Micro- and macro-drivers of child deprivation in 31 European countries

ANNE-CATHERINE GUIO, ERIC MARLIER, FRANK VANDENBROUCKE AND PIM VERBUNT

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Abstract

This paper analyses child deprivation in 31 European countries, using the scale officially adopted in March 2018 to measure child-specific deprivation at EU level. It combines single level and multilevel models to get a full picture of child deprivation drivers in EU countries. With regard to *within-country* differences, our results confirm the combined impact of variables related to the "longer-term command over resources" and variables indicating "household needs". However, our results also show that the relationship of these variables with child deprivation differs between countries. In the richest countries, the explanatory power of the variables related to household needs is the largest, whereas in the most deprived countries, the explanatory power of resource variables is generally greater. With regard to *between-country* differences, the specification of the model needs careful consideration. We argue that multilevel models should include household income at the micro level, if the aim is to fully gauge the impact of households' "longer-term command over resources" at the micro level. The multilevel model then assesses how much country-level features that are not reflected in household income and other individual characteristics at the micro level contribute to explaining differences across countries in deprivation. We find that public spending on in-kind social benefits is significant in this respect. Public spending on cash transfers plays only a limited role, when household incomes at the micro level are included; they play a significant role when household income is excluded. This does not diminish the importance of cash transfers in fighting child deprivation, but it qualifies the conclusions of papers which have analysed the relationship of social transfers on deprivation, using multilevel models but without controlling for individual household income. Finally, we find a significant relationship of GDP per capita, even when individual household incomes are included. This is not self-evident: it shows that GDP per capita is a proxy for important contextual variables which are not reflected in individual incomes and other individual characteristics.

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1 Introduction([1])

Fighting child poverty and investing in children's well-being has featured on the agenda of the European Union (EU) for many years. In February 2013, a new step forward was taken when the European Commission published a Recommendation on "Investing in children: breaking the cycle of disadvantage" (European Commission, 2013) subsequently adopted by the EU Council of Ministers. An important element of the EU Recommendation is that it calls on Member States to "(reinforce) statistical capacity where needed and feasible, particularly concerning child deprivation".

The best way to provide accurate information on the actual living conditions of children in the EU, without making assumptions about the sharing of resources within the household, is to develop child-specific deprivation indicators - i.e., indicators based on information on the specific situation of children, which may differ from that of their parents. The 2009 wave of the EU *Statistics on Income and Living Conditions (EU-SILC)* included an ad hoc module aimed at collecting such information. In the first in-depth analysis of these data carried out by Guio et al (2012), an optimal set of children's deprivation items was identified and a child deprivation index was proposed. These items were then included again in the 2014 EU-SILC ad hoc module on deprivation, allowing additional analysis by Guio et al (2018). The final list of items proposed by Guio et al (2018) was adopted in March 2018 and consists of 17 items, covering both material and social aspects of deprivation, which can be aggregated in a child-specific deprivation scale to measure and monitor child deprivation in a robust and comparative way in the whole EU.

This paper analyses the determinants of child deprivation in 31 European countries (28 EU countries as well as Iceland, Serbia and Switzerland ([2]), using the scale adopted at the EU level. It combines analyses based on both single level and multilevel models (following Verbunt and Guio, 2019). In doing so, it seeks to obtain a better and robust understanding of the joint relationship of micro-determinants (household's labour market attachment, household income, household composition, costs [due to needs related to housing, bad health…] etc.), macro-drivers and contextual determinants with child deprivation. It shows that both types of models are needed to get a full picture of child deprivation determinants. *Single level models* make it possible to identify specific national risk factors and offer a better understanding of *within-country variations* in the relationship of household determinants with child deprivation. Specifically, the single level models allow analysing and decomposing within country fit measures. This is not possible in a multilevel setting. The advantage of *multilevel models* is that they allow a better understanding of the *cross-national variations* in child deprivation in the 31-country pooled dataset. Both household-level and country-level explanatory variables are combined in this type of model. Hence, single level models remain important to understand the micro-determinants of child deprivation within each country (as coefficients are by definition allowed to vary in each country,

([1]) The authors wish to thank Brian Nolan, Jonathan Bradshaw, Elena Bárcena-Martín, Bertrand Maître, Kenneth Nelson and Geranda Notten for valuable discussions. All errors remain strictly the authors'. This work has been supported by the third Network for the analysis of EU-SILC (Net-SILC3), funded by Eurostat. The European Commission bears no responsibility for the analyses and conclusions, which are solely those of the authors. Email address for correspondence: anne-catherine.guio@liser.lu.

([2]) Norway could not be included due to the large amount of missing data on child deprivation.

national specificities with regard to micro-drivers are better captured); but they should be complemented by multilevel models to identify factors explaining the cross-national variations in child deprivation (that is, factors other than differences in the *composition* of national populations). So, the paper illustrates how the strength of both types of models can be combined to offer a comprehensive understanding of the policy levers that should be mobilised to fight child deprivation in the EU([3]). This is the first contribution of the paper to the literature.

A second contribution, the main one in our view, is that it both replicates and confronts a broad spectrum of (sometimes diverging) results reported in the literature and suggests reasons why variables, measured both at the micro- and macro-level, (do not) have a relationship with child deprivation. In most of the multilevel models described in the literature, the inclusion of *macro-level* variables (national social transfers in cash, Gross Domestic Product (GDP) etc.) is justified by the fact that more generous welfare systems or more prosperous economies lead to lower levels of deprivation in the country. However, once micro-level (household-level) determinants that capture individual resources and social transfers received by the household are included in the model, the reason why such macro-level variables would still have a significant relationship with deprivation is not discussed. A priori, one would expect that solely macro-drivers that are *not* included at the micro level, such as the national amount of transfers in-kind, should explain between-country differences in deprivation in the multilevel model. However, many papers show the significant impact of other aggregated variables, such as national social transfers in cash or GDP per capita, after controlling for individual household income and other relevant household-level variables. The crucial question is therefore *why* a variable whose full impact is already taken into account at the household level, is expected to have an additional explanatory power at the country level. We argue, contrarily to most of the previous papers, that this is because such variables provide proxies for contextual elements not included in the model. To disentangle the relationship of micro- and macro-drivers, we replicate a number of analyses presented in other papers using a large variety of macro-variables linked to social transfers (generosity of in-kind and in-cash transfers, importance of pro-family transfers, adequacy of social assistance and pro-poorness of the transfers), as well as different measures of countries' standards of living.

A third and related added value of the paper is that we explicitly argue why we expect certain *micro-level variables*, such as parents' education or migrant status or (quasi-)joblessness of the household to have a relationship with deprivation, next to the household's current income. Often, the expectation that such "social stratification" variables are related to deprivation is taken for granted without further argument.

A fourth added value of the paper is the use of Shapley decompositions to establish the relative importance of the independent variables in both single and multilevel models (following Verbunt & Guio, 2019). Usually, econometric models are used to identify significant relations. This paper goes a step further and provides a measure of the relative impact of each explanatory variable in the different countries covered.

The paper is organised as follows. Section 2 defines child deprivation and the new indicators used. Section 3 provides an illustrative analysis of child deprivation in the EU countries. Section 4 reviews the macro- and micro-determinants of child deprivation. Section 5 presents the models and estimation strategy. Section 6 presents in detail the results of both the single level and multilevel models. Section 7 concludes.

([3]) The single level model has yet another advantage: it allows analysing and decomposing the within country fit measures, which is not possible in the multilevel setting.

2 A robust EU measure of child-specific deprivation

The optimal set of child deprivation items agreed at the EU level is both theory and data driven.

From a theoretical point of view, it largely relies on Townsend's concept of relative deprivation:

"*Poverty can be defined objectively and applied consistently only in terms of the concept of relative deprivation. […] Individuals, families and groups in the population can be said to be in poverty when they lack the resources to obtain the type of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved, in the societies to which they belong. Their resources are so seriously below those commanded by the average individual or family that they are, in effect, excluded from ordinary living patterns, customs or activities*." (Townsend, 1979, p. 31)

From a data analysis point of view, the analytical framework used to select the optimal set of child deprivation items draws extensively on the 1999 Poverty and Social Exclusion (PSE) Survey deprivation indicator construction methodology (Gordon et al, 2000; Pantazis et al, 2006).

To ensure a robust item selection, Guio et al (2018) examined four aspects:

1. The suitability of each deprivation item, in order to check that citizens in the different Member States (as well as the different population sub-groups within each Member State) consider them necessary to have an "acceptable" standard of living in the country where they live. "Suitability" is understood as a measure of face validity amongst the EU population.
2. The validity of individual items, to ensure that each item exhibits statistically significant relative risk ratios with independent variables known to be correlated with deprivation.
3. The reliability of the deprivation scale, to assess the internal consistency of the scale as a whole - i.e. how closely related the set of deprivation items are as a group. This analysis is based on Classical Test Theory, Item Response Theory and Hierarchical Omega Analysis.
4. The additivity of items, to test that someone with a deprivation indicator score of "2" is suffering from more severe deprivation than someone with a score of "1", i.e. that the deprivation indicator's components add up.

The deprivation items that successfully passed these four tests can thus be considered to be suitable, valid, reliable and additive candidates for being aggregated into an EU child-specific deprivation scale.

The final list of items proposed by Guio et al (2018) for the measurement of child deprivation consists of 12 "children" and 5 "household" items, which cover both material and social aspects of deprivation:

Children items:

1. Some new (not second-hand) clothes
2. Two pairs of properly fitting shoes
3. Fresh fruit and vegetables daily
4. Meat, chicken, fish or vegetarian equivalent daily
5. Books at home suitable for the children's age
6. Outdoor leisure equipment
7. Indoor games
8. Regular leisure activities
9. Celebrations on special occasions
10. Invitation of friends to play and eat from time to time
11. Participation in school trips and school events
12. Holiday

Household items:

13. Replace worn-out furniture
14. Arrears
15. Access to Internet
16. Home adequately warm
17. Access to a car for private use

In the analysis presented below, it is important to keep in mind some elements related to data collection and processing. First, in EU-SILC data relating to the living conditions of children are not collected from the children themselves, but from the adult answering the "household questionnaire" (household respondent). Secondly, according to the survey protocol to be followed by countries, if in a given household at least one child does not have an item, it is then assumed that all the children belonging to that household lack that item. It would of course be preferable to know the deprivation levels of each child in a household separately; it would then be possible to study differences in child deprivation within individual households, as well as between households (e.g. are girls more likely than boys to suffer from deprivation within a same household, or teenagers more likely than younger children?). However, collecting this type of information would be quite delicate and would also lengthen significantly the EU-SILC questionnaire. Thirdly, for most "children's items", the information relates to children aged between 1 and 15 (i.e. children's items are collected in households with at least one child in this age bracket). Therefore, the child-specific deprivation indicator covers only children aged between 1 and 15. Yet, one item is collected in households with at least one child attending school (school trips).

Besides the items relating *directly* to the deprivation situation of children, the above 17-item list includes some household items. As emphasised by Guio et al (2012, 2018), not only items directly impacting children's immediate well-being should be considered in the children's index, but also items likely to have an *indirect* impact on their well-being. Indeed, qualitative studies have shown that children in households suffering from financial strain often do not ask their parents for the things they need in order to try to protect their parents from stress and feelings of guilt (Ridge, 2002 and 2011).

Using the above list, Guio et al propose to aggregate the items at the child level. The deprivation scale is the unweighted sum of the 17 items, ranging from 0 (no items lacked) to 17 (all items lacked) (see Guio et al 2012, p. 110, for the reason why they opt for the unweighted sum, rather than a weighted sum of deprivations). The reliability of the scale is very high at EU level as well as in all EU Member

States. The Cronbach's alpha is greater than 0.70 (the usual minimal threshold) in all EU countries, and greater than 0.90 in seven countries and for the pooled EU-28 dataset.

It is also worth highlighting that this index is based on an *enforced lack* concept. In the EU-SILC survey, for the retained child-specific items, three answer categories are proposed:

1. the child(ren)/ child(ren)'s household has (have) the item;
2. the child(ren)/ child(ren)'s household does (do) not have the item because it (they) cannot afford it;
3. the child(ren)/ child(ren)'s household does (do) not have the item for any other reason.

