on child-specific material deprivation by analyzing its association with the degree of urbanization at the individual and regional level. Most related studies analyze the relationship between household material deprivation and urbanization at the country level, but very few focus on child material deprivation, especially

[1] https://ec.europa.eu/commission/priorities/deeper-and-fairer-economic-and-monetary-union/european-pillar-social-rights/european-pillar-social-rights-20-principles_en

at the regional level. We also study to what extent regional differences in the degree of urbanization explain differences in child material deprivation. Regional heterogeneity within a country has been scarcely addressed in the related literature. We use data on Spain from the European Union Statistics on Income and Living Conditions survey (EU-SILC hereafter) for the years 2009 and 2014, which includes a specific module on material deprivation. As we describe in detail below, the focus on Spain is justified as it is has the largest incidence of child material deprivation in Europe, substantial regional heterogeneity in the degree of urbanization and high economic disparities among regions.

Our findings show that, first, the differences across regions and time in the incidence of child material deprivation should be explained jointly by household and family background and regional characteristics. Secondly, household material deprivation exerts an almost two times larger effect than household income on the incidence of child material deprivation. Thirdly, while living in cities or towns does not directly affect child material deprivation, it does have an effect through household material deprivation that is 1.5 times higher than household material deprivation itself. Fourthly, we find that living in a densely populated or intermediate density region increases the intensity of child material deprivation. These findings arise from educational/leisure needs, but household material deprivation is no longer relevant for basic needs, thus suggesting that income and degree of urbanization play a main role in child material deprivation. Main results hold for the whole distribution of household material deprivation with the exception of the top quintile where it becomes the main driver over income and degree of urbanization. Thus, our findings might be of help for politicians and policymakers to design the most effective policies intended to alleviate child material deprivation in upcoming business-cycle downturns beyond income-based policies.

The analysis and prevention of child multidimensional poverty and social exclusion is of particular interest for several reasons. First, the impact of child poverty and exclusion poses a serious threat to future generations in terms of both economic development and social stability (Esping-Andersen et al., 2002). Secondly, the 2008 economic and financial crisis in the European Union had a significant impact on child inequality and social exclusion. Moreover, due to the current global situation caused by the COVID-19 pandemic, especially in the most affected countries such as Spain, material aspects, as well as the need to reduce material deprivation, will become increasingly relevant for the future development of children. For instance, the widespread implementation of online learning requires children to have access to a computer and the Internet in order to keep up with their classes. More

deprived children without access to these resources will not only have greater educational disadvantages during childhood, but also unequal opportunities in the future. Thirdly, the analysis of heterogeneous incidence within and across countries is very relevant for policy decisions, yet the analysis at the regional level should be as well. Regional policymakers are also responsible for social policy (Ayala and Navarro, 2004; Piacentini, 2014). Moreover, knowing the effects of living in urban areas in the different regions within the same country on child material deprivation is relevant given that urbanization levels have changed substantially in the last decades. This is a particularly important issue in countries like Spain, where patterns of economic development in terms of a north–south divide between the regions appear evident (Eurostat, 2017).

Following the introduction, the literature on child material deprivation and its determinants is reviewed in section 2. The empirical strategy is described in section 3. The dataset and variables are presented in section 4. The main results are provided in section 5. Robustness check analyses are included in section 6. Finally, section 7 concludes the analysis.

2. Background

2.1. Child material deprivation

The related literature has traditionally assumed that children and adults within the same household have similar deprivation levels and needs. As mentioned, recent studies based on children specific items have demonstrated that the needs and living standards of children can be different from those of adults although they live in the same household. The specific items to measure child material deprivation have also brought to light the fact that the incidence of children and household material deprivation differs. In what follows, we provide some statistics on the incidence and discuss measurement issues concerning child material deprivation.

2.1.1. Incidence of child material deprivation

The incidence of material deprivation at the EU level, using EUROSTAT data, reveals that the proportion of adults in a household material deprivation situation in 2014 was 22% in Spain, while this figure was 21% in EU. From 2009 to 2014, the incidence and evolution vary across Spanish regions. In 2009, the incidence of household material deprivation ranged

from 5.5% in Aragon (northeast) to 30.5% in the Canary Islands. In 2014, however, it varied from 6.4% in Navarra (northeast) to 30.1% in Murcia (south).

However, when focusing on the child-specific material deprivation rate, we find that the differences between Spain and the average level in the EU are larger. According to EUROSTAT, the EU child-specific material deprivation rate in 2014 was 23.2% for children 1–15 years old, whereas it was 28.3% in Spain. By age, we observe that the child-specific material deprivation in 2014 for children 1–5 years old in the EU (Spain) was 20.6% (26.5%), for children 6–11 years old in the EU (Spain) it was 23.9% (27.3%) and, finally, for those 12–15 years old in the EU (Spain) it was 25.3% (32.4%). Note that the largest differences between Spain and the EU reside in the youngest (1–5 years) and the oldest (12–15 years) children. However, in terms of the intensity of deprivation, this gap is not so evident. While the mean number of deprivation items among deprived children is 6.1 in the EU, this average is 5.9 in Spain.

A large heterogeneity by regions is also found in Spain (Figure 1). First, we observe that the proportion of children who lack at least one item is generally higher in 2014 than in 2009 in all Spanish regions except Navarra and La Rioja (northeast). Secondly, although there is some heterogeneity within regions, we observe that the percentage of children who lack at least one item is larger in regions classified as center, east and south of Spain, particularly in 2014. In line with Daly et al. (2008) for Australia, this shows that the geographical location of a region is also relevant to determine the level of child material deprivation in a country such as Spain where there are clear differences between the north and the south; hence, a regional-level analysis is more interesting.

-----Insert Figure 1 here-----

2.1.2. Child material deprivation measurement

Measurement issues entail three different methodological choices: the items, the aggregation of those items and the choice of a threshold. Before we continue, some comments on the definition of 'material deprivation' are in order.

Material deprivation is generally defined as a relative lack of goods, resources or services broadly available in a society and is widely accepted as a multidimensional concept (Townsend, 1993). Nonetheless, different approaches to deprivation have been developed. Townsend (1979) related the concept of deprivation to the inability of "living a decent life" and regarded the simple lack of necessities and activities widely encouraged in the society to

which they belong as implying deprivation. In contrast, Mack and Lansley (1985) developed the concept of "enforced lack"—that is, people would like to have access to the lacked items but cannot afford them due to financial pressures. This definition emphasizes the difference between people's preferences and constraints. In the EU-SILC, questions on durable goods rely on Mack and Lansley's approach and allow distinguishing between lack of items (due to choice) and enforced lack of items. To exclude choices and lifestyle preferences and differences in taste and constraints from the concept of deprivation, the recent related literature is often based on the enforced lack of items to reflect deprivation (Nolan and Whelan, 1996, 2007; Guio, 2009; Guio et al., 2009, 2020; Fusco et al., 2011; Bárcena-Martín et al., 2017b). As pointed out by Guio et al. (2009), the enforced lack approach makes the indices more comparable with income poverty, where measures of material deprivation are expected to provide a more absolute view of the standard of living than income poverty. Guio et al. (2020) also stated that measures based on the concept of enforced lack discriminate better between worse-off and better-off children than those based on simple lack, thus ensuring the higher reliability of the index.

Regarding the items, the existing evidence shows that domains of child well-being (health, education, safety, housing, emotions, social relationships or integration, civic engagement, productivity, etc.) are related to questions of how children are faring, while country-level variables (family processes and family socio-economic profile) reflect aspects of children's environments that are likely to influence their well-being.

To date there is no official EU indicator of children's material deprivation, although there is a consolidated proposal in Guio et al. (2020). Using the child-specific items collected in the EU-SILC, some proposals can be found across the related literature. De Neubourg et al. (2012) constructed a 14-item child deprivation index, 13 of which are child specific while 1 is measured at the household level (access to the internet). Guio et al. (2012) proposed an 18-item child deprivation index that mixes child-specific items (13) with household items (5). Later studies have relied on Guio et al.'s index to provide a description of deprivation among children in the EU-27 (Frazer and Marlier, 2014). Chzhen and De Neubourg (2014) and Chzhen et al. (2016) defined three distinct age groups that they analyzed separately. Gabos et al. (2011), Watson et al. (2012) and Whelan and Maitre (2012a, 2012b) estimated a child deprivation scale based on 14 specific child-related variables. Bárcena-Martín et al. (2017a, 2017b) uses the 12 specific child-related variables included in the special module.

Guio et al. (2018, 2020) combines the 12 specific child-related variables with 5 household items.

Another methodological issue is how to treat information contained in multiple items. Among the various options to aggregate items into a single index, one is the 'counting' approach (Atkinson, 2003), in which deprivation is simply the number of items in which a person fails, with the same weight assigned to each item. The main advantage of this approach is that it simplifies the interpretation of the results, while its main drawback is that no discrimination is made about the items, and double counting can occur when items overlap (Brandolini, 2008). To incorporate the preferences expressed by members of society, the alternative aggregation procedure is to assign different weights to different items. Decancq and Lugo (2013) distinguish three classes of approaches to set the weights: data-driven, normative and hybrid.

Finally, the inclusion of a threshold to determine whether or not children are deprived is done for example in the EU to define severe material deprivation (lack of 4 out of 9 items at the household level). However, instead of the fact of being deprived (extensive margin), this index allows us to capture the intensity of the deprivation (intensive margin).

2.2. Determinants of child material deprivation

Previous literature highlights the convenience of combining individual (household and family/parental characteristics) and aggregated factors to analyze child material deprivation. Regarding socioeconomic status, income could seem to be a key factor to determine child material deprivation. However, although having more household income allows basic needs to be met, using income alone does not fully predict this kind of deprivation and the association is far from perfect (Bárcena-Martín et al., 2017b; Guio et al.,2020). Whelan et al. (2001) stressed that some low-income households lead to little additional deprivation and some higher-income households experience a lot.

Concerning non-income variables, child material deprivation has also been related to other household and parental characteristics, such as the composition of the household, whether the property is owned or rented, health and employment status, education, immigrant condition and age of parents. Previous studies have found that children who do not live in a single-parent household, those in a household with fewer children and the household is owned, as well as those who live with more educated parents with good health, being non-immigrant and in full-time employment report lower levels of child material deprivation (see,

for instance, Moore et al., 2007; Tarky, 2010; De Neubourg et al., 2012; Wüst and Volkert, 2012; Bárcena-Martín et al., 20017a, 2017b; Hidalgo-Hidalgo, 2019; Guio et al., 2020).

The related literature has also shown that although parents and children may not experience deprivation to the same extent, there is an association between children and household material deprivation (see, for instance, Grodem, 2008; Guio et al., 2012, 2018; Bárcena-Martín et al., 2017b). Thus, to adequately measure children's material deprivation it is necessary to look at the material deprivation that affects the household in which they live. In this vein, Grodem (2008) explicitly analyzed the effect of household material deprivation on child material deprivation, finding that deprivation reported by parents in several areas translates into deprivation for their children in the same areas. Moreover, she found that the effects of household material deprivation indicators on child material deprivation are stronger than those related to household characteristics, including income. Additionally, Guio et al. (2012) stated that problems of arrears may impact not only on the household's adult members, but also on the children through the financial stress they will feel and the possible consequences of this stress in the short and longer term. Using the EU-SILC 2009 module on deprivation for Spain, Bárcena-Martin et al. (2017b) found that the level of child deprivation varies among household types—that is, even after controlling for the socio-economic characteristics of the household and parents, the lack of certain items at the household level induces a more intense child material deprivation. Therefore, they concluded that there exists an association between child material deprivation and the household material deprivation profile that surpasses the socio-demographic characteristics of the household and parents.

As regards the macro variables, related studies consider that country-specific conditions determine a household's economic vulnerability, which influences deprivation (see, for instance, Bárcena-Martín et al., 2014, 2017a). As pointed out by Bárcena-Martín et al. (2014) for household material deprivation, there is a significant relationship between social policy generosity and inequality level with household material deprivation. Bárcena-Martín et al. (2017a) concluded that country-specific characteristics are crucial to explain differences in child material deprivation across European countries. Hidalgo-Hidalgo (2019) tested whether public policies implemented during individuals' childhood have a long-run effect on the probability of being poor in adulthood in European countries. For instance, she showed that more public expenditure in education has an important long-term effect in reducing poverty incidence in adulthood. Guio et al. (2020) stressed that more generous welfare systems or

more prosperous economies lead to lower levels of deprivation. In fact, they showed a negative relationship between GDP per capita and child material deprivation, although this relationship is expected to be small or inexistent. Nonetheless, they also concluded that the effect of macro-drivers on child deprivation intensity depends on the inclusion of GDP in the model. Specifically, when including GDP, they found that in-kind social benefits, pro-poorness of social transfers and the proportion in GDP of total social benefits have a significant negative relationship with child deprivation intensity After including GDP, however, family benefits, total benefits and cash transfers are not significant.

