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COUNTRY DIFFERENCES IN MATERIAL DEPRIVATION IN EUROPE

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This paper assesses to what extent differences in the characteristics of individuals (micro-level perspective) and country-specific factors (macro-level perspective) can explain country differences with respect to material deprivation levels. Thus, our work aims to simultaneously consider the macro dimension and the predominantly individually-oriented study field of material deprivation using multilevel techniques. We make use of the European Union Statistics on Income and Living Conditions. Our results show that country-specific factors seem to be much more relevant than individual effects in explaining country differences in material deprivation. We estimate that the introduction of country-specific factors reduces the proportion of total variance due to between-country differences in deprivation by 72.7 percent, while individual-level variables reduce this proportion by only 9.4 percent. We also show, through interaction variables, that the effect of sociodemographic characteristics can be shaped by institutional and structural factors, especially by the level of GDP.

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1. INTRODUCTION

Nowadays, it is widely agreed that poverty has a multidimensional nature. In fact, with regard to material aspects, individuals with the same income may suffer different deprivation levels. They can experience poorer living standards due to the effects of accumulated resources, employment status, educational level, housing tenure, non-cash income, and social benefits, among other factors. Therefore, being poor cannot simply imply low monetary resources. To capture this idea, several proposals have appeared in the literature to measure the level of multidimensional deprivation (e.g., Nolan and Whelan, 1996, 2010; Atkinson *et al*., 2002; Atkinson, 2003; Bourguignon and Chakravarty, 2003; Chakravarty and D'Ambrosio, 2006; Ayala *et al*., 2011).

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In the European Union, the multidimensional framework has gained relevance over the past few years. As pointed out by Figari (2012) and Nolan and Whelan (2011), quantitative non-monetary indicators have been employed to monitor the Lisbon Strategy to fight against poverty as well as to evaluate the targets of the new Europe 2020 Strategy for "smart, sustainable and inclusive growth." Moreover, as Nolan and Whelan (2010) have shown, non-monetary indicators are designed to allow comparability across countries and over time, and additionally to make an in-depth analysis of the factors associated with different types of deprivation (and their variation across countries). An interesting variation in cross-country patterns across the dimensions can be seen, for example, in Nolan and Whelan (2010) and Boarini and Mira d'Ercole (2006).

In the existing literature, two distinct approaches have been considered to explain material deprivation across different countries: micro- and macro-level approaches. The former effectively scrutinizes the precise mechanisms of individual deprivation, but omits information for country characteristics, although such macro-level differences manifest at the individual level. Alternatively, macro-level studies may suffer from a black box problem of causal inference because micro-level mechanisms are unobserved (Goldthorpe, 2000). Moreover, macro-level studies can only control for individual characteristics such as family structure at the aggregate level (e.g., the rate of elderly couples). Our approach combines both micro and macro perspectives.

The main goal of this paper is to examine whether country differences with respect to material deprivation levels can be explained by differences in the characteristics of individuals (micro-level perspective) or by country-specific factors (macro-level perspective). In particular, we contribute to the existing research by analyzing country differences in deprivation through simultaneously considering the macro-level dimension and the predominantly individually-oriented study field of deprivation. Our method of analysis takes advantage of multilevel techniques that are especially suited for the analysis of such mixed-level data. To our knowledge, our study is among the first to estimate a multilevel model of deprivation (some scarce examples are Whelan and Maître, 2012, 2013). Additionally, another difference with respect to most other studies is the inclusion of a wide sample of European countries. In order to answer our question, we will make use of the European Union Statistics on Income and Living Conditions (EU-SILC) for the year 2007.

The paper is structured as follows. Section 2 deals with the concept of material deprivation. Section 3 reviews some significant papers on the study of material deprivation. Section 4 describes the data used, the deprivation index, and the variables introduced in the study. The method of analysis is explained in Section 5. Section 6 presents and discusses the results of our analysis. The final section concludes.

2. Material Deprivation

The measurement of material deprivation involves a set of methodological decisions which may partly condition the results, namely the definition of deprivation, the selection of items to measure deprivation, the aggregation procedure, and the deprivation line.

2.1. *Definition of Deprivation*

The seminal contribution of Townsend (1979) focused on people who were incapable 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. Contrary to that idea, Mack and Lansley (1985) developed the concept of "enforced lack," which emphasizes the difference between people's preferences and constraints. To exclude lifestyle preferences from the concept of deprivation, the recent related literature is often based on the enforced lack of items to reflect "deprivation" (see, e.g., Nolan and Whelan, 1996, 2007; Whelan and Maître, 2007; Guio, 2009; Guio *et al.*, 2009; Fusco *et al.*, 2011). In the present study, deprivation is defined as a situation that reflects enforced failures in different items.

2.2. *Selection of Items*

The Europe 2020 strategy for smart, sustainable, and inclusive growth was developed in 2010. Concretely, the EU has set five ambitious objectives or targets to be reached by 2020, specifically employment, innovation, education, social inclusion, and climate/energy. Each Member State has adopted its own national targets in each of these areas. One of these targets, social inclusion, is related to promoting social inclusion, particularly the reduction of poverty by aiming to lift at least 20 million people out of the risk of poverty and social exclusion in the EU. Following the Europe 2020 strategy, individuals at risk-of-poverty are persons with an equalized disposable income below the risk-of-poverty threshold, severely materially deprived persons, and those with a very low work intensity.

In this paper we adopt the Europe 2020 strategy and consider the same nine items when considering deprivation, that is: to pay utility bills; to keep their home adequately warm; to pay unexpected expenses; to eat meat, fish, or a protein equivalent every second day; to enjoy a week's holiday away from home; to have a car; to have a washing machine; to have a color TV; and to have a telephone.

In order to test the reliability of the items as good proxies of the underlying deprivation concept, we have employed Cronbach's alpha. This is known as the Kurder–Richardson Formula 20 when it is transformed to analyze the correlation between dichotomous indicators. Cronbach's α takes a high value if there are many items in the scale and the items are highly correlated with each other, thus implying the presence of an underlying factor. A threshold widely used to judge if a set of items is reliable is usually identified at around 0.70. We calculate the overall Cronbach's α to be 0.718; a satisfactory level of reliability in most countries.[1]

2.3. *Problem of Aggregation*

In measuring material deprivation at the individual level, it is necessary to aggregate the information on the different functioning failures of each individual.