Only children lacking an item for affordability reasons (and not by choice or due to any other reasons) are considered as deprived of this item. Those lacking the item for "other reasons" are treated, together with those who have the item, as not deprived. There are, however, a number of questions raised by the notion of enforced lack (McKnight, 2013; McKay, 2004). The "other reasons" modality can encompass a large range of possible situations: people may not want/need an item, or they may be prevented from having an item for many different reasons (e.g. lack of time of the parents due to caring responsibilities or due to work, no vehicle/ public transport, feeling unwelcome, etc.). Some of these "other reasons" may be correlated with their living standards, in the case of adaptive preferences, or shame to admit that children lack the item because it is unaffordable (Guio et al, 2012, p.34). That is the reason why Guio et al (2018) investigated the characteristics of children living in households replying that they do not have the item for "other reasons". They show that using the concept of enforced lack (rather than simple lack) makes it possible to control for individual preferences due to differences in cultures, age of children or parental practices. They also show that measures based on the enforced lack concept discriminate better between the worse-off and better-off children than those based on simple lack, and that the use of enforced lack ensures a higher reliability of the index.

The scale officially adopted in March 2018 sets the threshold at three items. In the rest of the paper, we will both analyse the full scale of deprivation (ranging from 0 to 17) and the proportion of children lacking at least three items, i.e. the child-specific deprivation *intensity* and the child-specific deprivation *rate([4]).*

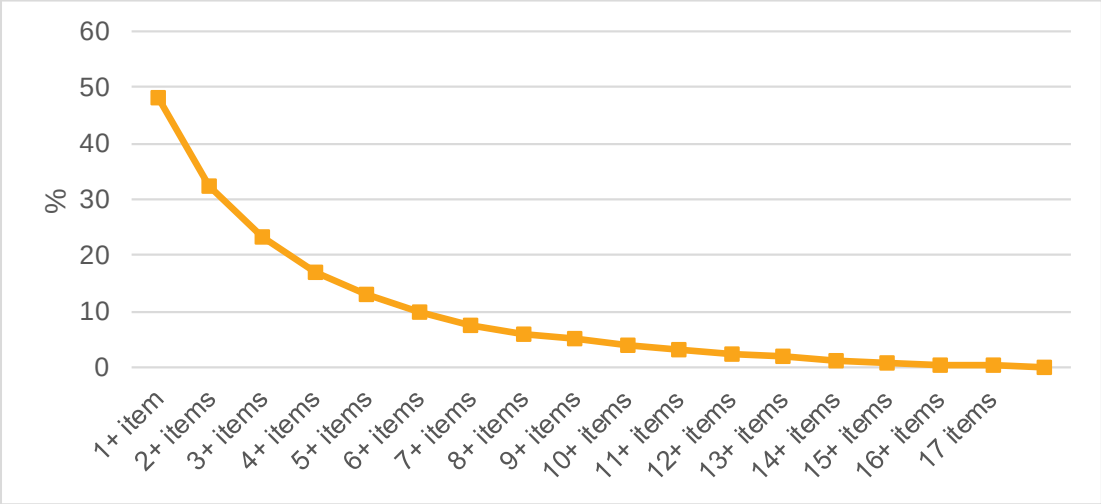
([4]) A second child-specific EU indicator has also been adopted at EU level: the average number of items lacked by deprived children. This measure is different from the child-specific deprivation intensity considered here, which looks at all children rather than only deprived children.

3 General overview of child deprivation in the EU

The incidence of each individual deprivation item is presented in Table 1 and compared to the EU-28 average. This heat map highlights countries showing consistently high deprivation levels across several items, such as Bulgaria and Romania, or on the contrary low levels (Nordic countries, Austria, Netherlands, Luxembourg). It also highlights countries where there is a mixed picture depending on the item, i.e. countries suffering from relative disadvantages for some items, and relative advantages for others.

Figure 1 presents the distribution of children (aged between 1 and 15 years) according to the number of items lacked for the 31-country pooled dataset. Around 50% of children in the pooled dataset lack at least one item. One out of three children lacks two items or more and one child out of four lacks at least three items.

Figure 1: Distribution of children (aged between 1 and 15 years) according to the number of items lacked, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014,
(%)



Source: EU-SILC 2014 cross-sectional data, authors' computation.

At the national level, the proportion of children lacking at least three items ranges from 4% in Sweden to 71% in Romania.

Table 1: "Heat map" providing for each item the proportion of children lacking the item in the country, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014
(%)

	Fruit & vegetables	Books	Shoes	Indoor games	Proteins	Internet	Celebration	Outdoor equipment	Clothes	School trips	Friends	Car	Home warm	Leisure	Arrear	Holidays	Furniture
Sweden	0.1	0.6	0.3	0.3	0.0	0.4	1.3	0.8	0.9	0.8	0.7	3.1	0.8	2.5	8.8	5.5	5.6
Finland	0.3	0.5	0.8	0.2	0.2	0.4	0.3	0.3	3.5	0.6	0.1	3.6	0.7	1.3	16.5	7.2	11.6
Iceland	0.4	0.3	1.9	0.2	0.8	0.5	0.3	0.6	0.9	0.6	0.1	2.7	2.2	4.3	24.1	3.6	20.4
Denmark	0.5	2.5	2.3	0.8	0.6	0.6	1.3	2.2	2.0	1.4	1.5	5.1	2.5	3.3	9.5	9.1	14.6
Switzerlan	0.5	0.4	0.3	0.7	1.3	0.9	1.4	0.4	1.6	0.8	0.4	4.5	1.0	5.1	10.8	4.9	12.5
Austria	0.5	1.3	1.1	1.1	1.8	1.0	1.8	3.1	1.9	2.5	3.6	7.4	4.3	10.2	10.6	17.8	15.7
Netherland	0.6	0.5	3.6	0.4	2.5	0.2	1.9	1.6	1.6	1.4	1.2	6.5	2.8	6.4	9.5	16.2	25.2
Luxembou	0.8	0.8	1.0	1.5	1.1	1.4	1.9	2.7	2.9	3.6	2.3	2.1	1.0	2.7	6.3	9.4	20.9
Slovenia	1.0	1.1	1.2	1.3	1.4	1.3	2.5	2.0	5.9	2.3	3.4	3.3	4.0	10.7	28.0	7.2	15.8
Spain	1.7	2.3	3.0	3.5	2.9	13.5	11.4	5.8	7.7	10.6	12.8	6.6	12.0	13.1	17.8	34.5	46.4
Germany	1.8	0.7	2.2	0.6	3.6	0.9	1.5	1.3	2.1	0.6	1.7	4.4	5.3	6.2	9.7	17.4	17.8
Malta	1.9	2.0	5.9	2.1	6.9	4.4	4.9	4.1	6.1	2.7	4.9	4.5	21.6	6.0	22.0	34.9	29.7
Cyprus	2.1	5.4	1.3	3.6	2.4	8.7	10.8	7.7	5.4	2.5	12.3	1.4	25.4	21.2	41.7	40.2	60.9
Belgium	2.3	4.4	3.6	2.5	2.7	3.8	5.8	4.2	8.2	3.8	6.0	7.4	4.8	9.0	12.1	19.2	18.4
Italy	2.6	7.7	2.9	5.6	5.7	10.8	7.1	6.0	8.5	9.5	7.5	2.3	18.4	13.7	20.6	29.5	38.8
Ireland	2.6	1.0	6.5	1.4	3.1	4.8	3.0	3.2	12.3	3.3	3.2	6.6	9.4	7.3	25.6	53.1	28.6
France	2.7	1.2	5.2	1.0	2.3	1.8	5.2	1.7	8.9	4.8	2.4	2.8	5.1	6.2	15.0	11.6	28.0
Portugal	2.9	6.4	3.6	5.4	1.2	11.5	8.3	4.6	14.4	9.1	13.6	9.9	25.2	23.4	17.7	36.7	57.5
Czech Rep	3.0	2.0	3.0	2.8	4.7	4.0	3.6	7.8	6.3	5.0	2.4	11.8	6.0	8.5	10.4	8.7	47.8
Poland	3.5	2.9	1.4	2.3	3.0	3.1	9.7	4.3	3.2	8.5	8.7	7.5	7.9	18.8	19.3	26.2	31.5
United king	3.6	1.0	2.2	1.4	3.0	4.7	2.3	5.7	3.7	3.3	7.1	10.7	9.4	6.3	18.0	35.3	31.6
EU-28	4.1	4.4	4.7	4.7	5.2	6.9	7.2	7.1	7.5	7.4	8.2	8.7	10.0	12.6	18.3	26.3	33.8
Croatia	4.5	7.2	3.2	5.7	6.2	4.9	5.6	5.9	5.3	7.8	7.4	7.0	9.1	8.9	35.9	29.2	32.3
Greece	5.4	7.2	0.6	4.1	9.2	8.9	18.9	10.1	1.8	21.2	14.1	8.6	30.5	15.8	54.2	41.3	57.5
Estonia	6.7	2.5	1.6	1.6	6.1	0.9	3.4	3.7	2.4	3.0	4.9	9.7	1.4	4.1	16.2	10.3	27.4
Lithuania	7.8	2.3	0.4	2.8	6.3	5.3	5.0	6.6	13.0	5.8	9.9	12.0	25.6	18.8	17.8	19.2	50.1
Serbia	9.7	7.9	8.2	6.2	15.1	13.8	10.6	10.9	13.8	15.0	7.9	20.9	15.6	20.9	48.5	39.7	61.4
Slovakia	9.8	10.4	6.6	7.6	12.9	9.1	12.0	11.0	14.0	9.1	15.3	13.9	7.8	11.0	10.8	15.5	45.3
Latvia	10.0	11.0	11.7	8.7	8.2	8.1	10.3	16.4	24.5	7.6	11.3	23.4	18.2	16.2	31.6	27.6	57.7
Romania	14.8	24.8	28.0	42.4	21.6	36.7	33.2	55.5	26.6	30.3	40.1	45.3	15.4	60.1	29.3	61.4	67.3
Hungary	22.8	15.5	7.8	13.7	22.0	18.2	15.4	17.0	27.2	15.2	30.6	31.1	12.5	20.9	36.2	51.1	52.9
Bulgaria	40.2	43.2	49.0	38.4	42.4	26.9	32.3	52.0	36.2	42.5	41.4	30.2	40.2	52.3	43.9	54.6	72.1

Note: Countries are ranked according to the proportion of children lacking fruit and vegetables.
Source: Guio et al (2018)

In 2010, as part of the Europe 2020 strategy, EU Heads of State and Government agreed upon an EU social inclusion target: to lift at least 20 million people out of the "risk of poverty and social exclusion" by 2020. This target is measured on the basis of three indicators:

1. The at-risk-of poverty rate, which is defined as the proportion of people living in households whose equivalised income is below 60% of the national median household equivalised income.([5]) It is a relative measure of income poverty (as the poverty risk line varies from country to country) that covers the entire population.
2. The severe material deprivation (MD) rate, which is the proportion of people living in households lacking at least four of the following nine household items: (capacity) to avoid arrears in rent, mortgage or utility bills (1), to keep their home adequately warm (2), to face unexpected expenses (3), to have a meal with meat, chicken, fish or vegetarian equivalent every second day (4), to have one week annual holiday away from home (5), to have access to a car for private use (6), as well as to have a washing machine (7), a TV set (8) and a telephone (9)([6]). This indicator is defined for the whole population (as opposed to the child-specific indicator used in this paper).
3. The (quasi-)joblessness) rate, which is the proportion of people living in households whose work intensity is lower than 20%. The household work intensity is the ratio of the total number of months that all working-age (18-59) household members have worked and the total number of months the same household members theoretically could have worked. This indicator covers the population aged 0-59 (i.e. also children).

People "at risk of poverty or social exclusion" are people living in a household that is income poor and/or severely materially deprived and/or (quasi-)jobless.