2.3. Degree of urbanization

Although recent studies have analyzed the relationship between level of urbanization and poverty or deprivation (Ravallion et al., 2007; Daly et al., 2008; De Neubourg et al., 2012; Martínez-Vazquez et al., 2014; Arouri et al., 2017; Bárcena-Martín et al., 2017b; Liddle, 2017; Chen et al., 2019), there is still no agreement regarding the direction of the effect and even less so on child material deprivation.

Some of the related papers have demonstrated that the neighborhood where families live affects the risk of child material deprivation (Daly et al., 2008; De Neubourg et al., 2012; Sharkey et al., 2012; Bárcena-Martín et al., 2017b; Liddle, 2017). For instance, Ravallion et al. (2007) used a sample of 90 developing countries and found that while urbanization can help to reduce overall poverty, it can also lead to an increase in poverty in urban areas. Daly et al. (2008) showed for Australia that child material deprivation is strongly geographical dependent. De Neubourg et al. (2012) highlighted only small differences between child material deprivation rates in urban and rural areas of European countries. For Chicago, Sharkey et al. (2012) highlighted that children's behavior and functioning in the classroom setting is altered when they live in environments with high levels of violence, which is associated with low levels of attention and lower pre-academic skills. Martínez-Vázquez et al. (2014) found a U-shape relationship between the level of urbanization and poverty for a panel of 143 countries. Bárcena-Martín et al. (2017b) provided evidence of a positive association between living in big cities and child material deprivation in Spain. Using a sample of 128 countries, Liddle (2017) concluded that the levels of urbanization do not have a relationship with poverty/inequality indicators and or a nonlinear effect appears.

This non-conclusive evidence may be explained by the fact that urbanization could have two opposite effects on the poverty and deprivation of children and families (Bárcena-Martín

et al., 2017b; Bruder and Unal, 2017). On the one hand, urbanization provides a unique political, economic, cultural and educational environment, and offers better health services, more access to resources, labor market opportunities and, in general, increased opportunities for quality of life. On the other hand, although urban areas tend to be less poor, this may also lead to marginalized urban settings where children are exposed to high rates of crime, violence, abuse, housing deterioration and poverty, thus making poor people in urban areas more vulnerable to natural disasters, for instance. Additionally, smaller rural areas might take economic and social advantages of some of these benefits without incurring in the related costs, such as higher housing and living costs in general. For instance, urbanization can increase the wages of rural workers, since firms are concentrated in cities and attract both urban and nearby rural workers, thus reducing rural poverty (Arouri et al., 2017).

Regarding our case study, Spain presents some particular features concerning household and child material deprivation and the degree of urbanization. For example, according to EUROSTAT, while the % of deprived population in the EU in 2014 stood, on average, at 19.5% in cities, 17.4% in towns and suburbs and 21.1% in rural areas, the incidence in Spain was almost equally distributed by degree of urbanization with percentages around 20.0%, 20.5% and 20.6%, respectively.

In terms of child material deprivation, the EU-SILC data for Spain in 2009 shows that the percentage of the population in a situation of material deprivation was higher in densely populated areas than in intermediate density or thinly populated ones (see Figure 2). This occurs not only for those who lack at least one item, but for those who lack at least 3 items. However, this pattern reversed in 2014, as those living in villages had a higher child material deprivation rate.

-----Insert Figure 2 here-----

Child material deprivation shows larger heterogeneity given the huge variability of the degree of urbanization across regions. In Figure 3 we plot the degree of urbanization by region. Although the degree of urbanization varies within regions, the percentage of villages appears to be larger in the northeast, northwest and center of Spain, whereas the percentage of towns appears to be larger in the east and south of the country.

-----Insert Figure 3 here-----

Hence, although some studies have analyzed the effect of urbanization on material deprivation, we are not aware of studies that jointly analyze the effect of degree of

urbanization on child material deprivation, and to what extent the regional degree of urbanization explains the differential impact on child material deprivation.

3. Empirical strategy

We account for the hierarchical structure of data consisting of individuals nested into regions. The most appropriate econometric method would be a multilevel approach (Goldstein, 2003; Rabe-Hesketh and Skrondal, 2008). However, given the limited number of groups (only seventeen regions), the use of a multilevel analysis could bias our results. Therefore, following related papers such as Oswald and Wu (2010), Bryan and Jenkins (2013), Markaki and Longhi (2013) and Hidalgo-Hidalgo (2019), we use a two-step approach to carry out our analysis. This method entails one regression at the individual level and another regression at the regional-cohort level, thus allowing us to control for both individual and aggregated level characteristics. Among other advantages of the two-step approach, Bryan and Jenkins (2013) pointed out its ability to make explicit sources of data variation that underlie the estimates.[2] In addition, because their estimated coefficients are unbiased, the two-step approach can be seen as a benchmark for comparison with other approaches.

Specifically, we use pooled data from both waves (2009 and 2014). Therefore, our data cover two years for 17 regions, which leads to a total of 34 regional-cohorts that are included in the estimation. In the first step, the empirical strategy requires different specifications at the individual level. Our dependent variable is the child material deprivation index (CD_i), which, as we will explain in section 4, will take continuous values between 0 and 1. Thus, in the first step we estimate:

$$CD_i = \beta_0 + \beta_1 HD_{\mathrm{i}} + \boldsymbol{X}_i'\beta_2 + \boldsymbol{C}_{rt}'\beta_{rt} + u_i \qquad (1)$$

where HD_i is the household index for material deprivation and vector $\boldsymbol{X}_i$ contains a set of individual variables including information on household and parental characteristics. Term β_{rt} represents the regional-cohort coefficients, which capture the remaining differences across regions, *r*, and over time, *t*, in level of child material deprivation. The estimated coefficients of these regional-cohort dummies will be negative (resp. positive) for those regional-cohorts in which the incidence of child material deprivation is lower (resp. higher) than what we would expect given household and parental background variables. This term β_{rt}, to be fitted in Step 2 below might combine both observed and unobserved regional

[2] Bryan and Jenkins (2013) reviewed this and other modelling approaches used with multilevel country data.

cohort characteristics—that is, $\beta_{rt} = \boldsymbol{Z}'_{rt}\gamma + e_{rt}$, where $\boldsymbol{Z}'_{rt}$ contains variables summarizing regional cohort-level features. As pointed out by Bryan and Jenkins (2013), it is interesting to highlight that Step 1 uses only within-region cohort variation to estimate the parameters at individual level, while between-region cohort variation is also used in other multilevel techniques.

In the second step, following Oswald and Wu (2010) and Hidalgo-Hidalgo (2019), we use the estimated coefficients from the previous models of the regional cohort dummy variables, $\hat{\beta}_{rt}$, as the dependent variable of a model that includes variables at the regional level as explanatory variables. In particular, we incorporate regional information related to the density of an area in region *r* in year *t* in the vector $\boldsymbol{Dense}_{rt}$ plus other variables of interest in vector $\boldsymbol{Z}_{rt}$that characterize these regions and cohort. Additionally, we include year and region fixed effects denoted by θ_t and θ_r, respectively. The model can be specified as follows:

$$\hat{\beta}_{rt} = \alpha_0 + \boldsymbol{Dense}'_{rt}\alpha_1 + \boldsymbol{Z}'_{rt}\alpha_2 + \theta_t + \theta_r + \epsilon_{rt} \quad (2)$$

A detailed description of all the variables included in Equation (1) and (2) is provided in section 4.

An important concern when analyzing the casual impact of household material deprivation on child material deprivation is the existence of some possible sources of endogeneity regarding the relationship between both kinds of deprivation included in CD_i and HD_i. Thus, we now estimate a set of equations consisting of equation (1) and a household material deprivation estimation equation as follows:

$$HD_i = \lambda_0 + \boldsymbol{W}'_i\lambda_1 + \theta_t + \theta_r + v_i \quad (1')$$

where $\boldsymbol{W}_i$ is a set of individual variables including information regarding household and parental characteristics.

Equations (1) and (1') might both be linked through observed and unobserved variables (Wooldrige, 2010; Roodman, 2011). Both observed and unobserved characteristics can lead to biased estimates due to confounding. The confounding effects of observed characteristics can be taken into account using standard regression methods, but unobserved characteristics cannot. A natural extension to address this concern would be an instrumental variables approach. Unfortunately, it is very difficult to find valid instruments which serve that purpose in large scale surveys like the one we use in this paper. An alternative attempt would be to rely on dynamic panel models to control for material deprivation-state dependence and initial

level of material deprivation. Nonetheless, this via is also far from ours as our analysis is based on cross-sectional data drawn from the specific 2009 and 2014 EU-SILC modules on material deprivation.

The approach followed in this paper is to simultaneously estimate equations (1) and (1') so that we can control for the fact that unobserved covariates may influence child and household material deprivation simultaneously. It also allows us to properly address reverse causality and other possible sources of endogeneity. On the one hand, we adapt the control function method to eliminate the effects of unobserved confounding (Heckman and Robb, 1985; Newey et al., 1999). The control function approach to estimating consistent effects consists of two estimation stages: (i) a household material deprivation model and (ii) a child material deprivation approach on the level of household material deprivation and the residuals from the first-stage regression (the control functions).[3] On the other hand, recursive mixed-process models (Roodman, 2011) also jointly estimate child and household material deprivation and are a limited information maximum likelihood (LIML) estimator. This method allows for mutual interdependencies across deprivations and tries to capture the existence of both kinds of deprivation (child and household) and the possible correlation among them.

4. Data and variables

4.1. Data

For our empirical analysis, we use micro-data from the EU-SILC, an international database that includes information on household income and other relevant household characteristics, as well as information related to labor, health, demography and education at the individual level. Particularly, we work with data from the specific modules concerning material deprivation (2009 and 2014 waves), which include specific questions on child material deprivation.

It is relevant to highlight that although these modules provide information on specific items of child material deprivation, data relating to the living conditions of children are not collected from the children themselves, but from the household respondent.[4] According to

[3] Given the continuous nature of our material deprivation indexes, this method avoids problems related to forbidden regression as pointed out in Wooldridge (2010).

[4] The household head is the person responsible for the accommodation—that is, the person owning or renting the accommodation. If the accommodation is provided free, the person to whom the accommodation is provided

the survey protocol, if at least one child in a household does not have an item, it is then assumed that all the children belonging to the household lack that item. Moreover, these modules only consider children between 1 and 15 years of age and collect items on children only for those households with at least one child within this age bracket. Keeping this in mind, we restrict our analysis to this population group and the child and household material deprivation indexes therefore only cover children within this age bracket. Thus, our unit of measurement is the household, while the unit of analysis is the child. Likewise, to achieve our goals, we focus our analysis on households in the regions of Spain (except the autonomous cities of Ceuta and Melilla), which present, as seen in section 2.3., a high regional heterogeneity in the distribution of the degree of urbanization. The analysis is carried out over a sample of 4,461 observations distributed across the following 17 Spanish regions: Galicia, Asturias, Cantabria, the Basque Country, Navarre, La Rioja, Aragon, Madrid, Castile-La Mancha, Castile and Leon, Extremadura, Catalonia, Valencia, the Balearic Islands, Murcia, Andalusia and the Canary Islands.

4.2. Variables

4.2.1. Child material deprivation index

As revised in section 2.1.2., some aspects should be considered for the construction of an appropriate child material deprivation index, such as the selection of items, their aggregation and the deprivation line.

Concerning the selection of items, the EU-SILC provides information for fourteen different specific items related to children for the year 2009, while only thirteen items, which successfully passed the four tests of suitability, validity, reliability and additivity in 2009, are available for 2014 (for more details, see Guio et al., 2012). For the sake of homogeneity of both waves, to define child material deprivation indicator we select the twelve items that passed the four tests in Spain for both waves (see, Guio et al., 2018). The first four items are related to basic needs, while the remaining items are related education and leisure needs (see Table 1 for specific items).

--------- Insert Table 1 here ---------

is the responsible person. If two persons share responsibility for the accommodation, the oldest person is considered the responsible person.