[1]The unweighted mean reliability by country is 0.648, indicating that the selected items have been chosen in a consistent manner. Country-specific estimates show that Cronbach's alphas vary from 0.52 in Iceland to 0.73 in Bulgaria, with 25 countries showing values over 0.6.

Since the variables considered are qualitative, one option is the "counting" approach (Atkinson, 2003). A counting measure of deprivation is simply the number of items in which a person fails, with the same weight assigned to each item (Townsend, 1979; Mack and Lansley, 1985; Mayer and Jencks, 1989). Brandolini (2008) points out that 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.

Since some of the items may be more important than others, an alternative measure that assigns different weights to different items has been proposed in the literature. Decancq and Lugo (2012) distinguish three classes of approaches to set the weights: data-driven, normative, and hybrid. Data-driven weights are a function of the distribution of the achievements in the society and are not based, at least explicitly, on any value judgment about how the trade-offs between the items should be. Normative approaches only depend on the value judgments about the trade-offs and are not based on the actual distribution of the achievements in the society under analysis. Hybrid approaches are both data-driven and depend on some form of valuation of these achievements.

In our analysis we will consider data-driven weights where the weight associated to each item corresponds to the percentage of individuals owning the item in each country, what is known as the frequency-based weighting approach. This is motivated by the idea that individuals attach a higher importance to the shortfalls in items where a majority does not fall short. Therefore, less frequent deprivations are assigned a higher weight (Deutsch and Silber, 2005). The advantages of this approach are threefold. First, it allows the deprivation score of a given individual to increase if her conditions do not change, but all other individuals are better off. Second, the index takes into account variations in the possession of any item across countries due to economic, social, and cultural differences. Third, this approach is robust against the inclusion of items which are only relevant for a small minority of the population (Desai and Shah, 1988). Although in the present contribution we follow the frequency-based weighting approach, to compare results we also compute indices where all items are weighted equally (normative weights, where the weight is 1/9 for each item). Moreover we have also considered an overall weighting (Whelan and Maître, 2012, 2013) in which weights are computed across the entire set of countries considered, but we do not include the results here since we have reached similar conclusions.

2.4. *Deprivation Intensity*

Another issue arises when measuring deprivation: whether the interest is if the individual is deprived or not (i.e., working with thresholds) or the interest is the intensity of deprivation. Our main aim in this work is to study the determinants of the intensity of deprivation using a frequency-based weighting approach. However, for the sake of comparability, we also compute a measure of the intensity of deprivation considering equal weights and another measure that determines whether or not a person is severely materially deprived (following the criteria adopted under the Europe 2020 strategy, i.e., if a person cannot afford at least four of the nine previously-mentioned items).

3. Background

In recent years there has been considerable literature on material deprivation, though cross-national differences in the intensity of material deprivation have not received much attention. As pointed out in the introduction, the existing literature has followed two different approaches: micro- and macro-level analyses. In contrast, this paper proposes to jointly consider both micro and macro determinants and to disentangle which group of determinants is more relevant in explaining country differences in the intensity of material deprivation.

It thus seems appropriate to review and identify the main individual- and contextual-level determinants in the literature. We devote a specific subsection to papers that are most related to ours, which are all those that combine micro- and macro-level perspectives and mostly analyze cross-national differences in material deprivation. We present a detailed summary of contributions concerning micro-determinants in Table A1 of Appendix A and of those regarding the inclusion of macro-determinants in Table A2 of Appendix A.

3.1. *Micro-Level Determinants*

The micro-level perspective is the most extended approach in the analysis of material deprivation. In fact, there are numerous significant contributions in this direction. For an excellent review, see Boarini and Mira d'Ercole (2006). Although with different focuses and methodologies—even in the definition and type of material deprivation—these studies take into account individual-level socioeconomic determinants of deprivation to explain disparities among groups of countries.

We briefly summarize the most cited micro-level determinants in the related literature (see Table A1 in Appendix A), which we also use in this paper. Most studies find that women are generally more deprived than men, although this gender gap remains largely unexplained (see, e.g., Muffles and Fouarge, 2004; Halleröd *et al*., 2006).

As pointed out by Dewilde (2008), the negative relationship between age and deprivation can be related to the individual's position in either the housing market (in several countries most elderly people are outright owners and can thus get by on a smaller income), the labor market (unemployment affects young people more), or the fact that older people have better budgeting skills (age effect) or grew up in an era when people had less material demands (cohort effect). Eurostat (2002) states that due to housing deprivation, younger people are more deprived. Moreover, some studies found that the elderly surprisingly experience less deprivation than expected on the basis of their income (Muffles and Fouarge, 2004). Conversely, Tsakloglou and Papadopoulos (2002) find that, due to financial difficulties, the elderly are more likely to experience material deprivation.

A highly consistent result across all countries is that the presumptions of human capital theory that a higher education reduces deprivation and improves the life prospects of people are firmly confirmed (Muffles and Fouarge, 2004; Whelan *et al*., 2004; Boarini and Mira d'Ercole, 2006; Berthoud and Bryan, 2011; Figari, 2012).

A vast amount of literature considers that unemployed, inactive people, the long-term unemployed, or those working few hours have a high likelihood of deprivation (Layte *et al.*, 2001a, 2001b; Whelan *et al.*, 2001, 2004; Muffles and Fouarge, 2004; Halleröd *et al.*, 2006; Dewilde, 2008; Graaf-Zijl and Nolan, 2011; Pilkauskas *et al.*, 2012; Figari, 2012). In contrast, households with one or more self-employed or employed workers generally present lower deprivation scores (see, e.g., Eurostat, 2002; Berthoud and Bryan, 2011).

The relationship between material deprivation and the socioeconomic characteristics of the household is similar across countries. In all countries, people living alone and lone parents and families with dependant children are especially vulnerable to material deprivation (Tsakloglou and Papadopoulos, 2002; Boarini and Mira d'Ercole, 2006; Dewilde, 2008). Homeowners are less likely to report material deprivation than renters in all countries (Berthoud and Bryan, 2011; Figari, 2012).

In general, there is a weak association between personal income and the probability of experiencing different forms of material deprivation (Layte *et al.*, 2001a, 2001b; Whelan *et al.*, 2001; Figari, 2012; Fusco, 2012). Despite this weak association, Boarini and Mira d'Ercole (2006) found that the probability of experiencing material deprivation is twice as large among those in the lower quartile of the income distribution than for those in the middle quartile, although these differences vary greatly across countries.