A child-specific version of this measure can usefully be constructed by replacing the second indicator with the child-specific deprivation indicator and by considering only the child population for the other two indicators. If we do this, we can identify five clusters of the 31 countries covered in the paper, based on the three aspects of social inclusion (see Figures 2 and 3). Figure 4 completes this picture by providing information on the deprivation intensity, i.e. the average number of items lacked by the deprived children.

A hierarchical cluster analysis of countries leads to five groups:

- *Cluster 1* consists of Bulgaria and Romania, the two EU countries which suffer the most from child deprivation (around 70% in both countries) and from income poverty (32% and 39% respectively). These countries nevertheless differ in terms of (quasi-)joblessness, Romania being among the EU countries with the lowest rate (6%) and Bulgaria among those with the highest rate (15%). The intensity of child deprivation is very high in both

([5]) The equivalised income of a household is a net (disposable) income. It is calculated in three steps: a) all monetary incomes received from any source by any member of the household or the household itself are added up (these include income from work, income from capital, social benefits in cash as well as inter-household cash transfers), and taxes and social contributions that have been paid are then deducted from this sum); b) in order to reflect differences in a household's size and composition, the total (net) household income is divided by the number of "equivalent adults", using the so-called OECD-modified scale, which gives a weight to all members of the household (1 to the first adult, 0.5 to the second and each subsequent person aged 14 and over, and 0.3 to each child aged under 14); and c) finally, the resulting figure, the equivalised disposable income, is attributed equally to each member of the household (adults and children).

([6]) This indicator is referred to as "severe" MD in contrast to the "standard" MD which was initially agreed at the EU level one year before (threshold of three deprivations out of nine; see Guio 2009). In March 2017, the European Commission and all EU countries decided to replace the "standard" MD indicator with a new indicator based on the work by Guio et al (2012 and 2016). The new indicator consists of 13 items: seven household MD items (items 1-6 of the previous "standard" MD indicator plus inability to replace worn-out furniture) and 6 individual MD items (inability for the person to: replace worn-out clothes with some new ones, have two pairs of properly fitting shoes, spend a small amount of money each week on him/herself, have regular leisure activities, get together with friends/family for a drink/meal at least once a month, and have an internet connection). Referred to as "Material and social deprivation rate", this indicator is now included in the portfolio of EU social indicators used by the Commission and Member States to monitor EU progress towards the EU social protection and social inclusion objectives. The new indicator covers the entire population.

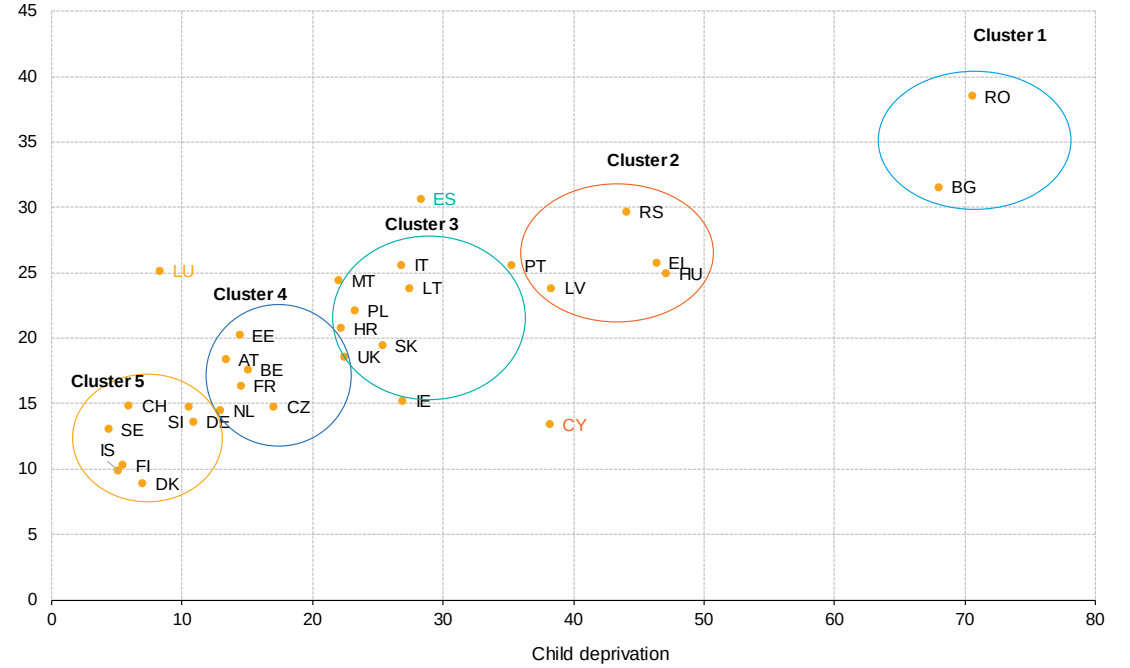
countries (on average, deprived children in these countries lack more than 8 items out of 17 in Romania and more than 10 items in Bulgaria), but lower in Romania than in Bulgaria.

- *Cluster 2* consists of Cyprus, Greece, Hungary, Latvia, Portugal and Serbia, which are characterised by a high prevalence of child deprivation (between 35 and 47%) and a high level of child deprivation intensity. Cyprus differs from the other countries in this group in terms of income poverty: 13% (one of the lowest rates in the EU) as against around 25% for the other countries (almost 30% in Serbia). Among EU countries, Hungary and Serbia differ from the rest of the group in terms of (quasi-)joblessness (two of the four highest rates in the EU, together with Ireland and Bulgaria).
- *Cluster 3* contains countries with a medium-to-high rate of child deprivation (22 to 28%): Croatia, Ireland, Italy, Lithuania, Malta, Poland, Slovakia, Spain and the UK. This group is heterogeneous in terms of income poverty (there is a two-to-one ratio between Ireland and Spain), (quasi-)joblessness (Ireland has the highest rate in the EU (21%) whereas the rates in Italy, Lithuania, Poland and Slovakia are between 5 and 9%) and child deprivation intensity (Ireland and the UK on one side, and Slovakia on the other side).
- Austria, Belgium, Czechia, Estonia, France, Germany and Netherlands constitute *Cluster 4*. They suffer from a low-to-medium level of child deprivation rate/intensity, income poverty and (quasi-)joblessness. For the latter indicator, Belgium is an exception as the proportion of children living in (quasi-)jobless households is 13% - a figure comparable to the performance of Croatia, Malta, Spain and the UK in Cluster 3. Belgium also has the highest child deprivation intensity in this cluster.
- Finally, the cluster with the lowest share of deprived children consists of the four Nordic countries, Luxembourg, Slovenia and Switzerland (*Cluster 5*). They are also characterised by low levels of child income poverty (except for Luxembourg, where it is high (25%)), (quasi-)joblessness and child deprivation intensity.

This clustering is based on aggregated data. It shows a large heterogeneity of national situations in the EU, even within clusters. Countries with similar child deprivation rates may have very different performances in terms of income poverty, (quasi-)joblessness or child deprivation intensity. In order to better understand the individual and institutional determinants of child deprivation, it is essential to use the richness of the individual information available in the EU-SILC dataset and to complement it with data on the institutional context in each country. The next sections use such information to deepen our understanding of the determinants of child deprivation through a systematic investigation of the explanatory power of both micro- and macro- variables.

Two dependent variables already introduced above are compared in these analyses: the child deprivation rate and the child deprivation intensity.

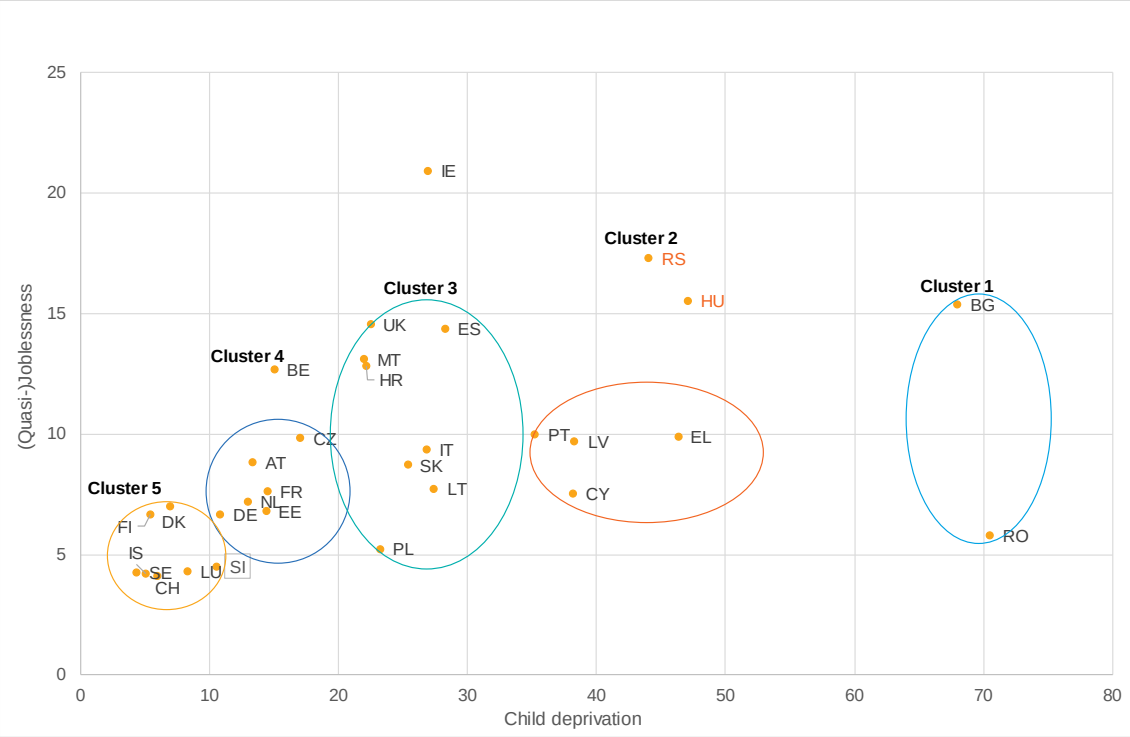
Figure 2: Proportion of children (aged between 1 and 15 years) who lack at least three items (out of 17) and proportion of children who suffer from income poverty, EU-28 Member States and non-EU countries covered by EU-SILC, 2014
(%)



Source: EU-SILC 2014 cross-sectional data, authors' computation.

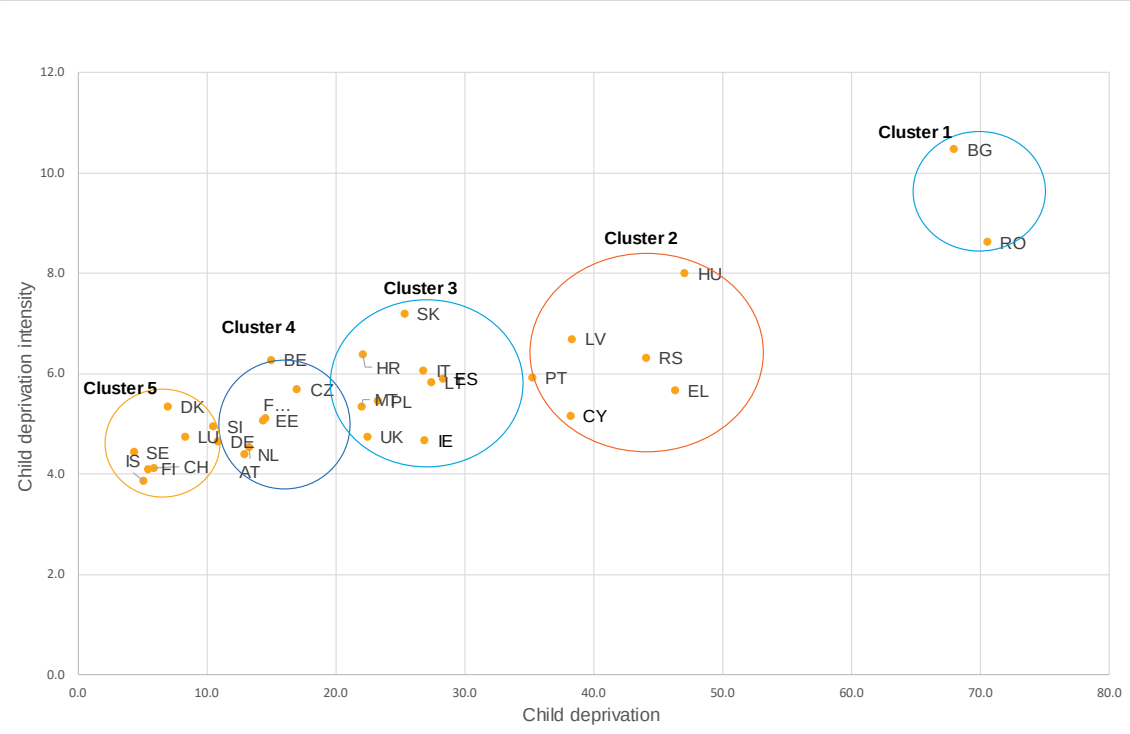
Figure 3: Proportion of children (aged between 1 and 15 years) who lack at least three items (out of 17) and proportion of children who live in a (quasi-)jobless household, EU-28 Member States and non-EU countries covered by EU-SILC, 2014

(%)



Source: EU-SILC 2014 cross-sectional data, authors' computation.