As regards the aggregation of the items, we follow the related literature (Brandolini, 2008; Guio et al., 2009; Fusco et al., 2011; Barcena-Martin et al., 2014) to build the child material deprivation index. Specifically, the weight associated to each item corresponds to the percentage of individuals owning the item in each region. Thus, this option considers that people attach greater importance to shortfalls in items where a majority does not fall short. One of the main advantages of this approach is that the indicators are constructed based on the distribution of achievements in society, and they do not take into account any value judgment. To build the child material deprivation index, we define a dichotomous indicator I_{ijr} for each item as follows:

$$I_{ijr} = \begin{cases} 0 & affordability \\ 1 & non\text{-}affordability \end{cases}$$

where $i = 1, \dots N$ represents the child; $j = 1, \dots J$ refers to the items considered; and $r = 1, \dots R$ denotes the region. w_{jr} denotes the weight corresponding to each item j where the weight is equal for children living in the same region, r. Thus, CD_i represents the child material deprivation level for each child as follows:

$$CD_i = \sum_{j=1}^{J} w_{jr} I_{ijr}$$

Following Figari (2011), we normalize the index by the sum of all weights to permit comparisons across Spanish regions. Hence, CD_i equal to 0 means that a child does not lack items, while if it equals 1, the child lacks all items. If we assume equal weights for all items, then the index is simply the number of items in which a person fails (Townsend, 1979; Mack and Lansley, 1985; Mayer and Jencks, 1989). This is called the *counting approach* (Atkinson 2003). However, as pointed out by Fusco et al. (2011), the use of weights could reflect the relative importance of individual items in the different regions.

Concerning the deprivation line, we could analyze whether the individual is deprived or not, or the intensity of deprivation. Our main interest is the intensity of deprivation; therefore, we do not fix any threshold to define whether or not children are deprived. Table 2 presents the descriptive statistics for the child material deprivation index, using weighting and the counting approach. We observe that the incidence and the average of child material deprivation are larger in 2014 (middle of the crisis) than 2009 (beginning of the crisis). We also find that among those that are deprived, the intensity of material deprivation is also higher in 2014.

-------- Insert Table 2 here --------

4.2.2. Explanatory variables

In line with the related literature, which highlights the need to combine individual and aggregated factors to analyze child material deprivation, we distinguish two groups of variables: individual-level variables and regional-level variables.

Individual-level variables

In order to test the relationship between household and child material deprivation we include the household material deprivation index (HD_i). The index is also defined as a frequency-based weighting index with the standard items defined in the Europe 2020 strategy (see Table 3 for specific items).

-----Insert Table 3 here------

On average, in our sample we observe that, as in the case of child material deprivation, the incidence of household material deprivation is increasing over time (see Table 4). In 2009, the percentage of households that were not deprived was 48.5%, while in 2014 the percentage decreased to 43.9%. Indeed, it is interesting to note that according to the standard measure of considering a child deprived if he/she lives in a deprived household, the incidence would be higher than if we consider specific child material deprivation for both years.

-----Insert Table 4 here------

Although for our analysis we consider material deprivation intensity, for the sake of simplicity in the descriptive analysis, lacking more than 4 items is the threshold we adopt for household deprivation in line with EUROSTAT's definition of severe material deprivation. The equivalent threshold for child material deprivation is 6 items, as shown in Table 4. The data for 2009 revealed that neither the household nor the children were deprived in 49.9% of households. Moreover, children were not materially deprived in 35.7% of the households, but the household was moderately deprived (there was a lack of at most three items), whereas in 10% of households that are moderately deprived, children lack at most 5 items. In 2014, 44.6% of the households were characterized by being not deprived either at the household level or the child level; a difference of 5.3 percentage points with respect to 2009. Additionally, 29.9% of the households where children were not deprived were moderately deprived (lack of less than 4 items), which is 5.8 percentage points less than in 2009. Of the households with moderate deprivation (lack less than 4 items), 13.8% also presented a lack of less than 6 items at the child level, which was 3.8 percentage points more than in 2009.

Finally, another increase from 1.8% in 2009 to 5.14% in 2014 was observed in severely deprived households (lack more than 4 items) whose children lacked less than 6 items.

Thus, as suggested in the previous literature, the sole use of household indicators of deprivation or information from parents as a proxy for childrens' own experiences is inadequate, as it does not help us to sufficiently identify the actual experiences of deprived and non-deprived children living in deprived and non-deprived households (see, for instance, Grodem, 2008; Whelan and Maitre, 2012a; Bárcena-Martín et al., 2017b). Moreover, these results also support that parents and children do not experience material deprivation to the same extent. In particular, in both years, about one third of the children lived in households that experienced some degree of deprivation.

In addition to the household material deprivation index, we include the degree of urbanization, which is associated with the characteristics of the area where the household is located. Degree of urbanization is measured using the DEGURBA classification implemented by Eurostat.[5] As previously explained, the degree of urbanization comprises three different types of areas: densely populated areas (cities or large urban areas); areas of intermediate density (towns and suburbs or small urban areas) and thinly populated areas (rural areas). We build two dummy variables, *Cities* and *Towns*, which take the value of 1 if the household is located in a city or town, respectively. Living in rural areas is therefore our reference category. As shown in Table 5, almost half the sample lives in cities, while 25% lives in towns.

-------- Insert Table 5 here --------

For the national total in 2009, the average intensity of material deprivation experienced by children shows an almost equal distribution by degree of urbanization, whereas in 2014 child material deprivation levels are slightly higher in towns. Nonetheless, there is a huge degree of heterogeneity across regions. As can be seen in Figure 4, there is no clear pattern regarding where child material deprivation is high. For instance, in Galicia, Madrid or the Canary Islands, children experience less material deprivation in towns and cities than in villages; in Asturias and Catalonia child material deprivation is larger in villages, especially when compared with towns; and in the Basque Country, Valencia and Andalusia children

[5]Eurostat groups together all LAU2s (Local Administrative Units - Level 2/municipalities) using a criterion of geographical contiguity in combination with a minimum population threshold based on population grid square cells of 1 km^2.

also experience more deprivation in cities and towns than in villages, although to a larger extent in cities.

-------- Insert Figure 4 here --------

In terms of the rest of the individual-level controls, the variable *Income* reflects the annual equivalized disposable household income and is considered for the estimations in logarithmic form. To test the impact of household type, we include the dummy variable denoted by *Couple*, which takes the value of 1 if there are two adults in the household with one or more dependent children, our reference category being other kinds of households with dependent children. To evaluate the effect of whether the accommodation is owned or rented, we consider a dummy variable *Owner*, which takes the value of 1 if the individual currently owns a dwelling. We also include the ratio of household members who suffer from any chronic illness or condition using the variable %*Chronic*, which ranges from 0 to 1. Additionally, to capture the effect of the number of children in the household in different age groups, we construct four variables: younger than three years old (#*Child (younger than 3*)); between three and five years old (#*Child (3 to 5*)); between six and eleven years old (#*Child (6 to 11*)); and between twelve and fifteen years old (#*Child (12 to 15*)).

Regarding the parental characteristics, we consider separate information for fathers and mothers. The variables related to the employment status include a set of dummies to capture whether fathers and mothers are working either full or part time (*Fulltime_father*, *Fulltime_mother*, *Parttime_father* and *Parttime_mother*), which take the value of 1 if the parents have a full- or part-time job, respectively. To evaluate the effect of parents' education, we introduce the dummy variables *Tertiary_father* and *Tertiary_mother*, which taking the value of 1 if they have at least a tertiary education. Moreover, we include the age of fathers and mothers using the dummy variables *Forty_father* and *Forty_mother*, which take the value of 1 if they are older than forty. Finally, we also include the effect of being an immigrant using the dummies *Immigrant_father* and *Immigrant_mother*. For household material deprivation, we define similar variables but at the household level. Particularly, we define three different dummy variables *None full time*, *Father full time*, *Both full time* to reflect whether none of the adults work full time, only the father works full time or both work full time, respectively. Thus, the reference category is a household where only the mother works full time. The equivalent is done for tertiary education (*None tertiary*, *Father tertiary*, *Both*

tertiary), for age (*None older than 45, Father older than 45, Both older than 45*) and immigrant status (*None immigrant, Father immigrant* and *Both immigrant*).

Regional-level variables

At the regional level, we use twelve indicators covering different regional characteristics. These were drawn from various databases: Eurostat, INE and the Spanish Ministry of Finance and Public Administrations. Table 6 shows the main descriptive statistics for both years at the national level.

-----Insert Table 6 here-----

Given our interest in exploring the effect of the density of the area at the regional level, we construct the indicators *Cities_reg* and *Towns_reg*, which reflect the percentage of cities and towns in each region, respectively. As shown in Table 6, almost the half the regional territory is concentrated in cities, although the proportion by regions is different and ranges from 12% to 80%. The average proportion of towns is lower than cities (almost 24%), and also presents a large variability since it ranges from 7% to 74% among Spanish regions.[6]

In line with previous studies, we include other aggregated characteristics (at regional level in our paper) to analyze child material deprivation (see, for instance, Bárcena-Martín et al., 2014, 2017a; Guio et al., 2020). Particularly, we include the economic situation, which reflects the competitiveness and business environment by region and has been measured using *GDP Per capita* to explore whether regional differences in child material deprivation could be explained by regional wealth. To consider the inclusive growth of the region, we have used two different perspectives. The first is related to inequality and poverty and is measured by the indicators *s80s20*, which is the income quintile share ratio to measure the inequality of income distribution; *Risk poverty*, which measures the percentage of people at risk of poverty or social exclusion; and *Long unemployment*, which measures the share of people that are unemployed for more than one year. The second includes two regional indicators for public expenditure on protection and social promotion (*Social protection*) and on the production of preferential public goods (*Public goods*), both of them as a proportion of the total expenditure. The labor market environment is measured by the following indicators: *Tertiary education*, which reflects the percentage of the population that has achieved at least this level of education; *Employment*, which measures the employment rate

[6] The regional values for these variables are available upon request.

of the 20–64 age group; and *Female unemployment* and *Female employment*, which measure the unemployment and employment rate of the female population, respectively.

5. Results

We estimate several models to evaluate the relative importance of household, parental and regional characteristics in explaining child material deprivation. We first report the model with no endogeneity considerations (Equation 1 and 2 described in section 3), then we present the estimation results with two different ways of correcting possible endogeneity driven by household material deprivation: the control function approach and the conditional (recursive) mixed-process estimator, as presented in section 3.

Regarding Step 1 of our estimation approach, we first estimate a version of Equation (1) without any individual or family explanatory variable $\boldsymbol{X_i'}$ and which only contains regional cohort dummies, β_{rt} (column 1 in Table 7). This model gives us information about the differences across regions and cohorts in terms of the level of child material deprivation without accounting for individual variables. Second, we include the set of parents and family background variables (column 2 in Table 7).

-------- Insert Table 7 here --------

As already mentioned, specifications include a full set of regional cohort dummies (β_{rt}). The χ^2 test at the bottom of the table (columns 1 and 2) shows that the regional cohort dummies are jointly statistically significant. This means that there are residual (non-random) differences across regions and time in the incidence of child material deprivation that cannot be explained by the set of household and parents variables we are using. This heterogeneity might be due to economic and social differences across regions and time, among which we consider the degree of urbanization. We address this point in the second step. In addition, observe that the size of the χ^2 is larger in the model with no explanatory variables (column 1) than in the model that includes individual variables (column 2). This finding suggests that child material deprivation intensity cannot be explained only by regional cohort variables.

As can be observed in the table, the intensity of household material deprivation increases the intensity of child material deprivation, while income reduces it. In terms of size, we find that one standard deviation increase in household material deprivation accounts for 50.8% of

a standard deviation increase in child material deprivation.[7] In other words, an average increase of 10% in household material deprivation would imply, on average, 0.005 units more of child material deprivation—that is, an average increase of 11%. As concerns income, one standard deviation increase in log income accounts for 15.4% of a standard deviation decrease in child material deprivation. An increase of 10% in income will account, on average, for 0.002 units less of child material deprivation—that is, an average decrease of 5%.[8] Therefore, as found by Grodem (2008), household material deprivation is of higher order relevance (it more than doubles the effect) for child material deprivation than for household income.

Finally, note that our variables of interest *Cities* and *Towns* are not significant differently from zero.[9] For the rest of the socio-economic variables we find that being a homeowner and having a mother who works part time reduce the level of child material deprivation, while number of children in the household of all ages increases it. We also find that the larger the number of family members with chronic diseases, the higher the child material deprivation.[10]

We now comment on the results for the model that corrects for the possible endogeneity of household material deprivation. We report the results for Equation (1) in columns 3 and 4 for the control function approach (CFA, hereafter) and for the conditional mixed procedure (CMP, hereafter), respectively. The results for Equation (1') are reported in columns 5 and 6, respectively. Once we control for possible endogeneity in household material deprivation, we might distinguish between a *direct* effect, measured by the estimated parameter in the equation of child material deprivation (Equation 1), and an *indirect* effect, measured by the estimated parameter in the equation of household material deprivation (Equation 1') and then through the household material deprivation parameter on child material deprivation.