3.2. *Macro-Level Determinants*

Figari (2012) highlights that a relevant part of the deprivation gap among countries is attributable to a country-specific effect, thus revealing the importance of factors such as cultural attitudes and institutions. In this direction, a number of studies have taken into account a macro-level perspective focused mainly on aspects of welfare regimes in their analyses (see references included in Table A2 of Appendix A).

There is a vast literature in which, rather than evaluating the impact of welfare regimes on deprivation, the influence of so-called "domain-specific" institutional measures is considered. The reasons for this choice as pointed out by Dewilde (2008) are twofold. First, most authors point to the considerable variations among countries belonging to the same regime cluster, leading them to conclude that it may be essential to incorporate country-specific features into the analysis (Maître *et al.*, 2005). Second, in order to formulate meaningful policy recommendations, we need to know which policies are related to which individual outcomes, preferably controlling for other possible explanations. In particular, the related literature has focused on the transfer system, since it is an important component of the welfare regime. There exists a significant relationship between social policy generosity (government social expenditure as a percentage of GDP) and material deprivation (e.g., Jenkins, 2000; Dewilde, 2008; Whelan *et al.*, 2008; Kenworthy *et al.*, 2011).

On the one hand, long-term unemployment affects individual characteristics such as the opportunity to earn income, work experience, and training (Whelan *et al.*, 2003; Muffles and Fouarge, 2004). On the other, it could indicate from the

macro perspective a poor record of employment creation, and less turnover and mobility in the labor market (flexibility of the labor market) as suggested by Blanchard and Summers (1986), Lindbeck and Snower (1989), and Bertola (1990).

In countries where societal inequalities are most pronounced, the levels of deprivation will also be the strongest (for related arguments, see Pichler and Wallace, 2009; Lancee and van der Werfhorst, 2012; Whelan and Maître, 2013).

Finally, GDP per capita might be interpreted as a general variable reflecting many other socioeconomic variables, therefore indicating the average material welfare of a society (Dewilde, 2008). In the related literature, the association between GDP and material deprivation is expected to be small (Whelan and Maître, 2012) or inexistent (Kenworthy *et al*., 2011).

3.3. *Combining Micro- and Macro-Level Determinants*

The need for research that combines micro and macro levels becomes evident. It is well known that the risk of deprivation across states in the absence of government intervention varies widely due to different economic and social circumstances. Hence, for instance, countries with different levels of GDP per capita, unemployment, and inequality may differ in average levels of deprivation. And, more interestingly, disadvantage does not always strike the same types of individuals across countries. Younger people are far more at risk of unemployment in Southern European states than in Northern European ones. Since this group of factors is not entirely unconnected to welfare policy (in its broadest sense), we need to be careful to separate individual factors from country-specific features when examining the effectiveness of welfare systems.

In relation to the papers which combine micro and macro levels summarized in Table A2 in Appendix A, we would like to point out the main differences with our work. In terms of the estimation procedure, it is worth noting that in studies that use dummy variables for countries or regime type (Layte *et al*., 2001b; Muffles and Fouarge, 2004; Dewilde, 2008), the target of inference is restricted to the groups represented in the sample and the effect of country-level predictors cannot be estimated simultaneously with group-level residuals. In the case of Dewilde (2008), standard errors are adjusted for clustering using robust standard errors, although it is not possible to assess the degree of between-country variation. We take advantage of multilevel techniques where the effects of country-level explanatory variables and the effects of country dummies can be disentangled by specifying country membership as an unobserved random effect. These models provide correct standard errors and also an estimate of the between-country variance in the level of deprivation.

In the line of the present paper, Whelan and Maître (2012, 2013) also consider multilevel techniques. However, our definition of deprivation is different and follows the Eurostat definition (their definition is either basic deprivation or economic stress); we consider more country variables (they consider GDP and inequality measures and in some cases welfare state dummies). Therefore, the results are also different. For example, Whelan and Maître (2012) find that the inclusion of country-level variables does not contribute much to the explanation of country differences in basic deprivation.

4. Data and Variables

To achieve our goals, we use the European Union Statistics on Income and Living Conditions (EU-SILC hereafter), an international database that consists of comparable, country-specific data. Specifically, we work with data for the year 2007 to perform our analysis.[2]

The analysis is carried out over a sample of 210,170 observations from 28 different countries with information on deprivation.[3] Since related research has suggested that, in general, household members tend to share the same standard of living (Nolan and Cantalon, 1998), we use the household as the unit of measurement, and the individual as the unit of analysis. This choice is also driven by the nature of the EU-SILC database, which collects non-monetary indicators only from the household reference person.[4] Our analysis focuses on the characteristics of the household reference person (HRP hereafter).

4.1. *Material Deprivation Index*

As mentioned before, to build the deprivation index we use the items proposed in the Europe 2020 strategy (Section 2.2). For each item we define a dichotomous indicator I_{ijc}:

$$I_{ijc} = \begin{cases} 0 & affordability \\ 1 & non\ affordability \end{cases} \quad for\ i = 1, \ldots, N; \quad j = 1, \ldots, J; \quad c = 1, \ldots, C,$$

where i refers to the individual; j corresponds to the items considered; and c represents the country. In the case of intensity of deprivation, we aggregate these indicators considering frequency-based weights. Denote w_{jc} as the weight corresponding to each item j where the weight is equal across individuals in the same country, c. Hence D_{ic} denotes the deprivation level for each individual:

$$D_{ic} = \sum_{j=1}^{J} w_{jc} I_{ijc}.$$

As in Figari (2012), we normalize D_{ic} by the sum of all the weights in order to permit comparisons across countries and multiply it by 100 to easily interpret the index as the percentage of consumption items the person is lacking (D_{ic} equals 0 if a person lacks no items and approaches 100 if an individual lacks all items).

[2]At the time this paper was written the most recent data available was for 2010. However, we use 2007 data since it is the wave in which more information is available on the items considered.

[3]The consideration of longitudinal data would only allow following an individual at most 4 years, which may not be enough time to capture the effect of most of the individual characteristics. Moreover, the longitudinal data considerably reduce the number of countries analyzed due to the lack of information for some variables or even for some countries in some years, which is essential to multilevel techniques. However, we have performed a sensitivity analysis based on longitudinal data with a multilevel model comprising three levels (149,688 individuals, 14 countries, 4 years). Estimates are available upon request. The results do not change, and if they do it is because some of the effects of the macro variables vanish.