Figure 4: Proportion of children (aged between 1 and 15 years) who lack at least three items (out of 17) and deprivation intensity (average number of items lacked among those lacking at least three items), EU-28 Member States and non-EU countries covered by EU-SILC, 2014
(%)



Source: EU-SILC 2014 cross-sectional data, authors' computation.

4 Micro-and macro-level determinants of child deprivation

In the existing literature on (material) deprivation determinants (as documented for the whole population), a distinction is drawn between so-called "micro-level" and "macro-level" determinants. The micro-level determinants are socio-economic characteristics measured at individual or household level that have a relationship with deprivation([7]). By contrast, the macro-level determinants look at macro-variables such as Gross Domestic Product (GDP), unemployment, inequality, welfare state regime etc. to account for differences in deprivation between countries (see, for example Kenworthy et al, 2011). Recently, multilevel studies have combined the micro-level and macro-level approaches, by jointly considering individual and country characteristics in pooled data settings (see Kim et al, 2010; Chzhen and Bradshaw, 2012; Nelson, 2012; Whelan and Maître, 2012, 2013; Israel and Spannagel, 2013; Bárcena-Martín et al, 2014; Chzhen, 2014; Visser et al, 2014; Saltkjel and Malmberg-Heimonen, 2017; Bárcena-Martín et al, 2017; Verbunt and Guio, 2019).

Verbunt and Guio (2019) show that the concomitant use of single level and multilevel models provides complementary information to explain the deprivation risk. The main advantage of estimating single level models for each country is that all the estimated (individual/household-level) coefficients are country-specific and, hence, explain the variance in the dependent variable *within countries*. For this reason, in our analysis below we look first in detail at the relationship of the different household socio-economic variables with child deprivation by country, using such models. Then, we compare the effectiveness of the household-level and country-level variables in explaining the between-country differences in a multilevel setting. The differences in the composition of the population in terms of household-level risk factors may not fully explain the *between-country* differences in the risk of child deprivation. Country-level variables in the model are therefore included to better understand the relationship with child deprivation of variables not fully captured at the household level.

4.1. Micro-level determinants

It is well documented that demographic and socioeconomic characteristics of households influence child income poverty and deprivation (see for example Tárki, 2011). Both social stratification – the social stratum to which the household belongs – and resources are at play, and the relation between the social stratum and the resources as joint determinants of deprivation is probably much more complex than a reduced form empirical model can account for: the social stratum influences not only the level of resources a household commands, but also their use.

([7]) For an extensive review of the micro-level determinants of (material) deprivation, see Perry, 2002 and Boarini and Mira d'Ercole, 2006.

To specify an empirical model, notwithstanding this difficulty, we distinguish three sets of household-level variables that can explain children's likelihood of deprivation and/or deprivation intensity among *all* children (not just deprived children as in Figure 4):

1. the longer-term command over resources;
2. needs related to health and housing;
3. the size and composition of the household.

Deprivation emerges in the confrontation between available resources and needs. As will become clear, the distinction between variables captured under set 1) and variables grouped under sets 2) and 3) is largely (but not fully) a distinction between "resources" and "needs". However, important factors that influence both the household's command over resources and its needs are not available in our micro dataset (EU-SILC). This holds, for instance, for the household's consumption of in-kind benefits for which we use as "proxy" the national social spending in-kind in the multilevel models. Yet, some relevant elements are missing in both the single level and multilevel models: in-kind support from family/friends, as well as a direct measure of wealth. Also it is important to highlight that the national social spending in-kind that we use is only a crude measure. Indeed, when using this aggregate we also miss important relevant elements: what is the proportion of the benefits that goes to children, what proportion goes to poor/deprived children, what are the quality and affordability of services?

First, children's material well-being depends on how much the household can consume, which, in turn, depends on its "command over resources". Although current (disposable) household income is usually used as a proxy for "command over resources", the association between current income and deprivation is far from perfect. This imperfect link is documented extensively in the literature (see among others Whelan et al, 2001; Whelan and Maître, 2006; 2007; Berthoud and Bryan, 2011; Fusco et al, 2011; Nolan and Whelan, 2011; Verbunt and Guio, 2019). It can be explained by difficulties in measuring income (as is notably the case for self-employed people) and deprivation, and by the fact that households with equal resources may have different needs and face different costs. But, importantly, it can also be explained by the fact that current income is only one element in a household's command over resources. A household's command over resources is also determined by its previous, current and future income, its wealth and its ability to borrow.

We use three variables, available in EU-SILC, which can plausibly serve as proxies for the household's *longer-term* command over resources (in addition to its current income), its *wealth* and its *ability* to overcome short-term financial difficulties: current educational attainment, current (quasi-)joblessness and migrant status. Borrowing from economic jargon, these indicators can be related to the household's *permanent* income, its *wealth* and its ability to overcome *liquidity* constraints([8]). *Ceteris paribus* (for a given level of current income and other household characteristics), a higher level of education can indeed be expected to correlate statistically with: i) a stronger position on the labour market, hence less vulnerability with regard to adverse income shocks (e.g. income shocks because of unemployment or precarious employment); ii) parents that were higher educated and therefore richer, which implies more important bequests and thus wealth; iii) easier access to financial institutions to overcome liquidity constraints; iv) for younger people, a higher future return on human capital. *Ceteris paribus*, if someone in the household was born outside the EU, this correlates statistically with similar social factors: a more vulnerable position on the labour market, less inherited wealth, and more difficult access to financial institutions([9]). *Ceteris paribus,* (quasi-)joblessness at the household level is likely to signal a precarious position on the labour market for all working age household members, which is a predictor of future unemployment risks and, in addition, may hamper access to financial institutions to overcome liquidity constraints. Given its availability in EU-SILC, we are able to add a measure of the household's debt burden, which directly influences its longer-term command over resources, in addition to the three proxies just mentioned.

([8]) The extent to which one needs additional "social stratification" indicators to gauge an individual's or a household's permanent income, over and above its current income, is a moot question; see Kim et al (2018) and Brady et al (2017) for recent explorations of this issue. Here, we start from the theoretical expectation that education, joblessness and migrant status do play a role.

([9]) On the impact of migrant status on (material) deprivation, see de Neubourg et al (2012).

To sum up, in order to proxy as well as possible the longer-term command over resources at the household evel, we use six variables:

a) The yearly (disposable) non-equivalised income of households([10]), expressed in purchasing power standards (PPS)([11]) per 1000 (*household income*). Both the logarithm and linear forms of the income variable were introduced in the regressions. The best regression fit was obtained with the non-logarithm form of the variable. We use non-equivalised income, because the size and composition of the household enter separately in group 3) of our explanatory variables (see below).

b) The educational attainment of the highest educated parent (operationalised by three dummies: *low education* (no education, primary education or a lower secondary education), *medium education* (upper secondary or post-secondary non-tertiary education) and *high education* (tertiary education used as the reference category).

c) The (quasi-)jobless status of the household (*jobless*) which equals one when the adults (aged 18-59, excluding students) work less than 20% of their total work potential during the past year

d) A dummy measuring whether one household member was born outside the EU([12]) (*migrant*).

e) The debt burden of the household (*debt burden*), which equals one if payment of debts from hire purchases or loans other than mortgage or loan connected with the dwelling are considered as a heavy financial burden to the household.

f) The presence of self-employed people in the household (*self-employment*), a dummy variable which we include to take into account difficulties in measuring income for this sub-population.

Secondly, children living in households with the same resources but different needs may experience very different standards of living. Needs increase the level of resources necessary for a household to maintain its standard of living. Needs notably depend on health, tenure status, and the housing situation (see among others Whelan et al, 2004; Fusco et al, 2011, Verbunt and Guio, 2019)([13]). So, we introduce three variables to proxy the household's needs (and related costs):

a) The self-reported health status variable (*bad health*), which has a value of one if at least one person in the household reports having bad or very bad health.([14])

b) A tenure dummy (*rent*), which has a value of one if the household rents its dwelling on the private market or with a social (free or reduced) tariff, as compared to owning its own house.([15])

c) Two housing burden dummies, which measure if households' housing costs, including mortgage repayment (instalment and interest) or rent, insurance and service charges (sewage removal, refuse removal, regular maintenance, repairs and other charges) are a heavy (*heavy housing burden*) or a light housing burden (*light housing burden*), with no housing burden as the category of reference.

Thirdly, we include three socio-demographic variables related to the household size and composition:

([10]) The disposable income of a household is obtained by summing up all monetary incomes received from any source by any member of the household or the household itself and then deducting taxes and social contributions paid by the household.

([11]) On the basis of Purchasing Power Parities (PPP), Purchasing Power Standards (PPS) convert the amounts expressed in a national currency to an artificial common currency that equalises the purchasing power of different national currencies (including for those countries that share a common currency). It should be noted that PPS can be considered to be an imperfect tool to measure price differences in relation to deprivation. Reference budgets, priced baskets of goods and services that are needed for households in given countries, regions or cities to achieve a given standard of living, are a theoretically sound alternative. However, reference budgets are at this moment not yet available for all countries in the dataset.

([12]) For the three non-EU countries covered in the paper (Iceland, Serbia and Switzerland), a child is considered as migrant if at least one member of its household was born in a country which is neither the country of residence nor an EU country.

([13]) Childcare costs were included in the model (using as a proxy based on childcare attendance). However, the variable was missing for a large share of the sample of children and had no significant impact on child deprivation for the rest of the sample. A variable on childcare cost burden was collected in the EU-SILC ad-hoc module on public services in 2016, and should be more appropriate to test the impact of childcare costs on child deprivation when it becomes available.

([14]) We tested "limitation in daily activity" and "suffering from a chronic condition" as alternatives for the bad health variable. The bad health specification had the best fit to the data.

([15]) We introduced separate dummies for private market renting, renting with a free or reduced tariff and owning a house with a mortgage. The coefficients of the market and social renting gave very similar results, while owning a house with a mortgage was insignificant.

a) The total number of dependent children (i.e. all children aged 0-17 and dependent students aged between 18-24) in the household (*number of dependent children*), instead of implicitly adjusting the household income for its size and composition with an equivalence scale (as is done for the calculation of income poverty).

b) The age of the oldest child in the household among those children aged 1-15 (*age of oldest child*), in order to test whether the composition of the deprivation basket induces a systematic bias in favour of younger/older children, as would be the case if some of the items are less relevant for some age groups.

c) A dummy indicating if children live in a single-parent household (*single parent*). A priori, we expect this variable to be related both to the longer-term command over resources and the needs of the household. From a permanent income perspective, a single parent household is more vulnerable (it has fewer possibilities for employment risk pooling across adults in the household than households with more than one adult). From a needs perspective, single parents face fixed costs (housing, childcare costs, etc.) which generally represent a higher share of their household resources than households with more than one adult (remember that we do not equivalise household incomes). (They also face more difficulties in reconciling working life and family life and therefore are more likely to opt for part-time employment or inactivity; inactivity or a very low level of activity is however already taken into account by the variable on (quasi-)joblessness.)