We find that household material deprivation remains positive and turns out to be larger than before. Household income is no longer associated with child material deprivation, at least directly. However, higher household income is associated with lower household material deprivation, which will result in lower child material deprivation (indirect effect). In particular, a 10% increase in household income will decrease household material

[7] The standard deprivation of child material deprivation is 0.130 when we jointly consider both years in the sample.
[8] The 10% increase in income implies 0.024*ln(1+0.10)=0.002 units less of child material deprivation which over an average of 0.047 implies a decrease of 5%.
[9] We have also tried to estimate *Urban* with a dummy to jointly reflect *Cities* and *Towns*, and the effect is not significantly different from zero. These results are available upon request.
[10] For the sake of simplicity, the results can be found in Table A.1 of Appendix A.

deprivation by 0.004 units, which will lead to a 0.003 unit decrease in child material deprivation,[11] which implies an average decrease of 7% (larger than the 5% in column 2).[12] Note also that the size of the effect of household material deprivation has also increased, and now a 10% increase in average household material deprivation, from any other cause rather than income, increases child material deprivation by 0.008 units (average increase of 18%). Therefore, we still find that the effect of household material deprivation on child material deprivation is higher than that of income.

In terms of the effect of living in a city or a town, we again find that the direct effect is not significantly different from zero; but, now there is an indirect effect on child material deprivation through household material deprivation. Thus, living in a city increases average household material deprivation by 0.032 units and average child material deprivation by 0.028 units (an average increase of 59%).[13] Similarly, with the CFA methodology, living in a town increases average household material deprivation by 0.018 units and average child material deprivation by 0.016 units (an average increase of 33%).[14]

To sum up, we find that household material deprivation acts as an important driver of child material deprivation; not only directly, but also as an indirect channel through which income and urbanization affect child material deprivation. However, the effect of urbanization is the largest, the effect of living in a city is larger than living in a town, which is followed by household material deprivation, and the lowest effect corresponds to income. Therefore, all income-related policies to alleviate child material deprivation might have a lower effect than initially intended.

Next, we present the results of Step 2—that is, the impact of regional differences by using the estimated coefficients of the regional cohort dummies corresponding to the specification without and with endogeneity considerations. For the sake of simplicity, in Table 8 we only present the effects of the specific measure of the average percentage of cities

[11]These calculations are performed for the results with CFA, column 3, although we find similar figures with CMP, column 4.

[12] Note that we only quantify the indirect effect, as the direct effect is no longer statistically different from zero. The total effect would be 0.004 units, which implies an average decrease of 9%.

[13]Note that the city effect aggregates the direct effect (-0.016 in column 3) and the indirect effect through household material deprivation (0.028). The results for CMP are slightly lower and account for 0.022 units of child material deprivation.

[14]The results for CMP are similar, but living in a town would imply an increase of 0.009 units in child material deprivation.

(*Cities_reg*) and of towns (*Towns_reg*) by region (and their quadratic term) without and with time and region fixed effects, respectively.[15]

-------- Insert Table 8 here --------

Firstly, we find that *City_reg* effect is sensitive to the inclusion of time and regional fixed effects, which might also affect the incidence of deprivation. We find that without time and regional fixed effects, the effect of *City_reg* is similar to the one of towns and decreasingly positive (first column). However, once we control for these effects (second column), they turn out to be negative and increasing. In principle, this surprising effect vanishes and turns out to be positive when we consider that the full effect also occurs through the squared variable.

To illustrate the size of the effect, we focus on the specification that accounts for individual and household variables with regional and time fixed effects (i.e., the specification in column 2). The marginal impact of the percentage of cities by region is -0.200. Although this may be surprising in principle, this effect should be completed by the 0.712 of the squared variable. Note that an increase of one standard deviation (0.207) in the average degree of city urbanization increases child material deprivation by 0.069 units (half of the standard deviation of child material deprivation). However, this magnitude is not constant across regions. Note that after a proportion of cities of around 0.28, the direct effect becomes positive. In our sample, Cantabria, Extremadura, Navarre, Castile-La Mancha and La Rioja are the regions with a lower percentage of cities.

The estimate is positive in all specifications for *Town_reg* and negative for its squared. Therefore, the larger the number of towns in a region, the higher the incidence of child material deprivation, but the relationship is not linear. In an equivalent manner, the size of the effect for towns is such that an increase of one standard deviation (0.114) in the degree of town urbanization accounts for 87.8% of a standard deviation decrease in child deprivation and implies an increase in child material deprivation (taking the square into account) of 0.006 units (only 4.2% of the standard deviation).

The rest of the regional characteristics display an expected effect. The larger the GDP per capita, the higher the rate of employment (total and female employment), the more

[15]Results for the rest of the regional characteristics are relegated to Table A.2 in Appendix A. We have also considered a second specification containing the aggregate measure of cities and towns by region (*Urba_reg*) and its quadratic term without and with time and region fixed effects. The results, which are available upon request, do not change. The degree of urbanization larger than village increases the effect of the degree of urbanization on child material deprivation.

educated the population and the greater the expenditure on social protection (as a % of the total expenditure), the lower the child material deprivation. In contrast, the larger the inequality, long-term unemployment, social exclusion index and expenditure on public services (health, education, etc. as a % of the total expenditure), the higher the child material deprivation. This latter result that higher expenditure on public services leads to higher child material deprivation could be explained by the items considered in the child material deprivation index. For instance, although a region might spend more on health or education, this does not guarantee that the most deprived children will have access to items related to educational needs. In other words, higher spending on education, for example, would lead to a better and higher quality of this public service. However, this does not mean that this specific measure helps children directly or through their parents, as the children might not have access to appropriate books for her/his age, a suitable place for studying at home or is able to participate in school events that cost money, which would increase the child's material deprivation. Another reason could be because the income limit to receive benefits is too high, which would not reduce the material deprivation of all children who are more deprived.

To sum up, our evidence shows that, at the regional level, if children live in a densely populated or intermediate density region, there is an increase in the intensity of child material deprivation. However, this effect would depend on the region children live in.

6. Robustness check

In the present section, we challenge our results with a few different specifications to test if the relationships still hold.

6.1. Basic needs versus educational/leisure needs

Now we consider different dimensions of the child material deprivation index. As presented in Table 1, some of the items to measure child-specific material deprivation are classified as *Basic Needs* while other are considered *Educational and Leisure Needs.* In our previous analysis, we constructed the index with all the items regardless of this classification. As above, in this section we construct a separate index also using a frequency-based approach for both dimensions.

At a glance, in our sample we find that while the percentage of children not deprived of basic needs was 96.3% in 2009, this percentage fell to 88.4% for educational/leisure needs. In 2014, these percentages decreased to 91.3% and 79.1%, respectively. If we look at the

percentage of households which lacked at most three items but their children were not deprived, we find that they accounted for 44% of the sample in basic needs and 37.4% in educational/leisure needs in 2009. In 2014, however, these figures fell to 41.7% and 32.2%, respectively. This would seem to suggest that although the household presents some level of deprivation, children's basic needs come first and educational/leisure needs are secondary. Another difference arises when we consider the percentage of households in which at least one item is not affordable at either the household or the child level. In terms of basic needs, we found that 3.7% (8.7%) of households in 2009 (2014) lacked at least one item at both levels (household and child), while the percentages were 11.5% (20.4%), respectively, for educational/leisure needs. Again, we observe that the incidence of child material deprivation increases with time. All in all, there is a correlation between household material deprivation and child material deprivation, which is mostly driven by educational/leisure needs rather than basic needs.

The estimation results for the basic needs and educational/leisure needs indexes are reported in Table 9. The main difference with regard to the joint index for child material deprivation stems from the fact that, once we endogenize household material deprivation, it no longer has an effect on child material deprivation in terms of basic needs (Panel A), but still has an effect for educational/leisure needs (Panel B). This could imply that basic needs are always met, even if the household suffers from high intensity deprivation. This fact was suggested by the descriptive analysis as well. One of the implications of this finding is that the indirect effect of income and living in a city or town is no longer active for basic needs; nonetheless, it is still working for educational/leisure needs. Interestingly, for the latter type of needs, a negative direct effect appears for living in a city. In this case, we found that a 10% increase in household material deprivation increases child material deprivation in educational/leisure needs by 0.011 percentage points, while it increases by only 0.003 percentage points for living in a city (direct and indirect effect).

------- Insert Table 9 here --------

In terms of the regional degree of urbanization, as in the general case, the effect of the % of cities turns out to be negative up to a proportion of cities around 0.35 and then turns positive for the case of basic needs (only Extremadura, Navarre and Castile-La Mancha), and 0.24 for the case of educational/leisure needs (none of the regions are below this level). A new finding reveals that the effect of the proportion of towns for basic needs also decreases

child material deprivation up to this proportion of towns is 0.25 and then becomes positive (Madrid, Aragon and Castile and Leon). For educational/leisure needs, as in the case of the general index, the effect is positive for any proportion of towns.

Finally, we calculate the estimated effect of a child living in a city which consists of the sum of the individual effect that is constant across regions and the degree of urbanization of the child's region. As a reference, we take the models estimated with the CFA approach[16] and the regions with the lowest and the highest percentage of cities, which are Cantabria (northwest) and Madrid (northeast). As can be seen in Figure 5, the regional effect presents a huge variability among regions. The effect of living in a city ranges from -0.029 units for the general index in Cantabria to 0.313 units in Madrid. In the case of basic needs, the variability is lower and ranges from -0.015 to 0.189 (10% of the child material deprivation standard deviation and almost one and a half times, respectively). For educational\leisure needs, the variability increases and ranges from -0.039 to 0.378 units (one third of the child material deprivation standard deviation and almost three times, respectively).

------- Insert Figure 5 in here --------

We also observe that the effect of living in a city always increases child material deprivation (aggregate and by dimensions) in regions in the east and south, although there is some heterogeneity within regions. In the northwest, northeast and center of Spain, there is at least one region where the effect of living in a city is negative (Cantabria, Navarre, Castile-LaMancha and Extremadura). Note that in regions categorized as center, the effect in all regions is small. Note also that, in all regions, living in a city has a smaller effect on basic needs than educational/leisure needs.

Finally, the effect of living in a town is always positive although small with scarce variability, and ranges from 0.005 to 0.017 units for basic needs and 0.002 to 0.019 units for educational/leisure needs.

6.2. Alternative measures of material deprivation

We estimate our main specifications considering three modifications concerning how we measure household material deprivation: (i) the non-linear version of the index, (ii) the fact of being deprived and (iii) the counting approach index. The results are reported in Table 10.

------- Insert Table 10 here --------

[16] Results with the CMP approach are similar.

To account for non-linear effects, household material deprivation is included in logarithmic terms (Panel B). The results are similar to our benchmark case. The degree of urbanization is the largest confounder (more cities than towns), followed by household material deprivation and, finally, the lowest effect comes from income.

In the case of the counting index (Panel C), we again find that degree of urbanization is the main driver of child material deprivation, with living in a city exerting a larger effect than living in a town. In this case, household material deprivation ceases to influence child material deprivation more than income, which only occurs through the indirect effect.

When we did consider the intensity of household material deprivation, but the fact of being deprived (Panel D), we surprisingly found that the intensity of household material deprivation decreases the probability of children being deprived. This finding could be interpreted as the household protecting the children, as we found in the descriptive analysis. There is a larger proportion of households which are deprived and whose children are not than deprived households with deprived children. Additionally, we do not find any direct or indirect effect of the degree of urbanization. In this case, the size of household material deprivation and household income are fairly similar. Therefore, we do find a difference between the determinants of being deprived and the intensity of deprivation.

In terms of regional characteristics (Table 11), we find that the effect of the proportion of cities and towns in the region are similar to the effects in the benchmark case under all alternative measures of household material deprivation.

------- Insert Table 11 in here --------

6.3. Effects through the distribution of household material deprivation and income

We now analyze another form of non-linearity in the effect of household material deprivation and income which consists of defining their quintiles and determining whether the above findings hold at any level of income or household material deprivation. In Table 12 we report the estimation for our main variables of interest. Note that the income quintiles are defined in the standard manner. However, we discretize household material deprivation into five groups since 51.4% of the sample is not deprived at the household level. HD_i *(Q1)* is a dummy

that takes the value of 1 if the household is not deprived and we define the quartiles ($HD_i(Q2)$ to $HD_i(Q5)$) for the positive values of household material deprivation.[17]

------- Insert Table 12 here --------

We first note that household material deprivation increases child material deprivation if the intensity of the former is sufficiently high (i.e. being in HD_i(Q4) and HD_i(Q5)). Unlike the results in Table 8, where household material deprivation was considered a continuous variable, here the variable *HDi* is a continuous variable that masks the effect of those who do not suffer or suffer low intensity deprivation. This could be also helpful to interpret the fact that household material deprivation intensity reduces the probability of children being deprived found earlier. Income affects negatively and similarly across its distribution.[18] The influence of income on child material deprivation is constant along quintiles. Living in a city again only has an indirect effect through household material deprivation, whereas living in a town has no effect.