[4]The household reference person is the person responsible for the accommodation—that is, the person owning or renting the accommodation. If the accommodation is provided at no cost, the person to whom the accommodation is provided is the responsible person. If two persons share responsibility for the accommodation, the oldest person is considered to be responsible.

TABLE 1
AVERAGE LEVELS OF DEPRIVATION

	Frequency-Based Weighting Approach	Equal Weighting Approach	% Severe Deprivation
LU	3.73	4.21	0.80
NO	3.76	3.93	2.39
SE	4.73	5.09	2.10
NL	4.84	5.36	1.71
DK	5.80	6.15	3.22
IS	6.78	7.62	2.15
UK	6.94	7.84	4.16
FI	7.01	8.00	3.55
AT	7.26	8.44	3.29
ES	7.76	9.52	2.97
IE	7.76	9.43	4.53
BE	7.83	8.59	5.74
DE	8.24	9.76	4.76
FR	8.39	10.05	4.74
SI	9.47	11.63	5.09
IT	9.57	11.64	6.82
EE	9.85	13.22	5.61
CZ	10.24	12.30	7.36
PT	12.37	17.02	9.55
GR	12.37	15.05	11.45
CY	13.50	18.11	13.29
SK	14.19	18.73	13.70
LT	15.42	19.66	16.57
HU	16.53	24.09	19.89
PL	17.04	23.08	22.32
LV	18.61	25.62	24.88
RO	25.04	32.10	36.53
BG	31.19	43.92	58.51
TOTAL	10.23	12.73	8.95

Notes: Given that the first two columns measure intensity of deprivation, the values go from 0 to 100. The third column measures the % of individuals that cannot afford at least four of the nine items proposed in the Europe 2020 strategy.

In this paper we compute three measures of deprivation: a frequency-based weighting deprivation (our main interest), an equal weighted deprivation, and the definition of severely materially deprived persons adopted as part of the Europe 2020 strategy. The three measures of deprivation are presented in Table 1.

We find that, on average, the intensity of deprivation is 10.23 in the frequency-based weighting approach, and 12.73 when using the equal weighting approach. Moreover, we can say that 8.95 percent of the population suffers from severe material deprivation. In terms of intensity of deprivation, as pointed out by Whelan *et al*. (2002), there is a high correlation (Spearman rank correlation of 0.99 for equal and frequency-based weight) and the country ranking is fairly common, that is, the ranking only differs for countries with lower levels of deprivation, and the ten most deprived countries remain constant with the three definitions of deprivation.

Finally, we observe a considerable variation in deprivation levels across countries in the three definitions (the highest deprivation level is more than eight times higher than the lowest). For example, Luxembourg shows the lowest level (about 3.73) and Bulgaria the highest (about 31.19). As regards severe deprivation in the

countries considered, the percentage increases from 0.8 percent (Luxembourg) to 58.51 percent (Bulgaria).

4.2. *Explanatory Variables*

In accordance with the related literature, we have chosen the following variables to measure the set of determinants from the individual perspective (micro-level analysis). We consider whether or not the individual is living in a household whose HRP is a woman (*Woman*), HRP is below 30 years of age (*Young*) or over 65 years of age (*Old*), and whether the HRP has attained tertiary education or the second stage of tertiary education (*Tertiary*). We also include information about whether HRP is working full time for pay or profit (*Work*), whether the house is owned by a member of the household (*Tenure*), and the household annual equivalent disposable income measured in 10,000 euros (*Income*) using the modified OECD equivalence scale, that assigns a value of 1 to the first adult in the household, 0.5 to each remaining adult, and 0.3 to each person younger than 14. To describe the structure of the household where the individual is living, we construct a group of dummy variables to cover the existing possibilities. *More2adults* is coded 1 for households with more than 2 adults, and 0 otherwise. *More2children* is coded 1 if there are more than 2 children in the household and 0 otherwise. *One_p_household* is coded 1 if there is only one person in the household. *Young_couple_nochild* takes the value of 1 if there are 2 adults under the age of 65 and no dependent children in the household. *Old_couple_nochild* is coded 1 if there are 2 adults over the age of 65 and no dependent children in the household. *Nochild* is coded 1 for other types of household without dependent children. *Single_parent* takes the value of 1 for single parent households with 1 or more dependent children. *2adultswithchildren* is coded 1 if it is a household with two adults and one or more children (the reference category). *Otherwithchildren* takes the value of 1 for other types of household with dependent children. *Other* is coded 1 for other types of household.

Similarly, following the related literature, we include the determinants from the country-level perspective (taken from Eurostat). To describe the welfare state we define *Socialprot*, which measures the ratio of total expenditure on social protection and GDP by country. We also consider *Longterm_unemployment*, which denotes the long-term unemployment rate in the country; *s80s20*, which is the income quintile share ratio and is a measure of the inequality of income distribution; and *GDP*, which is the GDP per capita expressed in Purchasing Power Standard as a percentage of the EU27 average. The percentage of the population with upper secondary or tertiary education attainment and the percentage of elderly people in the country were also included in previous models, but had no effect on deprivation.

5. The Model

To model the intensity of material deprivation, which is a continuous dependent variable, the usual linear estimation method is typically utilized. Alternatively, Tobit models are used in the literature since the deprivation index clusters at zero. Angrist and Pischke (2009) and Figari (2012) pointed out that the choice of linear estimation method is more appropriate if the data are truly censored (as

the zero value is not a statistical artifact or due to some kind of censoring) than a Tobit-type latent variable model. In the case of severe deprivation, which is a categorical variable, we consider the logistic regression model.

Additionally, given the hierarchical structure of data, that is, individuals (first level) clustered into countries (second level), the most appropriate econometric method is the multilevel model (Goldstein, 2003; Rabe-Hesketh and Skrondal, 2008) because the standard regression model violates the assumption of the independence of errors, even if country-level variables are not included. Ignoring clustering leads to the underestimation of standard errors, particularly for predictors measured at the group level.