These three sets of household-level variables are used in the single level models (for each country), as well as at the micro level of the multilevel model (for the pooled dataset). All summary statistics can be found in Annex 1. Annex 2 presents the correlation coefficients between these variables.

4.2 Combining micro- and macro-level determinants

In multilevel models, household-level risk factors are complemented by country-level and/or contextual variables. The selection of explanatory variables included in these models needs careful consideration: depending on the research question one wants to answer, it may be appropriate or inappropriate to include certain variables in the model.

Table 2 summarises the results obtained with multilevel models in existing research on (child) deprivation. At the macro level, these models typically include explanatory variables which correlate with the average level of household income in the country, most often GDP per capita; they often also include aggregate measures of social spending. With the exception of Bárcena-Martín et al (2014) and Whelan and Maître (2012), the papers we found do not include household income at the individual level, whilst they include individual household variables related to education, socio-economic status and employment. This choice of variables at the micro level raises questions: the most plausible argument to include variables related to education, status and employment at the micro level, is that these variables correlate with the household's "longer-term command over resources", as explained above. However, current income certainly also correlates with the household's "longer-term command over resources"; presumably it is even the best proxy for a household's longer-term command over resources (see Kim et al, 2018 and related literature). If the research objective is to explain child deprivation across Europe, we do not see good reasons for leaving out the best proxy for "longer-term command over resources" when it is available in the dataset. In fact, models excluding individual household income at the micro level but including national median household income, GDP per capita and social transfers at the macro level, are bound to mix up direct and indirect impacts of such variables. This is not to say that excluding individual household income in a multilevel model examining deprivation is always wrong. For instance, if the research question focuses on the relationship of cash transfers with material deprivation across countries, given their level of GDP per capita and given household *needs* measured at the micro level, one might want to exclude household income at the micro level, in order to gauge the relationship of cash transfers with deprivation.([16]) But we feel uncomfortable with models that

([16]) We thank Brian Nolan for extensive discussion on this issue, which is not to say that he would agree with our conclusion.

include all kinds of variables that determine households' longer-term command over resources except household income, and then add the level of cash transfers as explanatory variable.

However, once household income is included at the micro level, the inclusion of macro-variables that directly influence individual household incomes – such as GDP per capitamedian income, or cash transfers – needs careful consideration. A priori, we expect that only macro-variables without direct impact on individual incomes have an impact on between-country differences in deprivation, when individual incomes are accounted for at the micro level. A prime example of such a macro-variable is spending on *in-kind* social benefits: receipt of in-kind benefits is not included in individual household incomes. If a variable has a significant relationship with deprivation when it is included at both the macro and micro levels, such a result is *prima facie* counterintuitive and deserves further interpretation. We return to this when we discuss our results.

Table 2: Literature review of multilevel (material) deprivation studies

Micro- /Macro- Determinants	Sample and Econometrics	Deprivation definition and determinants	Main Findings
Nelson (2012)	Data: EU-SILC (2008), 26 European countries, cross-sectional Unit of analysis: Individual (below 65 years of age)	Deprivation Index: Standard EU definition Determinants: Micro (female, age dummies, single person, lone parent, two-parent family, primary education, unemployed, non-EU migrant) and macro (type-case social assistance benefits, GDP per capita, activity rate, unemployment rate, long-term unemployment rate, educational expenditure, active labour market policy (ALMP) expenditure, public service expenditure, non-means-tested benefit expenditure)	All individual determinants which are normally related to material deprivation have a substantial and significant effect. Household income is not taken up as a variable in the model. Social assistance benefits are negatively associated with material deprivation. After controlling for social benefits, GDP per capita, the activity rate, the unemployment rate and the long-term unemployment rate are significant, while non-means-tested benefit expenditure, ALMP, education expenditure and public services expenditures are not significant. Looking at effects of cross-level interactions, the author finds that social assistance benefits reduce the influence of four individual-level variables on material deprivation (i.e. single person, lone parent, unemployed, primary education).
Whelan and Maître (2012)	Data: EU-SILC (2009), 28 European countries, cross-sectional Unit of analysis: Individual (household reference person) Model: Multilevel linear model Dependent variable: Basic deprivation	Deprivation Index: Basic Deprivation which comprises items relating to enforced absence of a meal, clothes, a leisure activity, a holiday, a meal with meat or a vegetarian alternative, adequate home heating, shoes. Determinants: Micro (logarithm of **household income**, professional occupation, education (pre-primary, primary, lower secondary, higher education), age, gender, marital status, immigrant, number of children, lone parent, employment status, tenure) and macro (logarithm of Gross National Disposable Income per head (GNDH), welfare regime dummies and Gini)	All individual determinants which are normally related to material deprivation have a substantial and significant effect. Household reference person's socioeconomic variables were related to basic deprivation and account for substantial proportions of both within-country and between-country variance. The addition of macro-economic factors to the model contributed relatively little to the explanatory power and only GNDH was significant. The welfare regime dummies add little in terms of variance explanation. Further, there is a set of significant interactions between micro variables and GNDH: the impact of the micro variables is contingent on the level of aggregated income in society.
Chzhen and Bradshaw (2012)	Data: EU-SILC (2009), 24 European countries, cross-sectional Unit of analysis: Individual, **children living in lone parent families** Model: Multilevel logistic model Dependent variable: Material Deprivation	Deprivation Index: Standard EU definition Determinants: Micro (gender of lone parent, number of children, age of youngest child, marital status, education, economic activity) and macro (logarithm of GDP per capita, logarithm of social transfers)	All individual determinants which are normally related to material deprivation have a substantial and significant effect. Household income is not taken up as a variable in the model. The effect of transfers is negatively associated with material deprivation, but only when the differences in GDP per capita are not controlled for. Once the variation in country wealth is taken into account, the effect of social transfers disappears.

Visser et al. (2014)	Data: European Social Survey (ESS), 25 European countries, cross-sectional Unit of analysis: Individual Model: Multilevel linear model Dependent variable: Economic Deprivation	Deprivation Index: Confirmatory factor analysis on three variables measured on an ordinal scale (0-6): 'I have had to manage on a lower household income', 'I have had to draw on my savings or get into debt to cover ordinary living expenses' and 'I have had to cut back on holidays or new household equipment'. Determinants: Micro (national income position (quartiles), job status, employment status, marital status, number of children, urbanization, parental education, age, ethnicity) and macro (unemployment rate, GDP per capita, relative changes in the percentage of unemployment people and GDP, total social spending expenditure)	All individual determinants which are normally related to material deprivation have a substantial and significant effect. Household income is not taken up as a variable in the model. Macroeconomic circumstances and social protection expenditures show a significant impact on deprivation, after controlling for the individual level variables. Various crossed effects between micro- and macro-variables are found: the impact of the relative national income position on material deprivation varies according to the economic circumstances and the generosity of the welfare state. The paper also shows that adverse economic circumstances affect the deprivation-reducing impact of social transfers (country-level interaction).
Bárcena-Martin et al. (2014)	Data: EU-SILC (2007), 28 countries, cross-sectional Unit of analysis: Individual (household reference person) Model: Multilevel linear model Dependent variable: Material Deprivation	Deprivation Index: Linear index , weighted by frequency weights Determinants: Micro (female, young, old, tertiary education, working, tenure status, **household** income, household structure variables) and macro (long-term unemployment rate, S80/S20, GDP per capita, total social spending expenditure)	All individual determinants which are normally related to material deprivation have a substantial and significant effect. A (jointly) significant impact of social policy generosity, inequality and GDP is found. 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. Cross-level interactions show that social policy generosity, higher GDP and lower inequalities decrease the effect of the individual-level variables on material deprivation.
Chzhen (2014)	Data: EU-SILC (2008-2012), 31 European countries, cross-sectional Unit of analysis: Individual level, **child population** Model: Multilevel logistic model Dependent variable: Severe child deprivation	Deprivation Index: Standard EU definition Determinants: Micro (low work intensity, lone parent, large family, migrant, owner-occupier, one adult works in public sector, age of youngest child, highest level of education) and macro (Minimum income protection scheme, total social spending, unemployment rate)	All individual determinants which are normally related to material deprivation have a substantial and significant effect. Total social spending and the unemployment rate reduces material deprivation for children. The negative effect of the minimum income protection scheme indicator was statistically significant only when other country-level characteristics were not accounted for. Income, measured both at the individual and country-level, is not included in the model.

Bárcena-Martın et al. (2017)	Data: EU-SILC (2009), 27 European countries, cross-sectional Unit of analysis: Individual, **child population** Model: Multilevel logistic model Dependent variable: Child deprivation	Deprivation Index: Linear index with frequency weights based on 14 specific items included in the child-specific module of the EU-SILC 2009. Determinants: Micro (age of the child, work intensity, lone parent, urban area, owner, chronic illness or condition, female household reference person (HRP), tertiary education HRP, young HRP, immigrant HRP) and macro (GDP per capita, long unemployment rate, s80s20, social spending expenditure functions)	Child deprivation is significantly related to household characteristics and to country-level determinants. The latter explain more than half of the cross-national variation in child deprivation levels, once the micro-level determinants have been controlled for. GDP per capita and inequality has a statistically significant association with child material deprivation in all model specifications. A strong and negative relationship between social protection as a share of the GDP and child deprivation is found. Some benefit functions targeted at children do not have the intended negative impact on child deprivation, while other functions not explicitly targeted at children appear to be effective in reducing child deprivation. Household income and cross-level interactions are not regressed.
Saltkjel and Malmberg-Heimonen (2017)	Data: EU-SILC (2009), 27 European countries, cross-sectional Unit of analysis: Individual, **child population** Model: Multilevel linear model Dependent variable: Material Deprivation	Deprivation Index: Standard EU definition Determinants: Micro (gender, age, country of birth, marital status, limiting longstanding illness, self-defined economic status, education level) and macro (Social protection expenditure in PPS per head, divided by the inverse of the employment rate)	All individual determinants which are normally related to material deprivation have a substantial and significant effect. Welfare generosity is related to a lower risk of material deprivation among disadvantaged groups, when assessing a combination of the main effects of welfare generosity and the group-specific effects. Income, measured both at the individual and country-level, is not included in the model.

Note: Extension of the literature review of Bárcena-Martin et al. (2014) (online appendix)

To test whether social transfers have a significant association with child deprivation, we mobilise a large number of indicators that capture differences in social spending across the 31 countries analysed, in terms of spending size (total, cash and in-kind), targeting on families/children, pro-poorness and adequacy:

a) Social welfare generosity is operationalised by several variables. A first measure expresses total social spending as a percentage of GDP and is derived from the Eurostat European System of integrated Social Protection Statistics (ESSPROS) database (*total social benefits, % of GDP*). In addition, following Verbunt and Guio (2019), we also distinguish between in-cash (*cash social benefits, % of GDP*) and in-kind (*in-kind social benefits, % of GDP*) social spending. Social spending covers sickness/healthcare, disability, family/children, unemployment, pension, survivor, housing and all not elsewhere classified social exclusion benefits([17]). These variables measure the generosity of the welfare state in the country, as a proportion of the GDP. Alternatively, we also use household-level variables that measure the level of net social benefits received by households with children (any benefit, not just family-related benefits), and are directly derived from the EU-SILC micro-data. This is the average equivalised social transfer computed per child (*cash social benefits, in PPS per child*). Lacking additional information in EU-SILC on the distribution of in-kind benefits in PPS, we use in-kind social benefits derived from the ESSPROS database and expressed in PPS per head (*in-kind social benefits, in PPS per head*). Total social spending sums up both in-cash and in-kind social benefits (*total social spending, in PPS per head*).

b) We evaluate the relationship of social spending geared to families and children with child deprivation. We use the ESSPROS average family transfer expressed as a proportion of GDP, covering both in-kind and in-cash benefits (*family social spending benefits, % of GDP*) and the average gross equivalised family benefits per child based on EU-SILC micro-data (*family cash social benefits, PPS per child*).([18]) One should remember that cash-transfers are already included in individual household income whilst in-kind transfers are not. Hence, if we obtain a significant coefficient for a macro-variable including cash-transfers to the target population, the interpretation is not straightforward (see above).

c) The pro-poorness of in-cash social benefits is an important aspect of the redistributive system. The question of the optimal degree of universalism and targeting is still open to debate. Following Marx and co-authors (2013) and Diris et al (2017), we measure the degree of targeting by the share of transfers that is distributed to the lowest five deciles of the pre-transfer household income distribution of children (*pro-poorness bottom 50*).([19])The countries with the highest share of transfers (more than 75%) going to the bottom 50% of the distribution are the Czechia, Denmark, Greece, Iceland, Ireland, Malta, Poland, Portugal and United Kingdom (see Annex 1). Again, significant coefficients for such a variable require careful interpretation, since individual incomes of poor households in our dataset already include these transfers. A first descriptive analysis indicates that the negative relationship between targeting (*pro-poorness bottom 50*) and size (as measured by social transfers in % of GDP or per head) is not confirmed by our data (see Annex 3).

d) Nelson (2012) argues against analysing the relationship of social transfers with via an expenditure-based approach, as we proposed above. Expenditure-data mix information on

([17]) It might seem counterintuitive to include pensions and survivor benefits in this concept when explaining differences in child deprivation across countries. However (see for example Diris et al, 2017), pensions constitute an important share of household income for non-elderly individuals in some countries (mainly those where intergenerational households are more prevalent).