In terms of size, we should account for any change in income that can happen at any quintile and at any level of household material deprivation. We plot these effects in Figure 6. Note that the effect of income is plotted in absolute terms.

------- Insert Figure 6 here --------

We observe that in the model without endogeneity considerations, income in all quintiles has a higher effect than household material deprivation (only considered to be equal at Q5). The interpretation of this result could be that once we keep non-deprived households as the reference category, the effect of income is larger than in the case of household deprivation as a continuous variable. Once we correct for endogeneity, either with CFA or CMP, we observe that income is very relevant for reducing child material deprivation among children living in a household with the higher intensity of material deprivation ($HD_i(Q5)$). Finally, the effect on child material deprivation of living in a town (city) is larger than the effect of living in a household with some degree of material deprivation.

[17] Note that with the CFA methodology, the effect of household material deprivation takes into account the effect of the latent factors, and for $HD_i(Q2)$ and $HD_i(Q3)$ the combination of both implies an effect which is not significantly different from zero.

[18] Tests have been run and differences among the income quintiles are not significantly different from zero.

6.4. Multilevel estimation techniques

Now we estimate our initial measure of material deprivation with the frequency-based index, but using multilevel techniques. The regional cohort is now our second level. With multilevel techniques we can control for individual and regional heterogeneity. We can also endogenize household material deprivation using CFA and CMP as before (see Table 13).

------- Insert Table 13 in here --------

We find that the household material deprivation effect on child material deprivation is larger than the effect of degree of urbanization and income. The additional variability at the individual and regional level could be driving this change. In particular, a 10% increase in household material deprivation produces an increase in child material deprivation of 0.004 (columns 2 and 4) and 0.012 units (column 3), while the decrease in child material deprivation due to income is about 0.003–0.004 units. The main change when using multilevel techniques is the degree of urbanization. While the % of cities has a positive effect only at the regional level, direct and indirect effects now coexist at the individual level. Thus, we found that living in a city (town) increases child material deprivation by 0.009 (0.006) units, independently of the method chosen to correct endogeneity. However, although the effect is larger than that of income, it is not clear now whether it is lower or not than the effect of household material deprivation (under CFA it is, while under CMP it is not).

7. Conclusions

In this paper, we compare how household material deprivation, income and degree of urbanization affect the intensity of child material deprivation. For our analysis, we consider different measures of child and household material deprivation and the distribution of income and household material deprivation. In general, the degree of urbanization and household material deprivation are larger drivers of child material deprivation than income. The exceptions are (i) the index of child material deprivation consisting of basic needs, where household material deprivation has no effect; (ii) income is the main driver if we do not consider the endogenous weights for items when building the index (the counting approach); and (iii) within households at the top quintile of deprivation, where household material deprivation has a larger effect than degree of urbanization;

Based on our results, we can conclude that all income policies to alleviate child material deprivation might have a lower effect than initially intended. Thus, our findings might be of help for politicians and policymakers to design the most effective policies intended to eliminate, or at least reduce, the incidence of child material deprivation beyond income-related programs. Special attention should be paid to the role played by the degree of urbanization and regional differences. We have shown that living in a city or a town could have either a positive or a negative effect on child material deprivation depending on the specific degree of urbanization of the region. Social intervention programs might be related to degree of urbanization and therefore the incidence of these programs could vary by region.

Additionally, we find that larger expenditure on social programs helps to reduce child material deprivation. Like previous studies at the country level (see, for instance, Bárcena-Martín et al., 2014; Bárcena-Martín et al., 2017a: Guio et al., 2020), at the regional level we can also conclude that countries with more prosperous regions and generous social benefits systems tend to have lower child deprivation levels. Moreover, in line with Bárcena-Martín et al. (2017a), the most effective social benefits are not necessarily those targeted at children. This is also related with our evidence, which shows that a reduction in household material deprivation would help to reduce child material deprivation, although not totally. More specifically, our results highlight that children's basic needs are always protected even if they are living in a deprived household, while educational and leisure needs are not always completely met. Thus, in line with the Europe 2020 Strategy, measures at the regional level that enhance economic growth and reduce inequality and social exclusion should be considered. Nonetheless, these policies should not focus only on increasing individual income since, as shown previously, income is not the best driver to reduce child material deprivation. Thirdly, and in line with the regional characteristics discussed above, degree of urbanization, economic growth, public expenditure and others are relevant to explain regional differences in child material deprivation. Hence, policies focused on reducing child material deprivation or on urbanization should be defined at the regional level and consider regional-specific characteristics.

Nonetheless, although this paper constitutes a notable advance in the analysis of factors that explain regional differences with respect to child material deprivation levels, further work is needed to analyze the causal relationship between regional-specific public policy and child material deprivation and determine how to reduce it, especially in cities and towns where the incidence is higher and where most people are expected to live in the near future.

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Appendix

Table 1. Non-monetary child deprivation indicators

BASIC NEEDS
Some new (not second-hand) clothes
Two pairs of properly fitting shoes (including a pair of all-weather shoes)
Fresh fruit and vegetables once a day
One meal with meat, chicken or fish (or vegetarian equivalent) at least once a day
EDUCATIONAL OR LEISURE NEEDS
Books at home suitable for their age
Outdoor leisure equipment (bicycle, roller skates, etc.)
Indoor games (educational baby toys, building blocks, board games, computer games, etc.)
Regular leisure activity (swimming, playing an instrument, youth organizations, etc.)
Celebrations on special occasions (birthdays, name days, religious events, etc.)
Invite friends round to play and eat from time to time
Participate in school trips and school events that cost money
Suitable place to study or do homework

Note. Variables from the EU-SILC 2009 and 2014 module on material deprivation.

Table 2. Descriptive statistics of child material deprivation

		Mean (SD)
2009	% of not deprived	0.861 (0.347)
	Weighting index[(a)]	0.209 (0.171)
	Counting index[(a)]	2.560 (2.087)
	No. observations	2,372
2014	% of not deprived	0.759 (0.427)
	Weighing index[(a)]	0.251 (0.207)
	Counting index[(a)]	3.134 (2.517)
	No. observations	2,089

Note. [(a)]These are conditional means on the fact of being deprived. CD_i is the child material deprivation index. Standard deviation in parenthesis. Adapted from the EU-SILC (2009-2014).

Table 3. Non-monetary household deprivation indicators

ECONOMIC STRAIN
Afford to keep home adequately warm
Afford to pay for a one-week annual holiday away from home
Afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day
Afford to pay unexpected financial expenses
Afford to pay utility bills
DURABLES
Have a telephone
Have a color TV
Have a washing machine
Have a personal car

Note. Variables from the EU-SILC 2009 and 2014 module on material deprivation.

Table 4. Household and child material deprivation

			Household		
			Not deprived	Lack<4 items	Lack≥ 4 items
2009			48.5%	47.3%	4.25%
	Not deprived	86.1%	49.9%	35.7%	1.1%
Children	Lack< 6 items[(a)]	12.3%	0.6%	10.0%	1.8%
	Lack≥6 items	1.6%	0.0%	0.4%	1.3%
No. Observations				2,372	
			Not deprived	Lack<4 items	Lack≥4 items
2014			43.9%	47.26%	8.8%
	Not deprived	75.9%	44.6%	29.9%	1.43%
Children	Lack<6 items	19.6%	0.7%	13.8%	5.14%
	Lack≥6 items	4.5%	0.0%	1.9%	2.3%
No. Observations				2,089	

Note.[(a)] The choice of 6 items is ad-hoc and is in line with the most extended choice of 4 items to reflect severe material household deprivation (4/9 for household material deprivation, 6/12 for child material deprivation). Adapted from EU-SILC (2009 and 2014).

Table 5. Descriptive statistics of household and parental explanatory variables

	2009		2014	
	Mean	SD	Mean	SD
Individual-level variables				
HD_i	0.087	0.113	0.105	0.131
Cities	0.483	0.500	0.482	0.500
Towns	0.242	0.428	0.252	0.435
Income[(a)]	16.21	11.63	14.19	10.14
Couple	0.861	0.346	0.888	0.315
Owner	0.800	0.400	0.756	0.429
%Chronic	0.187	0.276	0.180	0.276
#child (younger than 3)	0.209	0.435	0.241	0.455
#child (3 to 5)	0.400	0.572	0.433	0.580
#child (6 to 11)	0.835	0.709	0.870	0.746
#child (12 to15)	0.457	0.628	0.408	0.592
Parental variables				
Fulltime father	0.643	0.479	0.592	0.492
Parttime father	0.014	0.117	0.030	0.172
Tertiary father	0.324	0.468	0.350	0.477
Forty father	0.591	0.492	0.617	0.486
Immigrant father	0.200	0.400	0.200	0.400
Fulltime mother	0.357	0.479	0.334	0.472
Parttime mother	0.159	0.365	0.158	0.365
Tertiary mother	0.342	0.474	0.435	0.496
Forty mother	0.436	0.496	0.466	0.499
Immigrant mother	0.218	0.413	0.204	0.403
None full time	0.259	0.438	0.304	0.460
Father full time	0.384	0.486	0.362	0.481
Both full time	0.259	0.438	0.230	0.421
None tertiary	0.549	0.498	0.480	0.500
Father tertiary	0.109	0.312	0.085	0.279
Both tertiary	0.214	0.411	0.265	0.441
None older than 45	0.380	0.485	0.347	0.476
Father older than 45	0.184	0.387	0.187	0.390
Both older than 45	0.408	0.491	0.430	0.495
None immigrant	0.763	0.426	0.766	0.424
Father immigrant	0.020	0.139	0.030	0.170
Both immigrant	0.181	0.385	0.170	0.376
No.. Observations	2,372		2,089	

Note.[(a)] In 1000 euros. Adapted from the EU-SILC (2009 and 2014).

Table 6. Descriptive statistics of explanatory variables at regional level

	2009		2014	
Variables	Mean	SD	Mean	SD
Cities reg	0.490	0.248	0.497	0.163
Towns reg	0.232	0.127	0.238	0.102
GDP Per capita	10.02	0.208	9.984	0.230
s80s20	5.613	0.550	6.382	0.761
Risk poverty	24.94	7.067	29.39	9.743
Long unemployment	4.287	1.370	12.95	3.115
Social protection	0.107	0.019	0.083	0.018
Public goods	0.583	0.073	0.521	0.061
Tertiary education	29.74	5.756	34.73	7.237
Employment rate	63.75	5.358	59.99	6.488
Female unemployment	18.51	5.517	25.94	7.261
Female employment	42.17	5.312	39.87	5.547
No. Observations	2,372		2,089	

Note. Adapted from the EU-SILC (2009 and 2014).

Table 7. Estimation results for children and household material deprivation (Step 1)

	Child Mat. Dep. (CD)				*Household Mat. Dep.*	
	OLS	OLS	CFA	CMP	CFA	CMP
HD_i		0.538***	0.870**	0.918**		
		(0.046)	(0.267)	(0.350)		
Cities		-0.005	-0.016+	-0.014	0.032***	0.024***
		(0.005)	(0.009)	(0.009)	(0.004)	(0.005)
Towns		0.001	-0.005	-0.004	0.018**	0.014*
		(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
Income		-0.024***	-0.011	-0.008	-0.038***	-0.041***
		(0.005)	(0.012)	(0.016)	(0.003)	(0.005)
Household Characteristics[a]	No	Yes	Yes	Yes	Yes	Yes
Parental Characteristics[a]	No	Yes	Yes	Yes	Yes	Yes
Time fixed effects	No	No	No	No	Yes	Yes
Region fixed effect	No	No	No	No	Yes	Yes
Const.	0.018**	0.180***	0.024	-0.012	0.411***	0.443***
	(0.006)	(0.052)	(0.140)	(0.189)	(0.045)	(0.054)
Correlation (CD_i HDi)[(b)]					-0.334	-0.370
					(0.269)	(0.333)
F-test (β_{rt})	9.220	2.590	2.100	55.090		
Prob>F-test (β_{rt})	0.000	0.000	0.000	0.009		
Chi squared (β_{rt})	163.4	123.6	105.641	4090.3		
Prob> Chi-squared (β_{rt})	0.000	0.000	0.000	0.000		
R-squared	0.129	0.446	0.447			
Regional cohort variables	34	34	34	34		
No. Observations	4,461	4,461	4,461	4,461	4,461	4,461

Note. Standard errors in parentheses. +p*<.1, *p<.05, **p<.01, ***p<.001**.** [(a)]The estimated parameters are reported in Table A.1 in Appendix A. [(b)]Statistic in column 5 is the *latent factor* for the CFA estimation; whereas statistic in column 6 is the *Athrho12* coefficient from the CMP estimation.