A natural way to analyze such a hierarchical data structure is to use contextual regression models that integrate variables at several levels of a hierarchy in a single analysis. Kreft and de Leeuw (1998) noted three different approaches in contextual regression modeling: traditional non-hierarchical extensions (e.g., separate regressions by country), classical contextual models (e.g., analysis of covariance), and modern multilevel models (random components). In separate regressions, no country-level explanatory variables can be included in the analysis. A major drawback to the analysis of covariance is that the effects of country-level explanatory variables are confounded with the effects of country dummies. This disadvantage can be overcome by using a multilevel model that is precisely designed to simultaneously analyze variables from different levels, which is a different problem than correcting for the data structure (Mass and Hox, 2004; Hox, 2010).

In classical contextual models and in modern multilevel models, individual and country-level variables can be introduced simultaneously. These methods can adequately split the variation into a between-individual level and a within-country level, but each in their own way. Classical contextual models let the intercept and/or the coefficients vary in a fixed way, while modern multilevel models allow the intercept and/or the coefficients to vary randomly.

Therefore, the multilevel approach is the appropriate estimation method for our goals, since first, it allows for estimation of robust standard errors and clustering of the sample; and second, it also allows measuring country-level variation (between-group variation) in relation to individual-level variation (within-group variation) and to control for country-level influences. Since country differences are of substantive interest to us, we need a model in which we can explore the information behind clustering.

Let us then consider a two-level structure where individuals, i (first level), are nested into countries, c (second level). We model random effects in the form of random intercepts. The random effect is summarized according to its estimated variance. Finally, it is worth mentioning that the random effects model is a "unit specific" rather than a "population averaged" approach.[5]

[5]There are reasonable multilevel modeling alternatives. We could estimate a model with robust clustered errors. The standard errors would be properly adjusted, but we would be unable to assess the degree of between-group variation. We could also have estimated a GEE (generalized estimating equation) model, but in this type of model no information about higher level variation is provided and it is only useful for making inferences about average population effects. For this reason, we propose the random effects model as its robustness is comparable to the above alternatives and we explicitly specify a hierarchical structure, and obtain correct standard errors and an estimate of between-group variance.

To observe the effect of different levels of variables on the differences in deprivation among countries, we run four specifications. The benchmark model (Model A), which does not include any explanatory variable, gives us information on whether there are country differences in material deprivation. The model for the intensity of deprivation can be written as follows:

$$D_{ic} = \beta_0 + \xi_c + \varepsilon_{ic} \tag{A}$$

where D_{ic} is the deprivation index for individual i in country c, as defined in Section 4. ξ_c designates the random intercept that represents the difference between country c's mean deprivation and the overall mean deprivation. ε_{ic} is the individual-level residual that reflects the difference between individual i's deprivation level and this individual's country mean deprivation; both of which are assumed to be independent and to follow normal distributions with a zero mean. We also estimate the random effect variance. Therefore, we define the between-country variance, σ^2_{ξ}, and the within-country between-individual variance, σ^2_{ε}. If the within-country variance were zero, all the variability would be between countries. In contrast, if the between-country variance were zero, then there is only variability between individuals of the same country. However, if it is significantly different from zero, then we can say that country differences are present. As is usual in this literature, to set the proportion of the total variance due to differences between countries, we use the variance partition coefficient (VPC). If the inclusion of different explanatory variables (individual and country level) makes the country-level intercept variance not statistically and significantly different from zero, then it is said that variables of this type capture the country variation and there is no significant country heterogeneity left. Similarly for the case of severe deprivation, we define the latent variable D^*_{ic} that reflects the level of deprivation of individual i in country c. The logistic model considers the observed variable D_{ic} that takes the value of 1 if the individual is severely deprived and 0 otherwise.

Departing from Model A, we propose Model B to test whether differences in deprivation among countries can be explained by specific individual factors.

$$D_{ic} = \beta_0 + \beta_1 x_{ic} + \xi_c + \varepsilon_{ic} \tag{B}$$

where x_{ic} is the set of individual variables considered. In addition, to check whether contextual-level determinants have an effect on differences among countries with respect to deprivation, we propose Model C.

$$D_{ic} = \beta_0 + \beta_2 y_{ic} + \xi_c + \varepsilon_{ic} \tag{C}$$

where y_{ic} is the set of contextual-level variables considered. Finally, Model D includes both individual-level and country-level variables.

$$D_{ic} = \beta_0 + \beta_1 x_{ic} + \beta_2 y_{ic} + \xi_c + \varepsilon_{ic}. \tag{D}$$

6. The Empirical Results

We present the estimation results for the frequency-based deprivation in Table 2. The results for the other measurement choices, equally weighted deprivation and severe deprivation, are relegated to Tables B1 and B2 in Appendix B, although we will discuss the principal differences here. We have tested the significance of country effects by comparing the null multilevel model with a null single-level model. We find that the country effects are significant for all the models proposed, thus supporting the use of multilevel techniques. Given the large size of the sample, the estimated parameters are fairly stable across the four specifications, indicating the robustness of the estimation procedure.

Before addressing our main goal, we briefly summarize the influence of the individual-level and country-level variables on deprivation. In terms of the influence of individual-level determinants on material deprivation, our results confirm previous evidence. That is, individuals who live in households whose HRP is a woman have higher levels of deprivation, older HRP are associated with lower deprivation than middle-aged individuals, and younger HRP show the opposite trend. Individuals living in households with an HRP having more than secondary education or with a full-time paid job or owning the house are associated with less deprivation. Only those living in households with no children are associated with less deprivation. Finally, the household equivalent income is negatively associated with deprivation.

In the model for severe deprivation, household composition has similar effects on deprivation except for the fact that not having children has a significant effect when considering elderly couples who are more likely to be severely deprived. Moreover, due to the nature of the severe deprivation variable, we substituted the variable household equivalent income for a dichotomous variable which takes the value of 1 if the individual is poor (household income lower than 60 percent of the contemporary median income), and the variable is strongly and positively associated with deprivation.

Concerning the influence of the contextual-level determinants (macro-level perspective) we obtain the following results. First, we find a negative and significant relationship between deprivation and social policy generosity in line with Kenworthy *et al*. (2011). We also conclude that long-term unemployment rates have a significant effect on deprivation when only macro variables are considered, but this effect vanishes when micro variables are introduced.[6] We find that countries with a more equal income distribution are associated with lower levels of deprivation, thus confirming that being deprived in an unequal country is different from being deprived in a more equal country.[7] This result differs from that of Whelan and Maître (2012), who found no association between deprivation and inequality measured through the Gini index. This result must be interpreted with caution as an additional estimation using the Gini coefficient leads us to the same conclusion as Whelan and Maître (2012) when only macro variables are

[6]In the model for severe deprivation this variable is still significant, but only at the 0.1 significance level.