([18]) We computed additional variables that consider the level of family benefits expressed as a proportion of total social spending (ESSPROS) and as a proportion of household income (EU-SILC micro-data). Both variables were found to have a statistically insignificant relationship with child deprivation and explained little about between-country differences in child deprivation. ([19]) We use the share of transfers that is distributed to the lowest two deciles in the pre-transfer household income distribution (excluding pensions) (*pro-poorness bottom 20*) as an alternative variable for robustness analysis.

([19]) We use the share of transfers that is distributed to the lowest two deciles in the pre-transfer household income distribution (excluding pensions) (*pro-poorness bottom 20*) as an alternative variable for robustness analysis.

system generosity with information on the business cycle and the composition of the population. Also, these data refer to gross public spending (in ESSPROS data, and to a certain extent also in EU-SILC data([20])), and do not account for national differences in taxation. Furthermore, by looking at the national average of social spending per head, the expenditure approach cannot account for variations in treatment of families by household composition or social situation. These are the main reasons why some authors opt for a "household-type" approach (rather than an expenditure approach): it makes it possible to overcome these drawbacks and better measure cross-country differences in social transfers Nelson, 2012; Chzhen, 2014). Household-types simulate the level of benefits and taxes for standardised household types across countries, instead of averaging actual expenditure data. Whilst it has advantages, this approach has also limitations. One of the limitations, especially for comparative analyses, is the difficulty to propose a representative set of "household types" for the various countries considered (Bárcena-Martín et al, 2017, 2018). Still, the "household type" approach is an interesting alternative for measuring the adequacy of minimum income schemes. In this paper, the indicator used is the minimum income benefit (for the type under review) expressed as a percentage of national median household income (*adequacy of minimum income benefit schemes*). We focus on one type: a married couple with two children, eligible for cash housing assistance([21]). The data are derived from the OECD database.

After considering income at household level, we introduce two measures to reflect general differences in standard of living.

a) First, as is the usual practice in the literature, we use GDP per capita, expressed in Purchasing Power Standards (*GDP per capita*). GDP per capita varies extensively across the 31 countries analysed and ranges from 10,100 (Serbia) and 12,800 PPS (Bulgaria) to 74,500 PPS (Luxembourg).

b) Secondly, we contrast the results obtained with GDP per capita with those obtained when the national median household equivalised (disposable) income (*median income*) is used. Median income is directly derived from the EU-SILC micro-data, using only the child population, and expressed in PPS per 1000. Household income is equivalised to account for between-country differences in household size and composition. The annual median household equivalised disposable income also varies extensively across the 31 countries analysed and ranges between 3,230 PPS (Romania) and 24,230 PPS (Luxembourg).

These two concepts are different in essence. GDP measures the national value-added produced by all sectors of the economy whereas the national median household equivalent income per child focuses only on the private household sector (and among this sector on the subset of households with children) and on disposable income. Contrary to the usual practice in multilevel analyses of poverty or deprivation, this last option better captures the national differences in standard of living of households.

Even though we control for low work intensity at household level (see above for the definition of the "(quasi-)jobless" indicator), we also introduce the unemployment rate to account for the possible effect of the business cycle on the size and pro-poorness of social benefits. The definition of the unemployment rate is the standard definition of the International Labour Office (ILO) – i.e. the number of people unemployed (ILO concept) as a percentage of the active population; it is derived from the Eurostat database (*unemployment rate*).

All summary statistics can be found in Annex 1.

As explained above, most of the papers using multilevel approaches test crossed effect between micro-

([20]) In EU-SILC, the amount of the various social transfers received by people/households are gross amounts except for the total amount of pensions received by the household and for the total amount of transfers received (with and without pensions) for which both gross and net figures are available.

([21]) We tested the sensitivity of our results to choice of the "standard" family type. Tests were made with married couples with two children not eligible for cash housing assistance, single-parent households with two children eligible for cash housing assistance and single-parent households with two children not eligible for cash housing assistance). Altering the reference family had no impact on our results.

and macro-variables. Cross-level interactions allow the coefficients of the household-level determinants to depend on country-level variables. We will also investigate these interactions.

5 The model and the estimation strategy

We use an unweighted count of child deprivation items (ranging from 0 to 17) as the dependent variable in our model. This has the advantage of using all the information on the number of deprivations suffered by children, without reducing it to a binary variable. However, as the deprivation rate (3+ threshold) has become an official EU social indicator since March 2018, we will test the robustness of our conclusions against the use of this indicator as our dependent variable. Our reference population covers children aged between 1 and 15 years, i.e. the age group for which the information is collected in the EU-SILC ad hoc module on child deprivation.

The dependent variable displays a large degree of over-dispersion. Over-dispersion in count data occurs when the variance is larger than its mean. It is therefore recommended to use a negative binomial model, as this technique weakens the highly restrictive assumption made in the traditional Poisson model that the variance is equal to the mean. Instead, the negative binomial model estimates an additional random parameter that takes the unobserved heterogeneity into account. The estimate of the dispersion parameter is significantly greater than zero in all models, indicating that the dependent variable is indeed over-dispersed and that the negative binomial models are the most suitable models.

We run both single level and multilevel negative binomial models to investigate the within and between-country determinants of child deprivation. The single level models investigate the relationship of the household-level variables with child deprivation. The main advantage of estimating single level models for each country is that all the estimated (individual/household-level) coefficients are country-specific and, hence, give a more precise estimate of the explanatory power of the model *within countries.* Multilevel models are particularly appropriate to study nested data designs, where respondents are organised within more than one level. In our study, individuals (*i*) are nested within countries (*j*). They are useful to account for unobservable differences in the dependent variable *between countries.* Country-level variables are therefore included in the model to better understand the relationship with child deprivation of variables not fully captured at the household level. Formally, the model is given by the following formula:

$$E[y_{ij}|[x_{\mathrm{h}ij}, z_{\mathrm{c}j}, U_j] = \mu_{ij}$$

$$\log(\mu_{ij}) = \beta_0 + \sum_{h=1}^{H} \beta_h x_{\mathrm{h}ij} + \sum_{c=1}^{C} \beta_c z_{\mathrm{c}j} + U_j$$

$$\mu_{ij} = \mathrm{e}^{\beta_0 + \sum_{h=1}^{H} \beta_h x_{\mathrm{h}ij} + \sum_{c=1}^{C} \beta_c z_{\mathrm{c}j} + U_j}$$

$$Var(y_{ij}|\mu_{ij}) = \mu_{ij} + v\mu_{ij}$$

where

$E(y_{ij})$ is the expected number of deprivation items for individual *i* (*i=1,..., N*) living in country *j* (*j=1,…,J*)

μ_{ij} is the conditional mean of the dependent variable for individual *i* (*i=1,..., N*) living in country *j*

(*j=1,…,J*)

β_0 is the overall intercept

x_{hij} is the value of the h^{th} (*h = 1,…,H*) independent variable defined at the household level for individual *i* (*i=1,..., N*) living in country *j* (*j=1,…,J*)

β_h is the coefficient of the h^{th} (*h = 1,…,H*) independent variable defined at the household level

z_{cj} is the c^{th} (*c = 1,…,C*) independent variable defined at the country level for country *j* (*j=1,…,J*)

β_c is the coefficient of the c^{th} (*c = 1,…,C*) independent variable defined at the country level

U_j is the error term for country *j* (*j=1,…,J*) , ~N(0, σ^2)

v is an over-dispersion parameter

We calculate pseudo R^2 measures to assess the overall explanatory power of the employed models. In the single level models, we use the McFadden pseudo R^2 measure. Following Verbunt and Guio (2019), we define a measure of explained between-country variance in the multilevel models (which is defined as the difference between the variance in random intercept values of the empty multilevel model and the variance in random intercept values of the models that include independent variables). We then apply Shapley decompositions on the pseudo R^2 measures to establish and compare the relative explanatory power of the independent variables (Shapley, 1953). The Shapley approach calculates the exact contribution of each independent variable to the total R^2-value. The method has been used to decompose the goodness-of-fit measure in both linear and logistic regression models (Deutsch and Silber, 2006; Verbunt & Guio, 2019).

In the single level models, we decompose the McFadden pseudo R^2 measure. This measure is based on the likelihood value, and higher values indicate a better fit of the model to the data. In the multilevel models, we are interested in the relative effectiveness of the independent variables in explaining between-country differences. We define a measure of explained between-country variance. Following Verbunt and Guio (2019), the explained variance measure is defined as the difference between the random intercept values of the empty multilevel model and the random intercept values of the models that include independent variables.

6 Results

6.1 National single level model

We ran negative binomial models at the country level. Table 3 reveals a considerable *cross-country variation in the McFadden pseudo R² measure* (see column 1). This means that the effectiveness of the household-level variables differs strongly across countries, which is a first interesting result. This model is the most effective in explaining child deprivation *intensity*([22]) in countries with the lowest share of child deprivation (Austria, Belgium, Denmark, Netherlands and Sweden). Conversely, the countries where the single level model has a lower explanatory power are Bulgaria, Cyprus, Estonia, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Serbia and Slovakia. In the child deprivation typology suggested in Section 3, all these countries belong to clusters 1, 2 or 3 (high to very high levels of child deprivation) except for Estonia (cluster 4). Yet, the specific situation of Greece and Hungary should be stressed: these countries have very high levels of child deprivation (they belong to cluster 2) but their R² is at the level of the weighted average of the 31 countries (Hungary) or higher (Greece). In countries where the single level model has a lower explanatory power, differences in socio-economic characteristics of households play a (much) smaller role in explaining the number of deprivations suffered by children. In several of these countries, this may be because the general standard of living is low and all children have, as a consequence, a greater likelihood of being (more) deprived.

In terms of relative share of explanatory power, Table 3 and Figure 5 show that the group of variables related to resources (income, presence of self-employed people in the household, education, (quasi-)joblessness, debt burden and migration) make, on average, a relative contribution of 55% to the fit. The variables related to needs (housing cost burden, bad health and tenure status ["rent" variable]) represent 38%. The other socio-demographic variables (household structure and size) contribute to around 7%. Figure 5 clearly illustrates that the explanatory power of the different variables differs between countries. In the richest countries, the explanatory power of the variables related to needs is larger. In countries with the highest proportion of child deprivation, the explanatory power of resources variables is generally greater.

The relationship of individual household income with child deprivation is significant in all 31 countries (see Table 4 for the detailed results). With an average contribution of 25% to the fit (from 7% in Slovakia to 36% in Cyprus, 37% in Portugal and 50% in Greece; see Table 3), it is the most important variable related to resources.