Table 8. Estimation results for child material deprivation (Step 2)

	OLS		CFA		CMP	
Cities reg	0.119***	-0.200***	0.118***	-0.198***	0.120***	-0.196***
	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
Cities_reg (squared)	-0.102***	0.712***	-0.095***	0.704***	-0.105***	0.700***
	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)
Towns_reg	0.038***	0.044***	0.037***	0.039***	0.018***	0.039***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)
Towns_reg (squared)	-0.013	-0.015*	-0.009	-0.011+	0.011	-0.011+
	(0.008)	(0.006)	(0.008)	(0.006)	(0.008)	(0.006)
Const.	0.129**	0.737***	0.146**	0.459***	-0.001	0.406***
	(0.047)	(0.098)	(0.046)	(0.098)	(0.045)	(0.098)
Regional Charact.[(a)]	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Region fixed effect	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
R-squared	0.742	0.986	0.717	0.984	0.717	0.983
No. Observations	4,461	4,461	4,461	4,461	4,461	4,461

Note. Standard errors in parentheses. +p*<.1, *p<.05, **p<.01, ***p<.001.[(a)]

Table 9. Estimation results by dimension of child material deprivation

	Children Mat. Dep. (CD)				*Household Mat. Dep. (HD)*	
	OLS	OLS	CFA	CMP	CFA	CMP
PANEL A: BASIC NEEDS						
HD_i		0.452***	0.504+	0.519		
		(0.065)	(0.279)	(0.322)		
Cities		0.002	0.001	0.001	0.021***	0.024***
		(0.005)	(0.011)	(0.009)	(0.004)	(0.005)
Towns		0.008	0.007	0.007	0.011**	0.014*
		(0.006)	(0.007)	(0.006)	(0.004)	(0.006)
Income		-0.015**	-0.013	-0.013	-0.038***	-0.041***
		(0.005)	(0.013)	(0.014)	(0.002)	(0.005)
Const.	0.005	0.088+	0.063	0.054	0.411***	0.437***
	(0.004)	(0.048)	(0.144)	(0.171)	(0.045)	(0.053)
Correlation (CD_i, HDi)[(a)]					-0.334	-0.065
					(0.269)	(0.312)
Cities reg		-0.188***	-0.187***	-0.187***		
		(0.003)	(0.003)	(0.003)		
Cities reg (squared)		0.533***	0.532***	0.531***		
		(0.007)	(0.007)	(0.007)		
Towns reg		-0.023***	-0.024***	-0.024***		
		(0.006)	(0.006)	(0.006)		
Towns reg (squared)		0.091***	0.092***	0.092***		
		(0.007)	(0.007)	(0.007)		
Const.		6.225***	6.182***	6.169***		
		(0.107)	(0.107)	(0.107)		
PANEL B: EDUCATIONAL/LEISURE NEEDS						
HD_i		0.614***	1.114**	1.292*		
		(0.050)	(0.344)	(0.561)		
Cities		-0.009	-0.025*	-0.025+	0.021***	0.024***
		(0.008)	(0.012)	(0.015)	(0.004)	(0.005)
Towns		-0.002	-0.011	-0.011	0.011**	0.014*
		(0.009)	(0.010)	(0.011)	(0.004)	(0.006)
Income		-0.027***	-0.008	0.001	-0.038***	-0.041***
		(0.007)	(0.015)	(0.024)	(0.002)	(0.005)
Const.	0.024*	0.614***	1.114**	1.292*	0.411***	0.442***
	(0.010)	(0.050)	(0.344)	(0.561)	(0.045)	(0.054)
Correlation (CD_i, HDi)[(a)]					-0.334	-0.501
					(0.269)	(0.379)
Cities reg		-0.226***	-0.224***	-0.221***		
		(0.007)	(0.007)	(0.007)		
Cities reg (squared)		0.929***	0.919***	0.910***		
		(0.017)	(0.017)	(0.017)		
Towns reg		0.124***	0.116***	0.114***		
		(0.011)	(0.011)	(0.011)		
Towns reg (squared)		-0.107***	-0.099***	-0.097***		
		(0.014)	(0.014)	(0.014)		
Const.		-4.052***	-4.459***	-4.599***		
		(0.220)	(0.220)	(0.219)		

Note. Standard errors in parentheses. +p*<.1, *p<.05, **p<.01, ***p<.001. [(a)]Statistic in column 5 is the *latent factor* for the CFA estimation, whereas statistic in column 6 is the *Athrho12* coefficient from the CMP estimation.

Table 10. Estimation results for different measures of child material deprivation (Step 1)

		Child Mat. Dep. (CD)			*Household Mat.Dep.*	
PANEL A: Frequency-based index	OLS	OLS	CFA	CMP	CFA	CMP
HD_i		0.538***	0.870**	0.918**		
		(0.046)	(0.267)	(0.350)		
Cities		-0.005	-0.016+	-0.014	0.032***	0.024***
		(0.005)	(0.009)	(0.009)	(0.004)	(0.005)
Towns		0.001	-0.005	-0.004	0.018**	0.014*
		(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
Income		-0.024***	-0.011	-0.008	-0.038***	-0.041***
		(0.005)	(0.012)	(0.016)	(0.003)	(0.005)
Const.	0.018**	0.180***	0.024	-0.012	0.411***	0.443***
	(0.006)	(0.052)	(0.140)	(0.189)	(0.045)	(0.054)
Correlation $(CD_i, HDi)^{(a)}$					-0.334	-0.370
					(0.269)	(0.333)
PANEL B: Log (freq-based index)						
HD_i		0.602***	1.032***	1.145***		
		(0.052)	(0.325)	(0.466)		
Cities		-0.004	-0.013	-0.015	0.022***	0.019***
		(0.005)	(0.008)	(0.010)	(0.004)	(0.004)
Towns		0.002	-0.003	-0.004	0.011+	0.011*
		(0.007)	(0.006)	(0.008)	(0.006)	(0.005)
Income		-0.025***	-0.01	-0.005	-0.033***	-0.035***
		(0.005)	(0.012)	(0.018)	(0.003)	(0.004)
Const.	0.018**	0.188***	0.011	-0.049	0.358***	0.386***
	(0.006)	(0.052)	(0.147)	(0.215)	(0.038)	(0.045)
Correlation $(CD_i, HDi)^{(a)}$					-0.433	-0.436
					(0.327)	(0.359)
PANEL C: Counting index						
HD_i		0.562***	0.940***	0.892***		
		(0.047)	(0.300)	(0.079)		
Cities		-0.034	-0.134	-0.107	0.263***	0.125+
		(0.068)	(0.096)	(0.070)	(0.045)	(0.073)
Towns		0.029	-0.022	-0.016	0.134+	0.130
		(0.081)	(0.079)	(0.082)	(0.075)	(0.086)
Income		-0.308***	-0.148	-0.158**	-0.422***	-0.750***
		(0.066)	(0.150)	(0.068)	(0.036)	(0.075)
Const.	0.224**	2.350***	0.304	0.435	4.659***	7.134***
	(0.078)	(0.630)	(1.787)	(0.700)	(0.504)	(0.809)
Correlation $(CD_i, HDi)^{(a)}$					-0.382	-0.654***
					(0.303)	(0.074)
PANEL D: Being deprived[(b)]						
HD_i		0.029***	-0.035	-0.085***		
		(0.004)	(0.045)	(0.009)		
Cities		0.007	0.009	0.01	0.107	0.121+
		(0.006)	(0.006)	(0.007)	(0.072)	(0.062)
Towns		0.008	0.01	0.011	0.110	0.112
		(0.007)	(0.008)	(0.008)	(0.078)	(0.074)
Income		-0.042***	-0.050***	-0.057***	-0.785***	-0.505***
		(0.006)	(0.011)	(0.007)	(0.078)	(0.060)
Const.	0.018**	0.396***	0.517***	0.611***	7.553***	4.675***
	(0.006)	(0.059)	(0.129)	(0.070)	(0.846)	(0.592)
Correlation $(CD_i, HDi)^{(a)}$					0.069	2.496***
					(0.045)	(0.154)
Household characteristics	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Parental characteristics	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Time fixed effects	*No*	*No*	*No*	*No*	*Yes*	*Yes*
Region fixed effect	*No*	*No*	*No*	*No*	*Yes*	*Yes*
Regional cohort variables	34	34	34	34		
No. Observations	4,461	4,461	4,461	4,461	4,461	4,461

Note. Standard errors in parentheses. +p*<.1, *p<.05, **p<.01, ***p<.001.

[(a)]Statistic in column 5 is the *latent factor* for the CFA estimation; whereas statistic in column 6 is the *Athrho12* coefficient from the CMP estimation [(b)]We report here marginal effects.

Table 11. Estimation results for different measures of child material deprivation (Step 2)

	OLS	CFA	CMP
PANEL A: Frequently based index			
Cities req	-0.200***	-0.198***	-0.196***
	(0.003)	(0.003)	(0.003)
Cities req (squared)	0.712***	0.704***	0.700***
	(0.007)	(0.007)	(0.007)
Towns req	0.044***	0.039***	0.039***
	(0.005)	(0.005)	(0.005)
Towns req (squared)	-0.015*	-0.011+	-0.011+
	(0.006)	(0.006)	(0.006)
Const.	0.737***	0.459***	0.406***
	(0.098)	(0.098)	(0.098)
PANEL B: Log(Frequently based)			
Cities req	-0.209***	-0.207***	-0.205***
	(0.003)	(0.003)	(0.003)
Cities req (squared)	0.721***	0.714***	0.708***
	(0.007)	(0.007)	(0.007)
Towns req	0.022***	0.016**	0.016**
	(0.005)	(0.005)	(0.005)
Towns req (squared)	0.014*	0.019**	0.019**
	(0.006)	(0.006)	(0.006)
Const.	1.325***	1.036***	0.953***
	(0.096)	(0.096)	(0.095)
PANEL C: Counting index			
Cities req	-2.305***	-2.301***	-1.709***
	(0.045)	(0.045)	(0.044)
Cities req (squared)	8.268***	8.204***	7.814***
	(0.110)	(0.110)	(0.095)
Towns req	0.167*	0.100	1.837***
	(0.073)	(0.074)	(0.089)
Towns req (squared)	0.191*	0.256**	-1.567***
	(0.091)	(0.091)	(0.106)
Const.	15.80***	12.56***	-29.70***
	(1.427)	(1.427)	(1.566)
PANEL D: Being deprived			
Cities req	-0.224***	-0.220***	-0.174***
	(0.003)	(0.003)	(0.002)
Cities req (squared)	0.774***	0.778***	0.519***
	(0.009)	(0.009)	(0.005)
Towns req	-0.001	-0.011**	-0.026***
	(0.004)	(0.004)	(0.003)
Towns req (squared)	0.070***	0.089***	0.073***
	(0.006)	(0.006)	(0.004)
Const.	3.371***	3.742***	2.920***
	(0.102)	(0.101)	(0.060)
Regional charact.	*Yes*	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*	*Yes*
Region fixed effect	*Yes*	*Yes*	*Yes*
R-squared	0.986	0.984	0.983
N. Observations	4,461	4,461	4,461

Note. Standard errors in parentheses. +p*<.1, *p<.05, **p<.01, ***p<.001.