[7]This is true in all models, except for model D for severe deprivation where this variable is not statistically significant, even when having the correct sign.

TABLE 2

MULTILEVEL LINEAR MODEL FOR FREQUENCY-BASED WEIGHTED MATERIAL DEPRIVATION

	A	B	C	D
Womanhead		1.082***		1.081***
		[0.253]		[0.253]
Younghead		0.771**		0.772**
		[0.301]		[0.301]
Oldhead		–2.778***		–2.779***
		[0.374]		[0.374]
Tertiaryhead		–4.377***		–4.378***
		[0.563]		[0.563]
Workhead		–4.945***		–4.946***
		[0.408]		[0.408]
More2adults		0.496***		0.495***
		[0.191]		[0.191]
More2children		6.653***		6.654***
		[1.255]		[1.255]
One_p_household		2.268***		2.268***
		[0.441]		[0.441]
Young_couple_nochild		–1.019***		–1.020***
		[0.276]		[0.276]
Old_couple_nochild		–1.243***		–1.243***
		[0.277]		[0.276]
Nochild		–1.072***		–1.074***
		[0.347]		[0.347]
Single_parent		5.790***		5.790***
		[0.487]		[0.487]
Otherwithchildren		0.710**		0.709**
		[0.295]		[0.295]
Other		1.302***		1.300***
		[0.408]		[0.407]
Tenure		–5.697***		–5.698***
		[0.451]		[0.451]
Income		–1.377***		–1.374***
		[0.261]		[0.261]
Socialprot			–0.353***	–0.359***
			[0.123]	[0.118]
Longterm			0.520**	0.303
			[0.239]	[0.219]
S80s20			1.481**	1.368**
			[0.634]	[0.601]
Gdp			–0.055***	–0.037***
			[0.017]	[0.014]
Constant	10.729***	20.677***	15.478***	27.160***
	[1.188]	[1.321]	[4.856]	[5.076]
SD(coef) σ_ξ	6.17***	5.312***	2.996***	8.601***
	[1.206]	[1.108]	[0.610]	[0.559]
SD(residual) σ_ε	13.41***	12.248***	13.41***	12.248***
	[0.603]	[0.617]	[0.603]	[0.617]
VPC	0.175	0.158	0.048	0.053
Observations	210,170	210,170	210,170	210,170
Number of groups	28	28	28	28
Log likelihood		–824,871.641	–843,904.069	–824,854.743

Notes: ***p < 0.01, **p < 0.05, *p < 0.1. Standard errors are shown in brackets.

considered. The difference in this result could be due to using different measures of inequality since the S80/S20 ratio focuses specifically on the two extreme quintiles of the distribution, while the Gini index takes into account the whole distribution. Finally, there exists a negative and small, but significant, association between GDP and material deprivation as Whelan and Maître (2012) find, but unlike Kenworthy *et al*. (2011), who found no association. The small effect of the GDP is expected as deprivation depends on the resources allocated to each individual and the per capita level has less influence.

To examine our main goal, that is, whether country differences with respect to material deprivation levels can be explained by differences in the characteristics of individuals (micro-level perspective) or by country-specific factors (macro-level perspective), we make use of the VPC.

Regarding the contribution of individual determinants (micro-level perspective) to the differences in material deprivation across countries, we find that the VPC ratio decreases by about 9.4 percent (from 0.175 in Model A to 0.158 in Model B) after controlling for individual variables in the frequency-based weighting deprivation model. We observe a reduction of the amount of variance at both the individual and country level and hence the total variance. The reduction in within-country variance is expected because we have introduced individual-level variables, while the reduction in between-country variance suggests that the distribution of individuals according to the individuals' characteristics differs from country to country. In the case of the equally weighted deprivation model, the reduction is about 5.47 percent and for the case of severe deprivation, the addition of these variables increases the VPC, which could be due to the fact that micro characteristics unmask country differences for the risk of being severely deprived.

To examine whether country differences with respect to material deprivation levels can be explained by country-specific factors (macro-level perspective), we compare Model A to Model C. We find that the VPC decreases by 72.7 percent (from 0.175 to 0.048) for the frequency-based weighting deprivation model. The reduction is 68.7 percent for the equally weighed deprivation model, and 67.04 percent for the severe deprivation model.

Finally, when considering both the micro level and the macro level simultaneously, the VPC decreases 69.6 percent for the frequency-based weighting deprivation model, 65.53 percent for the equally weighed deprivation model, and 56.46 percent for the severe deprivation model.

To sum up, the reduction of the unexplained variance due to the introduction of macro-perspective variables is much larger than the reduction due to micro-perspective variables. This would mean that in order to design measures to reduce the difference in deprivation among countries it would be more effective to stress the contextual differences.

Despite the reduction of VPC observed in all the specifications, the country intercepts have substantial variability (σ_{ξ} is significantly different from zero). This fact indicates that deprivation disparities across European countries are still wide and need to be further investigated.

We have also checked whether the effect of the micro variables is shaped by the macro variables. To do so we estimated additional models (E to I) that include

TABLE 3
MULTILEVEL MODEL FOR FREQUENCY-BASED WEIGHTED MATERIAL DEPRIVATION

	Model D	Model E	Model F	Model G	Model H	Model I
Micro variables	Yes	Yes	Yes	Yes	Yes	Yes
Macro variables	Yes	Yes	Yes	Yes	Yes	Yes
*GDP*micro variables*		Yes			Yes	Yes
*s80s20*micro variables*			Yes		Yes	Yes
*Socialprot*micro variables*				Yes		Yes
SD(coef) σ_ξ	8.601***	2.823***	2.862***	2.852***	2.832***	2.836***
	[0.559]	[0.539]	[0.561]	[0.539]	[0.549]	[0.544]
SD(residual) σ_ε	12.248***	12.130***	12.189***	12.154***	12.117***	12.091***
	[0.617]	[0.591]	[0.591]	[0.593]	[0.585]	[0.586]
VPC	0.053	0.051	0.052	0.052	0.052	0.052

Notes: ***p < 0.01, **p < 0.05, *p < 0.1. Standard errors are shown in brackets.

the interaction of the micro variables with the three macro variables that have a significant effect in model D, one at a time (see Table 3).[8]

The results show, first, that the higher the GDP level, the smaller the effect of individual characteristics and vice versa (Model E). Second, inequality enhances the effects of the individual characteristics, that is, the higher the inequality, the greater the effect of individual characteristics (Model F). These results are in line with those of Whelan and Maître (2013). Finally, in general, social policy generosity (Model G) reduces the effect of the individual characteristics, with the exception of the elderly HRP and household owners.