The educational level of the parents is also strongly associated with child deprivation, even when income, labour market attachment and other household-related demographic differences are taken into account. This confirms our expectation that educational attainment is a good proxy for the longer-term command over resources, independently from other proxies of command over resources. It makes an average contribution

([22]) As mentioned earlier, we use an unweighted *count* of child deprivation items as the dependent variable in our model. This indicator of child deprivation intensity ranges from 0 to 17.([23]) If the figure in the p>z column of Table 5 is less than 0.05, then the result is statistically significant at 5%.([24]) A rough proxy for "volatility" might be the size of cash benefits in relation to GDP, as cash benefits tend to reduce volatility of incomes. We should immediately concede that we do not find convincing evidence for this hypothesis: cash benefits (as a % of GDP) have a negative, but weakly insignificant (p=0.11) relationship with child deprivation after controlling for GDP per capita [M14].

of 15% to the fit and is the third most important variable across the dataset (after income and housing cost burden). The education variables are significant in all models tested and in all countries (with the exception of lower education in Sweden and medium education in Denmark and Luxembourg). The association is the strongest in Bulgaria, Hungary and Romania (27-37%) as well as, to a much lesser extent, Poland, Lithuania, Slovakia, Portugal and Malta (20-22%). These are all countries with (very) high child deprivation levels. A plausible explanation for this diverging effect across countries, which does not contradict our theoretical expectation, is that higher education is more scarce in these countries and thus more valuable on the labour market.

Living in a (quasi-)jobless household is positively related with child deprivation intensity in the majority of countries, even when household income is controlled for (see also Fusco et al, 2011 and De Graaf-Zijl and Nolan, 2011 for similar results). The variable is, however, not significant in Austria, Czechia, Denmark, Hungary, Iceland, Lithuania, Luxembourg, Netherlands, Poland and Hungary (Table 3). The contribution of (quasi-)joblessness to the fit, as shown in Table 3, is higher than 10% in Ireland, Spain, Croatia, Malta and Slovakia. The average contribution is 6%.

The other variables related to households' longer-term command on resources have a more limited association with child deprivation (i.e. self-employment, migrant, debt burden). For similar income levels, households with self-employed member(s) tend to suffer from a lower number of deprivations: in all but two countries the coefficient is significant and negative; the exception is Switzerland where the figure is positive and high (0.39) and France where it is not significant. This confirms previous results (see also Fusco et al, 2011; Berthoud and Bryan, 2011) and may be partly explained by the difficulty of measuring self-employment income in surveys such as EU-SILC or by the challenge of discriminating between personal and professional assets and costs for the self-employed. There are, however, many countries where the coefficient of self-employment is close to zero or negative, but not significant. Migration has the largest relative contribution to the fit measures in Denmark, Sweden and Switzerland: 7-12%, as opposed to 3% for the average. Households with a high debt burden also have a higher deprivation risk (this explains 6% of the fit, on average, across the 31 countries analysed). The share of the fit is the highest (10-15%) in richest countries such as Denmark, Iceland, Sweden and Switzerland.

As expected, households with higher costs face a higher child deprivation risk. The variable related to the housing burden appears to have a strong association with child deprivation intensity in most countries: it explains more than 20% of the fit in almost all countries and as much as 43% in Slovenia (average fit: 27%). Children living in households renting their dwelling tend to suffer more from deprivation than those owning it in all countries, except in Bulgaria, Estonia, Romania, Serbia and Slovakia, where the difference by tenure status is not significant. This variable explains a large share of the fit in Austria, Belgium, Denmark, Germany, Luxembourg, Netherlands, Sweden, Switzerland (12-18%) and in the UK (26%). The average fit is 7%. Finally, households in which at least one adult suffers from health problems also face higher risks of child deprivation (except in Bulgaria and Lithuania), which is in line with results shown in other studies (Fusco et al, 2011). This is explained by the burden of additional healthcare costs of having a household member with (very) bad health. It would be interesting to include information on any child health problems in the model. This variable, not yet available in EU-SILC, will be collected in future modules on child deprivation and living conditions.

Among the socio-demographic variables included in the model, the number of children is positively related to child deprivation in all countries. Living in a single-parent household increases the risk of child deprivation in many countries (22 out of 31). In the countries where it is not, this can be interpreted as the fact that it is not living in single-parent households *per se* that increases the child deprivation intensity, but the associated characteristics of these households in terms of low income and low labour market attachment. The age of the oldest child has no significant relationship with the child deprivation risk in two thirds of the countries studied. This is an important result as it indirectly confirms that the composition of the 17 deprivation-item basket proposed by Guio et al (2018) does not lead to systematic differences between age groups.

Sensitivity analyses

The results presented in this section relate to the deprivation *count* as the dependent variable (i.e. the deprivation *intensity*). Annex 4 presents the results of national logistic regressions using as dependent variable the deprivation *rate*, with a threshold set at 3+ lacks out of 17. The results and significances of the logit model are usually similar to those of the negative binomial model commented on in this section. The

differences between the two models at the country level appear mainly for the independent variables for which we highlighted non-significant relations (self-employment, migrant and single-parent households).

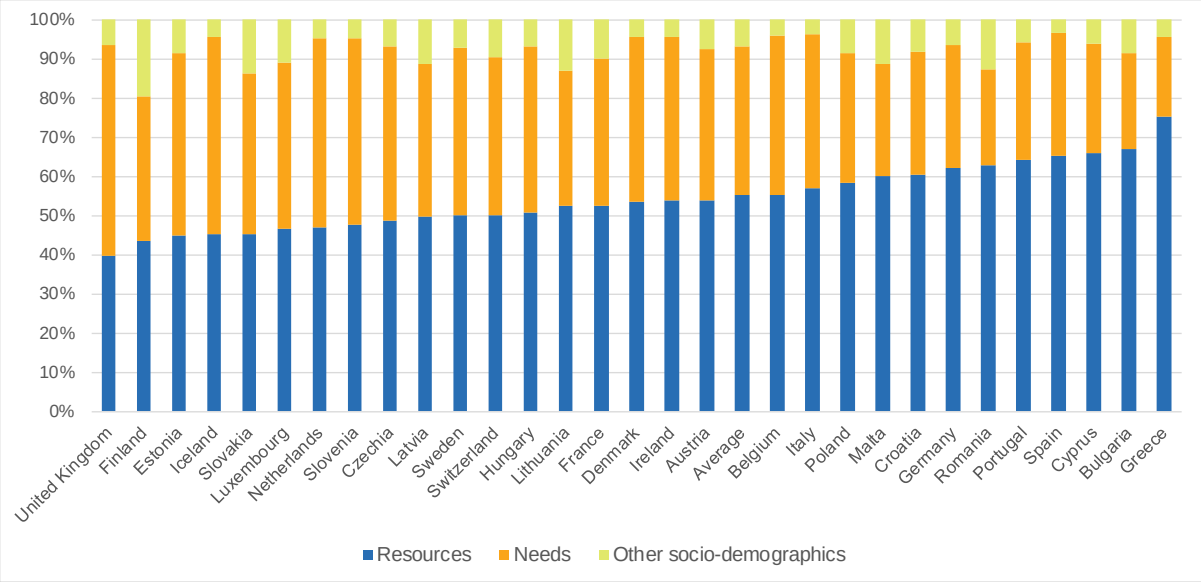
These results show that countries not only differ in terms of socio-economic composition (as stated in most multilevel models), but also in terms of the relationship of each household variable with the child deprivation risk, i.e. household income, (quasi-)joblessness, housing cost burden have a different association with child deprivation across European countries. This confirms our estimation strategy and means that both single and multilevel models are useful to highlight the right policy drivers across countries.

Table 3: Shapley decompositions of the household-level variables on the pseudo R²-measures, single level model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014

	Resources						Needs			Other socio-demograhpics
	R²	Income	Education	Quasi-joblessness	Debt burden	Migrant	Housing burden	Bad health	Rent	Household structure
Belgium	0.23	28,2% (1)	11,8% (4)	8,4% (5)	4,5% (6)	2,3% (9)	21,2% (2)	4% (8)	15,7% (3)	4% (7)
Bulgaria	0.07	22,2% (2)	37,3% (1)	6,4% (5)	0,8% (8)	0,1% (9)	22% (3)	1,7% (6)	0,8% (7)	8,7% (4)
Czechia	0.20	20,5% (2)	16,2% (3)	8% (5)	3,8% (8)	0,1% (9)	31,8% (1)	4,1% (7)	8,8% (4)	6,7% (6)
Denmark	0.24	25,2% (1)	4% (7)	3,9% (8)	11,9% (4)	8,7% (5)	25,1% (2)	3% (9)	14% (3)	4,3% (6)
Germany	0.18	31,5% (1)	15,5% (3)	9,1% (5)	5,4% (7)	0,7% (9)	16,7% (2)	4,7% (8)	10% (4)	6,4% (6)
Estonia	0.14	19,3% (2)	11,1% (3)	9,5% (4)	3,9% (6)	1,1% (8)	42,3% (1)	2,9% (7)	1,1% (9)	8,7% (5)
Ireland	0.18	28,4% (2)	8,8% (4)	11,9% (3)	4,3% (6)	0,3% (9)	30,5% (1)	3,9% (8)	7,6% (5)	4,3% (7)
Greece	0.19	50,3% (1)	13,1% (3)	6% (4)	1,3% (9)	4,3% (6)	16,1% (2)	2,8% (7)	1,4% (8)	4,6% (5)
Spain	0.20	29% (1)	17,2% (3)	10,6% (4)	3,7% (7)	4,6% (5)	25,5% (2)	1,7% (9)	4,2% (6)	3,5% (8)
France	0.17	23,7% (2)	15,3% (3)	5% (6)	3,9% (8)	4,6% (7)	25,9% (1)	2,9% (9)	8,6% (5)	10% (4)
Croatia	0.15	26,9% (1)	18,8% (3)	12,8% (4)	1,9% (8)	1,5% (9)	21,6% (2)	5,4% (6)	2% (7)	8,9% (5)
Italy	0.14	26,8% (2)	15,6% (3)	5,3% (5)	4,3% (7)	4,8% (6)	30,1% (1)	2,7% (9)	6,7% (4)	3,7% (8)
Cyprus	0.13	35,6% (1)	16,2% (3)	5,6% (6)	6,7% (4)	1,9% (9)	20,9% (2)	3,4% (8)	3,5% (7)	6,2% (5)
Latvia	0.14	25% (2)	15,8% (3)	4,8% (5)	3,8% (6)	0,1% (9)	34,3% (1)	2,1% (8)	2,8% (7)	11,2% (4)
Lithuania	0.14	23,5% (2)	21,3% (3)	4% (5)	1,8% (7)	1,9% (6)	32,3% (1)	1,1% (9)	1,2% (8)	13,1% (4)
Luxembourg	0.20	22,8% (2)	9,9% (5)	1,8% (9)	8,4% (6)	3,6% (8)	24,7% (1)	3,8% (7)	13,9% (3)	11,1% (4)
Hungary	0.17	18,6% (3)	27,4% (2)	3,8% (5)	1% (8)	0,1% (9)	37,3% (1)	2,8% (6)	2,3% (7)	6,7% (4)
Malta	0.15	20,1% (2)	19,7% (3)	11,6% (4)	8,3% (6)	0,2% (9)	21,7% (1)	2,1% (8)	4,9% (7)	11,4% (5)
Netherlands	0.25	22,3% (2)	8,4% (4)	5,1% (6)	6,8% (5)	4,5% (8)	29,3% (1)	2,3% (9)	16,7% (3)	4,7% (7)
Austria	0.23	17,4% (3)	17,6% (2)	4% (8)	8,9% (5)	6% (7)	22,6% (1)	4% (9)	12,1% (4)	7,4% (6)
Poland	0.13	29,6% (1)	22,3% (3)	3,2% (6)	3% (7)	0,3% (9)	24,9% (2)	3% (8)	5,1% (5)	8,5% (4)
Portugal	0.17	37,2% (1)	19,8% (3)	5,1% (6)	1,6% (8)	0,3% (9)	21,8% (2)	2,6% (7)	5,8% (4)	5,7% (5)
Romania	0.09	30,1% (1)	26,8% (2)	2,8% (5)	2,7% (6)	0,3% (9)	22,4% (3)	2% (7)	0,3% (8)	12,6% (4)
Slovenia	0.17	16,9% (2)	16,3% (3)	3,9% (6)	7% (4)	3,5% (7)	43,3% (1)	1,8% (9)	2,4% (8)	4,9% (5)
Slovakia	0.14	7,2% (5)	20% (2)	13,3% (4)	4,6% (6)	0,2% (9)	37,1% (1)	1,5% (8)	2,6% (7)	13,6% (3)
Finland	0.17	18,3% (3)	7,7% (5)	8,9% (4)	6,5% (7)	2,1% (8)	29,6% (1)	0,6% (9)	6,6% (6)	19,6% (2)
Sweden	0.28	13,6% (4)	4% (8)	6,5% (7)	14% (3)	11,8% (5)	21,5% (1)	3,2% (9)	18,2% (2)	7,2% (6)
United Kingdom	0.19	15% (3)	7,9% (5)	8,7% (4)	7,5% (6)	0,7% (9)	23,7% (2)	3,8% (8)	26,3% (1)	6,4% (7)
Iceland	0.16	14,4% (4)	12,2% (5)	3,2% (8)	15,1% (3)	0,3% (9)	29,2% (1)	16% (2)	5,3% (6)	4,3% (7)
Serbia	0.13	31,9% (1)	17,1% (3)	10,9% (4)	0,5% (7)	0,1% (9)	23,9% (2)	7,2% (6)	0,3% (8)	8,2% (5)
Switzerland	0.20	18,4% (2)	9% (6)	5,6% (8)	9,9% (4)	7,1% (7)	21,3% (1)	1,4% (9)	17,7% (3)	9,5% (5)
Average	0.17	25.3% (1)	15.3% (3)	6.9% (6)	4.9% (7)	2.7% (9)	24.7% (2)	3.1% (8)	10% (4)	7% (5)