Table 12. Estimation results across household material deprivation and income

	OLS	OLS	CFA	CMP	CFA	CMP
INDIVIDUAL VARIABLES						
HD_i (Q2)		-0.004	0.031***	0.003		
		(0.004)	(0.006)	(0.007)		
HD_i (Q3)		0.004	0.158**	0.014		
		(0.005)	(0.057)	(0.012)		
HD_i (Q4)		0.038***	0.187**	0.052***		
		(0.007)	(0.059)	(0.015)		
HD_i (Q5)		0.136***	0.282***	0.157***		
		(0.012)	(0.063)	(0.018)		
Cities		0.000	0.001	-0.001	0.275**	0.128*
		(0.006)	(0.006)	(0.006)	(0.086)	(0.060)
Towns		0.008	0.007	0.008	0.057	0.029
		(0.007)	(0.007)	(0.007)	(0.109)	(0.064)
Income (Q2)		-0.053***	-0.053***	-0.051***	-0.588***	-0.393***
		(0.009)	(0.009)	(0.010)	(0.084)	(0.073)
Income (Q3)		-0.044***	-0.047***	-0.039***	-1.080***	-0.696***
		(0.008)	(0.009)	(0.010)	(0.092)	(0.074)
Income (Q4)		-0.044***	-0.053***	-0.038***	-1.569***	-0.980***
		(0.008)	(0.009)	(0.011)	(0.096)	(0.089)
Income (Q5)		-0.041***	-0.061***	-0.034**	-2.302***	-1.413***
		(0.009)	(0.010)	(0.012)	(0.144)	(0.103)
Const.	0.033***	0.043*	0.084***	0.028		
	(0.004)	(0.017)	(0.019)	(0.019)		
Correlation (CD_i, *HDi*)[(a)] *at Q2*					-0.022***	-0.066
					(0.004)	(0.055)
Correlation (CD_i, *HDi*) [(a)] *at Q3*					-0.061***	
					(0.008)	
Correlation (CD_i, *HDi*) [(a)] *at Q4*					-0.183**	
					(0.059)	
Correlation (CD_i, *HDi*) [(a)] *at Q5*					-0.181**	
					(0.062)	
REGIONAL VARIABLES						
Cities reg		-0.211***	-0.223***	-0.212***		
		(0.002)	(0.002)	(0.002)		
Cities reg (squared)		0.821***	0.844***	0.822***		
		(0.005)	(0.004)	(0.005)		
Towns reg		0.019***	0.021***	0.019***		
		(0.002)	(0.002)	(0.002)		
Towns reg (squared)		0.119***	0.122***	0.120***		
		(0.003)	(0.003)	(0.003)		
Const.		3.225***	3.022***	3.251***		
		(0.055)	(0.051)	(0.055)		

Note. Standard errors in parentheses. +p*<.1, *p<.05, **p<.01, ***p<.001.[(a)]Statistic in column 3 is the *latent factor* for the CFA estimation, whereas statistic in column 4 is the *Athrho12* coefficient from the CMP estimation.

Table 13. Estimation results using multilevel techniques

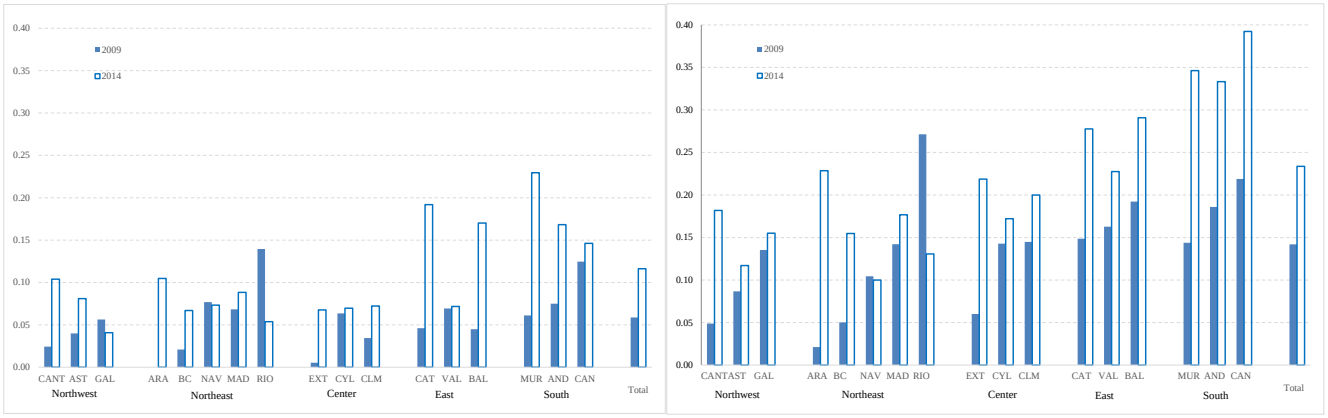
	Child Mat. Dep. (CD)				*Household Mat. Dep. (HD)*	
	OLS	OLS	CFA	CMP	CFA	CMP
INDIVIDUAL VARIABLES						
HD_i		0.425***	1.193***	0.454***		
		(0.014)	(0.222)	(0.014)		
Cities		0.000	-0.016**	0.000	0.021***	0.021***
		(0.004)	(0.006)	(0.003)	(0.004)	(0.004)
Towns		0.001	-0.007+	0.001	0.011**	0.011**
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Income		-0.020***	0.009	-0.020***	-0.038***	-0.038***
		(0.002)	(0.009)	(0.002)	(0.002)	(0.002)
Const.	0.033***	-0.013	-0.113	-0.001	0.080	0.080
	(0.004)	(0.378)	(0.381)	(0.339)	(0.325)	(0.330)
Correlation (CD_i, HDi)[(a)]					-0.770***	0.007***
					(0.222)	(0.000)
REGIONAL VARIABLES						
Cities reg		0.066*	0.032	0.064*		
		(0.032)	(0.033)	(0.030)		
Cities reg (squared)		-0.048	-0.01	-0.049		
		(0.042)	(0.043)	(0.038)		
Towns reg		-0.001	0.017	0.006		
		(0.041)	(0.042)	(0.040)		
Towns reg (squared)		0.016	-0.052	0.012		
		(0.066)	(0.069)	(0.064)		
Const.		0.063	-0.027	-0.001		
		(0.378)	(0.381)	(0.339)		
VAR(Residual)	0.011***	0.007***	0.007***	0.008***	0.085***	0.092***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
VAR(Cohort-region)	0.000***	0.000	0.000	0.000***	0.004+	0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)

Note. Standard errors in parentheses. +p*<.1, *p<.05, **p<.01, ***p<.001.[(a)]Statistic in column 5 is the *latent factor* for the CFA estimation, whereas statistic in column 6 is the *Athrho12* coefficient from the CMP estimation.

Figures

Figure 1. Incidence of child material deprivation in Spain by regions (2009-2014)

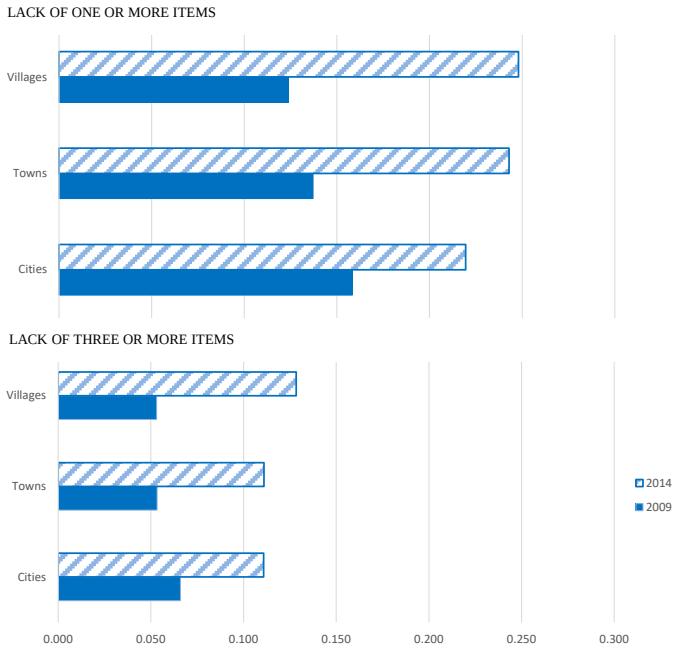
Panel A: lack some item **Panel B: lack three or more items**



Source: Own elaboration from EU-SILC 2009 and 2014.

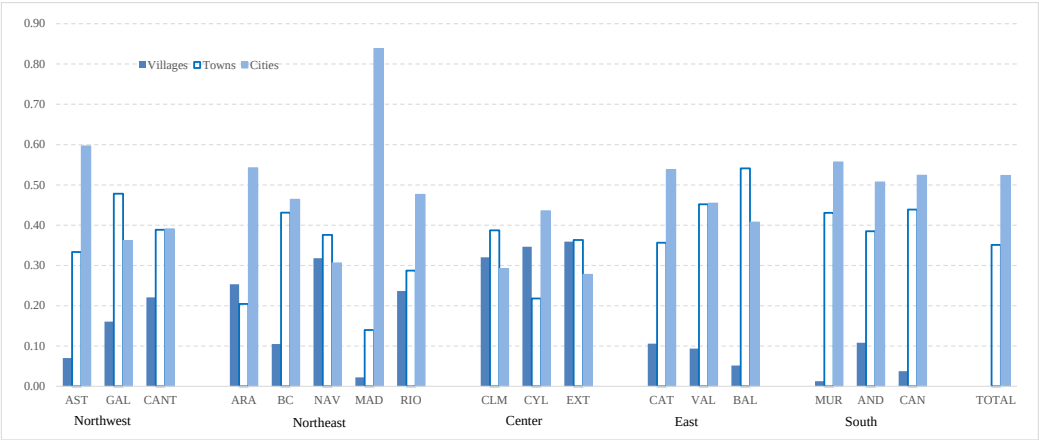
Note. In line with Eurostat, children are considered to be in a situation of material deprivation when they cannot afford at least three of the different items used to define this indicator (more details about the specific items are provided below).
NUTS classification from EUROSTAT (levels 1 and 2): Andalusia (AND), Aragon (ARA), Asturias (AST), Balearic Islands (BAL), Canary Islands (CAN), Cantabria (CANT), Catalonia (CAT), Castile-La Mancha (CLM), Castile and Leon (CYL), Extremadura (EXT), Galicia (GAL), Madrid (MAD), Murcia (MUR), Navarre (NAV), Basque Country (BC), La Rioja (RIO), Valencia (VAL).

Figure 2. Incidence of child material deprivation by degree of urbanization in Spain



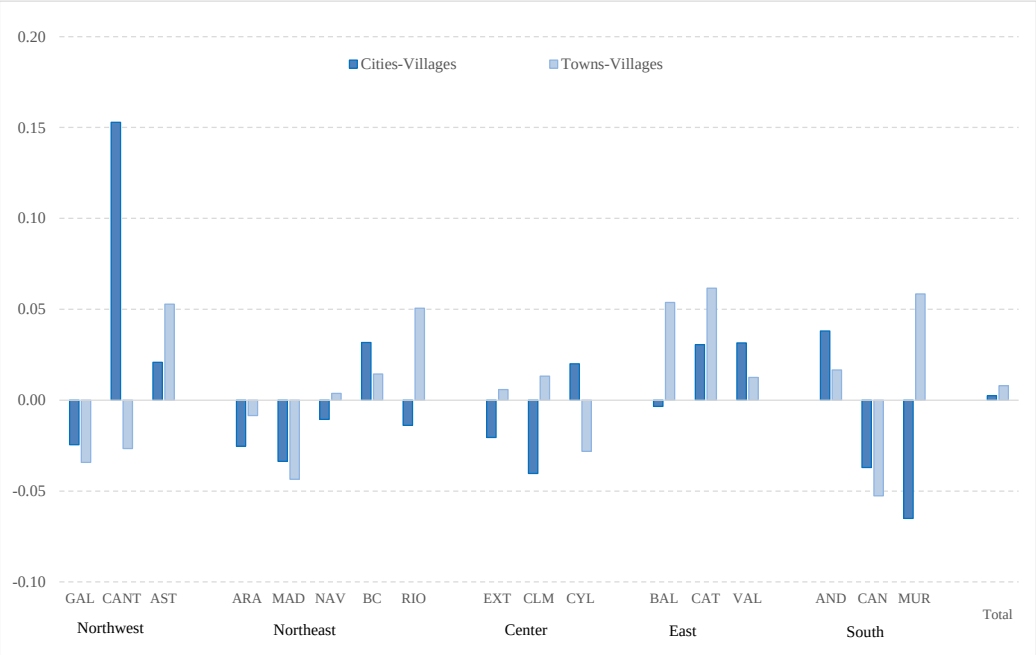
Source: Own elaboration from EU-SILC 2009 and 2014.
Note. Classification in DEGURBA is as follows: (1) *Densely populated area* or *cities*: Contiguous grid cells of 1 km^2 with a density of at least 1,500 inhabitants per km^2 and a minimum population of 50,000. (2) *Intermediate density area* or *towns*: Clusters of contiguous grid cells of 1 km^2 with a density of at least 300 inhabitants per km^2 and a minimum population of 5,000. (3) *Thinly populated area* or *villages*: Grid cells outside urban clusters.