Moreover, the introduction of these interactions reduces the proportion of total variance due to between-country differences in deprivation (VPC of Model E, F, and G with respect to Model D) by 3.3, 1.7, and 1.7 percent, respectively. The larger reduction corresponds to the model with the interactions between the GDP and the micro variables. The addition of the rest of the interactions to model E (model H and I) causes almost no additional reduction in the VPC.

7. CONCLUSIONS

Our results show that differences in material deprivation across European countries are explained from both micro- and macro-level perspectives, although country-specific factors seem to be much more relevant than individual effects in explaining these differences. Country-level variables reduce the proportion of total variance due to between-country differences in deprivation by 72.7 percent, while the introduction of individual-level variables reduces this proportion by only 9.4 percent.

The results regarding the interaction between micro- and macro-level variables lead to two conclusions. First, there is an extra reduction in the proportion of between-country variance with respect to total variance. Second, micro- and macro-level variables are not independent of each other (some of the interaction variables, especially those concerning the level of GDP, are significantly different

[8]For the sake of simplicity we have not included all the estimated parameters in this specification, only the VPC. The results are available from the authors upon request.

from zero). The interpretation is that the effect of the sociodemographic characteristics of the HRP can be shaped by institutional and structural factors. This highlights the influential role of public policies in terms of living conditions and, in particular, in the fight against material deprivation, as well as the considerable long-term character of country-specific factors related to deprivation.

Our results support the philosophy of the policy measures proposed in the Europe 2020 Strategy. Among its main proposals, the strategy encourages increasing household income with some member available to participate in the labor market (increase labor market commitment for women, the elderly, etc.). It also promotes increasing the household educational level, access to a house, etc. The Europe 2020 Strategy also promotes measures to enhance growth and reduce inequality. In order to evaluate the effectiveness of all the measures included in the Europe 2020 Strategy, our results show the importance of not only considering the evaluation of policies for promoting the individual characteristics that reduce the intensity of deprivation. Measures at the country level that enhance growth and reduce inequality should also be considered. Hence, in evaluating such policies it should be taken into account the fact that such macro policies have an indirect effect through the shaping they display with regard to individual characteristics, which would lead to an additional reduction in deprivation.

Notwithstanding, although this contribution constitutes a notable advance in the analysis of factors that explain European country differences with respect to material deprivation levels, the above findings should be complemented in subsequent research by specific analyses of each country in order to gain a better understanding of particular conditions and circumstances, and promote concrete political actions that contribute to achieving the Europe 2020 Strategy.

References

Angrist, J. D. and J. S. Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press, Princeton, NJ, 2009.

Atkinson, A. B., "Multidimensional Deprivation: Contrasting Social Welfare and Counting Approaches," *Journal of Economic Inequality*, 1, 51–65, 2003.

Atkinson, A. B., B. Cantillon, E. Marlier, and B. Nolan, *Social Indicators: The EU and Social Inclusion*, Oxford University Press, Oxford, 2002.

Ayala, L., A. Jurado, and J. Pérez-Mayo, "Income Poverty and Multidimensional Deprivation: Lessons from Cross-Regional Analysis," *Review of Income and Wealth*, 57, 40–60, 2011.

Berthoud, R. and M. Bryan, "Income, Deprivation and Poverty: A Longitudinal Analysis," *Journal of Social Policy*, 40, 135–56, 2011.

Bertola, G., "Job Security, Employment and Wages," *European Economic Review*, 34, 851–86, 1990.

Blanchard, O. and L. Summers, "Hysteresis and the European Unemployment Problem," in S. Fischer (ed.), *NBER Macroeconomics Annual 1986*, MIT Press, Cambridge, MA, 15–78, 1986.

Boarini, R. and M. Mira d'Ercole, "Measures of Material Deprivation in OECD Countries," OECD Social, Employment and Migration Working Papers, 37, OECD Publishing, 2006.

Bourguignon, F. and S. Chakravarty, "The Measurement of Multidimensional Poverty," *Journal of Economic Inequality*, 1, 25–49, 2003.

Brandolini A., "On Applying Synthetic Indices of Multidimensional Well-Being: Health and Income Inequalities in Selected EU Countries," Banca d'Italia, Temi di discussione 668, 2008.

Chakravarty, S. R. and C. D'Ambrosio, "The Measurement of Social Exclusion," *Review of Income and Wealth*, 52, 377–98, 2006.

Decancq, K. and M. A. Lugo, "Weights in Multidimensional Indices of Well-Being: An Overview," *Econometric Reviews*, 32, 7–14, 2012.

Desai, M. and A. Shah, "An Econometric Approach to the Measurement of Poverty," *Oxford Economic Papers*, 40, 505–22, 1988.