Figure 3: Degree of urbanization by regions in Spain (2014)



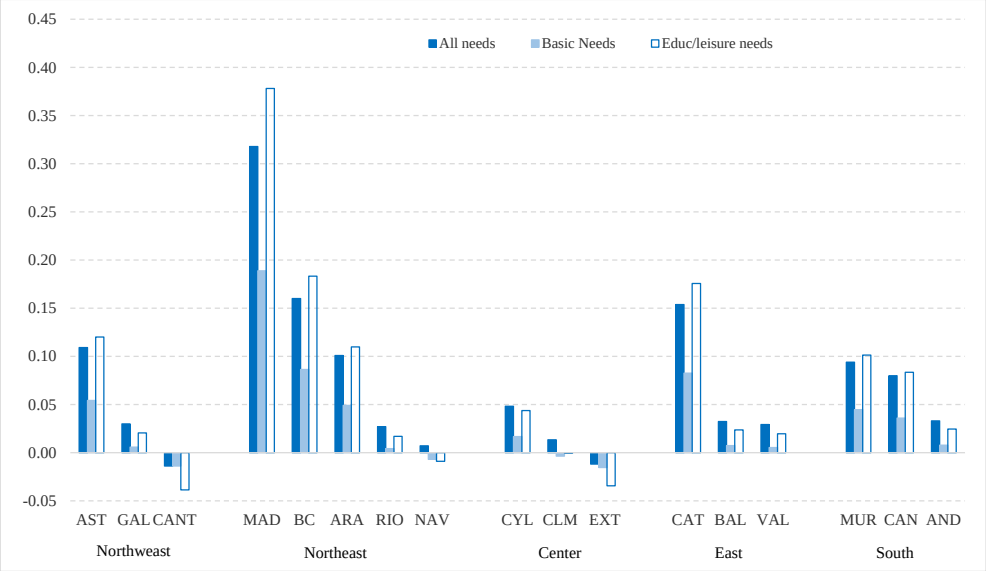
Source: Own elaboration from Spanish National Statistical Institute (INE).
Note. Classification in DEGURBA is as follows: (1) *Densely populated area* or *cities*: Contiguous grid cells of 1 km^2 with a density of at least 1,500 inhabitants per km^2 and a minimum population of 50,000. (2) *Intermediate density area* or *towns*: Clusters of contiguous grid cells of 1 km^2 with a density of at least 300 inhabitants per km^2 and a minimum population of 5,000. (3) *Thinl -populated area* or *villages*: Grid cells outside urban clusters.
NUTS classification from EUROSTAT (levels 1 and 2): Andalusia (AND), Aragon (ARA), Asturias (AST), Balearic Islands (BAL), Canary Islands (CAN), Cantabria (CANT), Catalonia (CAT), Castile-La Mancha (CLM), Castile and Leon (CYL), Extremadura (EXT), Galicia (GAL), Madrid (MAD), Murcia (MUR), Navarre (NAV), Basque Country (BC), La Rioja (RIO), Valencia (VAL).

Figure 4. Differential intensity of child material deprivation by region



Source: Own elaboration from Spanish National Statistical Institute (INE).
Note. Classification in DEGURBA is as follows: (1) *Densely populated area* or *cities*: Contiguous grid cells of 1 km^2 with a density of at least 1,500 inhabitants per km^2 and a minimum population of 50,000. (2) *Intermediate area* or *towns*: Clusters of contiguous grid cells of 1 km^2 with a density of at least 300 inhabitants per km^2 and a minimum population of 5,000. (3) *Thinly populated area* or *villages*: Grid cells outside urban clusters.
NUTS classification from EUROSTAT (levels 1 and 2): Andalusia (AND), Aragon (ARA), Asturias (AST), Balearic Islands (BAL), Canary Islands (CAN), Cantabria (CANT), Catalonia (CAT), Castile-La Mancha (CLM), Castile and Leon (CYL), Extremadura (EXT), Galicia (GAL), Madrid (MAD), Murcia (MUR), Navarre (NAV), Basque Country (BC), La Rioja (RIO), Valencia (VAL).

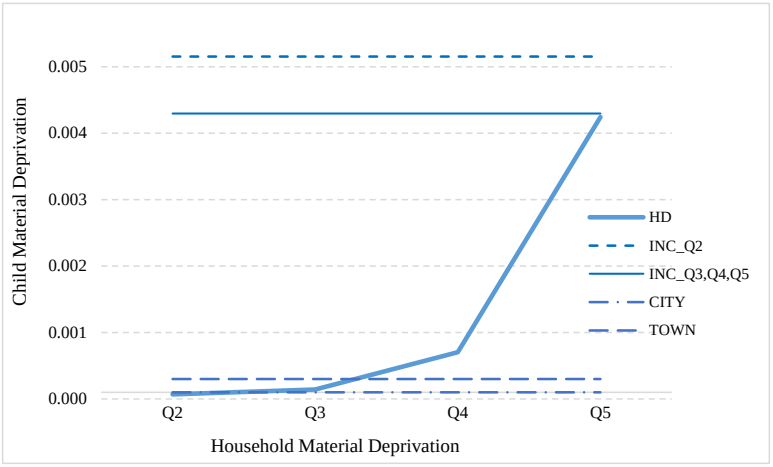
Figure 5. Size of the effect of living in a city by region



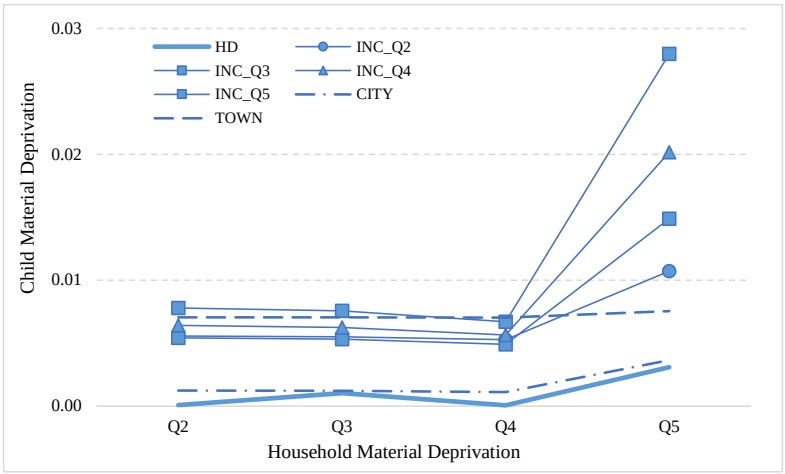
Note. Andalusia (AND), Aragon (ARA), Asturias (AST), Balearic Islands (BAL), Canary Islands (CAN), Cantabria (CANT), Catalonia (CAT), Castile-La Mancha (CLM), Castile and Leon (CYL), Extremadura (EXT), Galicia (GAL), Madrid (MAD), Murcia (MUR), Navarre (NAV), Basque Country (BC), La Rioja (RIO), Valencia (VAL).

Figure 6. Size of the effect of household material deprivation, household income and degree of urbanization

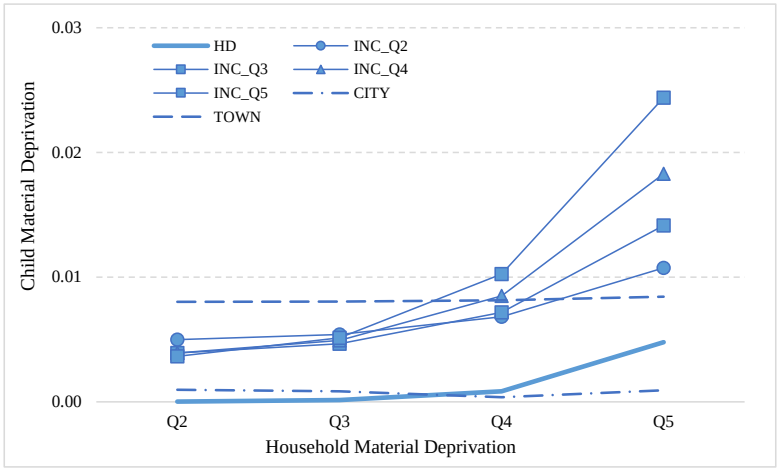
OLS



CFA



CMP



Appendix A

Table A1. Estimation results for child and household material deprivation (Step 1)

	Child Mat. Dep. (CD_i)			*Household Mat. Dep. (HD_i)*	
	OLS	CFA	CMP	CFA	CMP
Household Characteristics					
Couple	-0.011	-0.004	-0.003	-0.019**	-0.019*
	(0.008)	(0.010)	(0.011)	(0.005)	(0.008)
Owner	-0.020**	-0.014	-0.012	-0.016+	-0.018*
	(0.007)	(0.008)	(0.010)	(0.008)	(0.007)
%Chronic	0.019*	0.005	0.004	0.042***	0.040***
	(0.008)	(0.013)	(0.016)	(0.007)	(0.008)
#child (younger than 3)	0.023**	0.022**	0.022**	0.003	0.001
	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
#child (btw 3 and 5)	0.020***	0.020***	0.020***	0.002	0.002
	(0.006)	(0.006)	(0.005)	(0.008)	(0.005)
#child (btw 6 and 11)	0.018**	0.017**	0.017**	0.002	0.003
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
#child (btw 12 and 15)	0.021***	0.020***	0.020***	0.003	0.002
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)
Parental Characteristics					
Fulltime_father	-0.006	0.002	0.003		
	(0.005)	(0.007)	(0.009)		
Parttime_father	0.026	0.026	0.026		
	(0.018)	(0.018)	(0.018)		
Tertiary_father	0.013*	0.020**	0.021**		
	(0.006)	(0.007)	(0.007)		
Forty_father	0.007	0.012	0.014		
	(0.006)	(0.008)	(0.009)		
Immigrant_father	0.012	-0.003	-0.004		
	(0.011)	(0.018)	(0.020)		
Fulltime_mother	0.000	0.005	0.005		
	(0.004)	(0.005)	(0.006)		
Parttime_mother	-0.011*	-0.011*	-0.011*		
	(0.006)	(0.006)	(0.006)		
Tertiary_mother	-0.003	0.007	0.009		
	(0.004)	(0.010)	(0.012)		
Forty_mother	0.007	0.007	0.007		
	(0.006)	(0.006)	(0.006)		
Immigrant_mother	-0.015	-0.026*	-0.027+		
	(0.010)	(0.012)	(0.014)		
Household Characteristics					
None full time				0.023***	0.024**
				(0.004)	(0.007)
Father full time				-0.005	-0.006
				(0.003)	(0.006)
Both full time				-0.016*	-0.014*
				(0.006)	(0.006)
None tertiary				0.037***	0.036***
				(0.005)	(0.006)
Father tertiary				0.008	0.008
				(0.007)	(0.010)
Both tertiary				0.013**	-0.013*
				(0.003)	(0.005)
None older than 45				0.022	0.022
				(0.018)	(0.016)
Father older than 45				0.001	-0.002
				(0.018)	(0.014)
Both older than 45				0.007	0.004
				(0.015)	(0.015)
None immigrant				-0.019*	-0.017+
				(0.009)	(0.010)
Father immigrant				0.004	0.005
				(0.010)	(0.017)
Both immigrant				0.066**	0.059***
				(0.018)	(0.014)
Time Dummy				0.014***	0.013**
				(0.003)	(0.004)

Note. Standard errors in parentheses +p*<.1, *p<.05, **p<.01, ***p<.001.

Table A2. Estimation results for child material deprivation (Step 2)

	OLS		OLS		CFA		CMP	
	I	II	III	IV	V	VI	VII	VIII
GDP Per capita	-0.115***	-0.240***	-0.055***	-0.018*	-0.053***	0.007	-0.036***	0.011
	(0.008)	(0.003)	(0.005)	(0.008)	(0.005)	(0.008)	(0.005)	(0.008)
s80s20	0.008***	0.009***	0.004***	-0.009***	0.004***	-0.009***	0.006***	-0.009***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Risk poverty	0.000	0.007***	0.000	0.006***	-0.000**	0.006***	-0.000***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Long unemployment.	0.001***	0.001***	0.000	0.001***	0.000	0.001***	0.000	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Social protection	0.009***	-0.009***	0.004***	-0.005***	0.004***	-0.005***	0.004***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Public goods	0.004***	0.011***	0.004***	0.014***	0.003***	0.014***	0.004***	0.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tertiary education	0.003***	-0.016***	0.000	-0.017***	0.000	-0.017***	-0.001***	-0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Employment rate	0.002***	-0.010***	0.001***	-0.003***	0.001***	-0.003***	-0.000+	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female unemployment	0.434***	1.268***	0.382***	0.465***	0.373***	0.453***	0.427***	0.452***
	(0.028)	(0.005)	(0.017)	(0.018)	(0.017)	(0.018)	(0.017)	(0.018)
Female employment	0.024**	-0.222***	0.001	-0.238***	-0.002	-0.231***	-0.005	-0.228***
	(0.008)	(0.002)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)

Note. Standard errors in parentheses. +p*<.1, *p<.05, **p<.01, ***p<.001.

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