Deutsch, J. and J. Silber, "Measuring Multidimensional Poverty: An Empirical Comparison of Various Approaches," *Review of Income and Wealth*, 51, 145–74, 2005.
Dewilde, C., "Individual and Institutional Determinants of Multidimensional Poverty: A European Comparison," *Social Indicators Research*, 86, 233–56, 2008.
Eurostat, *European Social Statistics. Income, Poverty and Social Exclusion: 2nd Report*, European Commission, Luxembourg, 2002.
Figari, F., "Cross-National Differences in Determinants of Multiple Deprivation in Europe," *Journal of Economic Inequality*, 10, 397–418, 2012.
Fusco, A., "The Relationship Between Income and Housing Deprivation in Luxembourg: A Longitudinal Analysis," Working Paper No. 2012-10, CEPS/INSTEAD, 2012.
Fusco, A., A. C. Guio, and E. Marlier, "Income Poverty and Material Deprivation in European Countries," CEPS/INSTEAD Working Paper Series 2011-04, 2011.
Goldstein, H., *Multilevel Statistical Models*, Arnold, London, 2003.
Goldthorpe, J., *On Sociology*, Oxford University Press, Oxford, 2000.
Graaf-Zijl, M. and B. Nolan, "Household Joblessness and its Impact on Poverty and Deprivation in Europe," *Journal of European Social Policy*, 21, 413–31, 2011.
Guio, A. C., "What Can Be Learned From Deprivation Indicators in Europe," *Methodologies and Working Papers*, Eurostat, Luxembourg, 2009.
Guio, A. C., A. Fusco, and E. Marlier, "A European Union Approach to Material Deprivation Using EU-SILC and Eurobarometer Data," IRISS Working Paper Series 2009-19, 2009.
Halleröd, B., D. Larsson, D. Gordon, and V. Ritakallio, "Relative Deprivation: A Comparative Analysis of Britain, Finland and Sweden," *Journal of European Social Policy*, 16, 328–45, 2006.
Hox, J. J., *Multilevel Analysis: Techniques and Applications*, Routledge, Taylor and Francis Group, New York, 2010.
Jenkins, S. P., "Modeling Household Income Dynamics," *Journal of Population Economics*, 13, 529–67, 2000.
Kenworthy, L., J. Epstein, and D. Duerr, "Generous Social Policy Reduces Material Deprivation" in L. Kenworthy (ed.), *Progress for the Poor*, Oxford University Press, Oxford, 33–38, 2011.
Kreft, I. and J. de Leeuw, *Introducing Multilevel Modeling*, Sage Publications, Thousand Oaks, CA, 1998.
Lancee, B. and H. van der Werfhorst, "Income Inequality and Participation: A Comparison of 24 Counties," *Social Science Research*, 41, 1166–78, 2012.
Layte, R., B. Maître, B. Nolan, and C. T. Whelan, "Persistent and Consistent Poverty in the 1994 and 1995 Waves of the European Community Household Panel Survey," *Review of Income and Wealth*, 47, 427–49, 2001a.
Layte, R., C. T. Whelan, B. Maître, and B. Nolan, "Explaining Levels of Deprivation in the European Union," *Acta Sociologica*, 44, 105–22, 2001b.
Lindbeck, A. and D. Snower, *The Insider–Outsider Theory of Employment and Unemployment*, MIT Press, Cambridge, MA, 1989.
Mack, J. and S. Lansley, *Poor Britain*, Allen and Urwin, London, 1985.
Maître, B., B. Nolan, and C. T. Whelan, "Welfare Regimes and Household Income Packaging in the European Union," *Journal of European Social Policy*, 15, 157–71, 2005.
Mass, J. M. and J. J. Hox, "Robustness Issues in Multilevel Regression Analysis," *Statistica Neerlandica*, 58, 127–37, 2004.
Mayer, S. E. and C. Jencks, "Poverty and the Distribution of Material Resources," *Journal of Human Resources*, 24, 88–113, 1989.
Muffles, R. and D. Fouarge, "The Role of European Welfare States in Explaining Resources Deprivation," *Social Indicators Research*, 68, 299–330, 2004.
Nolan, B. and S. Cantalon, "Are Married Women More Deprived than their Husbands?" *Journal of Social Policy*, 27, 151–71, 1998.
Nolan, B. and C. T. Whelan, *Resources, Deprivation and Poverty*, Clarendon Press, Oxford, 1996.
———, "On the Multidimensionality of Poverty and Social Exclusion," in J. Micklewright and S. P. Jenkins (eds), *Inequality and Poverty Re-Examined*, Oxford University Press, Oxford, 146–65 2007.
———, "Using Non-Monetary Deprivation Indicators to Analyse Poverty and Social Exclusion in Rich Countries: Lessons from Europe," *Journal of Policy Analysis and Management*, 29, 305–25, 2010.
———, "The EU 2020 Poverty Target," UCD Geary Institute, Discussion Paper Series 2011-11, 2011.
Pichler, F. and C. Wallace, "Social Capital and Social Class in Europe: The Role of Social Networks in Stratification," *European Sociological Review*, 25, 319–22, 2009.
Pilkauskas, N., J. Currie, and I. Garfinkel, "The Great Recession, Public Transfers, and Material Hardship," *Social Service Review*, 86, 401–27, 2012.

Rabe-Hesketh, S. and A. Skrondal, *Multilevel and Longitudinal Modeling using Stata*, Stata Press, College Station, TX, 2008.
Townsend, P., *Poverty in the United Kingdom*, Penguin Books, Harmondsworth, 1979.
Tsakloglou, P. and F. Papadopoulos, "Poverty, Material Deprivation and Multidimensional Disadvantage During Four Life Stages: Evidence from ECHP," in M. Bargnes, C. Heady, S. Middleton, J. Millar, F. Papadopoulos, G. Room, and P. Tsakloglou (eds), *Poverty and Social Exclusion in Europe*, Edward Elgar Publishing, London, 24–52, 2002.
Whelan, C. T. and B. Maître, "Measuring Material Deprivation with EU-SILC: Lessons from the Irish Survey," *European Societies*, 9, 147–73, 2007.
———, "Understanding Material Deprivation in Europe: A Multilevel Analysis," *Research in Social Stratification and Mobility*, 30, 489–503, 2012.
———, "Material Deprivation, Economic Stress and Referencing Groups in Europe: An Analysis of EU-SILC2009," *European Sociological Review*, forthcoming, 2013.
Whelan, C. T., R. Layte, B. Maître, and B. Nolan, "Income, Deprivation, and Economic Strain. An Analysis of the European Community Household Panel," *European Sociological Review*, 17, 357–72, 2001.
Whelan, C. T., R. Layte, and B. Maître, "Persistent Deprivation in the European Union," *Journal of Applied Social Science Studies*, 122, 31–54, 2002.
———, "Persistent Income Poverty and Deprivation in the European Union: An Analysis of the First Three Waves of the European Community Household Panel," *Journal of Social Policy*, 32, 1–18, 2003.
———, "Understanding the Mismatch between Income Poverty and Deprivation: A Dynamic Comparative Analysis," *European Sociological Review*, 20, 287–302, 2004.
Whelan, C. T., B. Nolan, and B. Maître, "Measuring Material Deprivation in the Enlarged EU," Economic and Social Research Institute (ESRI) Papers WP249, 2008.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix A
Table A1: Literature review of micro determinants
Table A2: Literature review of micro-macro determinants
Appendix B
Table B1: Multilevel linear model of the equally weighted material deprivation
Table B2: Multilevel logit for severe material deprivation