Note: The income column includes the relative contribution of the household disposable income variable and the self-employment dummy. For Croatia, the "light housing burden" variable has been dropped, as the Shapley decomposition model did not converge when this variable is included. Reading note: The R² captures the relative fit of the (full) model to the data. The percentages reflect the relative contribution to the fit and the number between brackets ranks the variables according to their respective relative contribution Source: EU-SILC 2014 cross-sectional data, authors' computation.

Figure 5: Relative share of different household-level variables in the Shapley decompositions of the pseudo R^2-measures, single level model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014



Note: "Resources" refers to income, self-employment, low and medium education, (quasi-)joblessness, debt burden and migration; "Needs" to light and heavy housing cost burden, rent and bad health; "Other socio-demographics" to household structure and size. Countries are ranked according to the relative share of the variables related to the household resources in the Shapley decomposition.

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Table 4: Negative binomial model, single level model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014

		Resources							Needs				Other socio-demographics		
Country	Intercept	Household income	Low education	Medium education	(Quasi-) jobless	Self-employment	Debt burden	Migrant	Heavy housing burden	Light housing burden	Bad health	Rent	Number of dependent children	Single parent	Age of oldest child
Belgium	-0.2934	-0.0001***	0.5582***	0.3364***	0.2649***	-0.5986***	0.5497***	0.0046	1.5538***	0.7538***	0.3504***	0.7013***	0.029	0.2258***	-0.0142
Bulgaria	0.9403***	-0.0001***	0.7345***	0.3395***	0.1331**	-0.1736***	0.1375**	-0.0922	0.7595***	0.3546**	0.0801	0.0005	0.0041	0.1158	0.0244***
Czechia	-0.5801**	-0.0002***	0.9064***	0.5112***	0.086	-0.2469***	0.3204***	0.3518*	1.5299***	0.6606***	0.3321***	0.3648***	0.0811***	0.1972***	-0.0107*
Denmark	-1.2799***	-0.0001***	0.5404***	0.0504	-0.1335	-0.5449***	1.1392***	0.7624***	1.6162***	1.1928***	0.4008**	0.9339***	-0.0626	0.2154	0.0253*
Germany	-0.9912***	-0.0001***	0.9486***	0.5119***	0.6238***	-0.2738*	0.5777***	0.1995**	1.2815***	0.5561***	0.5807***	0.5677***	0.0833**	0.3078***	-0.0049
Estonia	-1.382***	-0.0001***	0.5481***	0.2768***	0.5406***	-0.4163***	0.419***	0.1699**	1.9254***	1.0666***	0.237***	-0.07	0.0353	0.3684***	0.0265***
Ireland	-0.6408***	-0.0002***	0.339***	0.1798***	0.2373***	-0.3254***	0.2902***	0.0049	1.9681***	1.2807***	0.5288***	0.2791***	-0.0233	0.1112***	-0.0017
Greece	0.8189***	-0.0001***	0.3755***	0.1781***	0.1048***	-0.0939***	0.0964***	0.1776***	0.9293***	0.5203**	0.2981***	0.1081***	0.0472***	0.1338**	0.0028
Spain	-0.5108**	-0.0001***	0.5756***	0.3957***	0.442***	-0.1505***	0.448***	0.3259***	1.2697***	0.1664	0.2251***	0.24***	0.0467***	0.066	0.0076**
France	-0.5168***	-0.0001***	0.6332***	0.3905***	0.2235***	0.01	0.3781***	0.3299***	1.164***	0.71***	0.3098***	0.344***	0.089***	0.2667***	0.0096*
Croatia	-23.6173***	-0.0002***	0.9207***	0.4176***	0.4551***	-0.1635*	0.2218***	0.1625**	24.0614***	23.1233	0.3335***	0.3527***	0.0939***	-0.163	0.0044
Italy	0.1116	-0.0001***	0.6864***	0.2191***	0.2158***	-0.2077***	0.4973***	0.3809***	0.6938***	-0.4688**	0.4857***	0.3692***	0.0746***	-0.0158	0.0035
Cyprus	0.0202	-0.0001***	0.3697***	0.1677***	0.1899***	-0.034	0.2848***	0.1525***	1.2895***	0.4985***	0.3278***	0.1542***	-0.0106	0.3755***	0.0135***
Latvia	-0.1542	-0.0001***	0.6017***	0.2827***	0.1481**	-0.2177***	0.2731***	0.1007	1.3495***	0.7091***	0.1841***	0.1223***	0.1118***	0.0906	0.0144***
Lithuania	-0.9646***	-0.0001***	0.8792***	0.4643***	0.0714	-0.4225***	0.2672***	0.4799***	1.7587***	1.133***	0.0943	0.1708**	0.13***	0.1155	0.0042
Luxembourg	-1.7437***	-0.0001***	0.3623***	0.1219	-0.1286	-0.3858*	0.6929***	0.4037***	1.5178***	0.5754**	0.5629***	0.6549***	0.009	0.8042***	0.0058
Hungary	-0.5097***	-0.0002***	1.0159***	0.5985***	-0.0212	-0.6102***	0.1136***	-0.1384	2.0151***	1.2331***	0.1543***	0.25***	0.0404***	0.2127***	-0.0017
Malta	-0.4359*	-0.0001***	0.5236***	0.1848**	0.3472***	-0.1432*	0.636***	0.1987***	1.0945***	0.4071**	0.5662***	0.1504**	0.1435***	0.266***	-0.0034
Netherlands	-0.8299***	-0.0001***	0.5395***	0.2234***	0.0587	-0.0355	0.7384***	0.5932***	1.7179***	1.0258***	0.6247***	0.7235***	-0.0492*	0.4331***	-0.0082
Austria	-1.52***	-0.0001***	1.1523***	0.5769***	0.1478	-0.4813***	0.9784***	0.2211***	1.4519***	0.668***	0.3637***	0.6205***	0.066*	0.2845***	0.0051
Poland	-0.3773**	-0.0002***	1.0793***	0.6337***	0.076	-0.4437***	0.3795***	0.6914***	0.9752***	0.0262	0.2113***	0.3569***	0.1073***	0.3239***	0.0037
Portugal	0.261*	-0.0001***	0.5541***	0.2571***	0.1008**	-0.4336***	0.1884***	0.1799***	1.1159***	0.5653***	0.1639***	0.183***	0.0268	0.0312	0.0091**
Romania	1.1457***	-0.0003***	0.5131***	0.3385***	0.1211*	-0.0396	0.2779***	-15.2373	0.7842***	0.3786***	0.1684***	0.0965	0.0486***	0.3355***	0.0059
Slovenia	-1.1679***	-0.0001***	0.7046***	0.3442***	0.1563**	-0.2937***	0.437***	0.2404***	1.8831***	0.8745***	0.4594***	0.1622***	0.1164***	0.1743**	-0.0024
Slovakia	-1.5961***	-0.0001***	0.8941***	0.4741***	0.552***	-0.2366***	0.206***	1.2629	2.02***	1.0698***	0.2235***	0.2067***	0.1554***	0.2993**	0.0071
Finland	-1.4217***	-0.0001***	0.5983***	0.2891***	0.6315***	-0.1197*	0.5583***	0.4719***	1.5859***	0.828***	0.3424**	0.4078***	0.0927***	0.2259***	0.0004
Sweden	-2.6208***	-0.0001***	0.0472	0.4236***	0.6224***	-0.3495*	1.3778***	0.804***	1.6201***	1.1335***	0.7127***	0.8543***	0.0747*	0.2699*	0.0226
United Kingdom	-0.9145***	-0.0001***	0.3394***	0.1905***	0.2885***	-0.0731	0.3892***	0.0976**	1.0651***	0.4919***	0.4128***	0.8403***	-0.0141	0.1425***	0.0153***
Iceland	-0.5677**	-0.0001***	0.5673***	0.2272***	0.0616	-0.0887	0.5411***	-0.2607*	1.067***	0.326**	1.0468***	0.2701***	-0.0149	0.0038	0.014
Serbia	0.4812*	-0.0003***	0.6203***	0.2509***	0.2514***	-0.3455***	0.1104***	-0.0064	0.6683***	-0.1271	0.2625***	0.1341***	0.0394***	0.141**	0.0165***
Switzerland	-2.8659***	-0.0001***	0.5984***	0.3126***	0.902***	0.3948**	0.7305***	0.55***	1.7356***	0.9975***	0.3889*	0.926***	0.1328***	0.7218***	-0.0001

6.2 European multilevel model

We pool all countries together and add a multilevel structure to investigate the *between-country* differences in child deprivation across the 31 countries analysed. We start with an empty random intercept model (M1, Table 5) and gradually introduce variables. First, the household-level variables are added (M2, Table 5). Next, we use a series of models containing one institutional variable, with the aim of comparing their between-country explanatory strengths (M3-12, Table 5). In the next set of models, we introduce GDP per capita levels and the unemployment rate to assess which institutional variables remain significant after controlling for macroeconomic circumstances (M13-22, Table 5). Next, we investigate the relationship of social spending, in terms of spending size and pro-poorness of cash transfers, with child deprivation when household income is not regressed (M23-25, Table 5). Finally, we use median income levels as an alternative variable to GDP per capita to test the sensitivity of our results (M26, Table 5). The estimated residuals at the country-level are given in Annex 5.

Description of the models

Table 5:	Table 5:	Table 5:	Table 5:	Table 5:	Table 5:
M1	M2	M3-M12	M13-22	M23-M25	M26
Empty random intercept model (no variables)	Household-level variables (all)	Household-level variables (all)	Household-level variables (all)	Household-level variables (no individual household	Household-level variables (all)
		One institutional variable	One institutional variable	Two institutional variables: social spending size (% of GDP) + pro-poorness	One institutional var iables: in-kind spending size (% of GDP)
			GDP per capita + unemployment rate	GDP per capita + unemployment rate	National median household equivalised income + unemployment rate

6.2.1. M1-M2: Empty and household-level model

The random intercept (0.70) in the empty model (M1, Table 5) indicates that significant differences in child deprivation exist between the 31 countries covered, which reflects the national patterns described in Section 3. For example, a child born in Bulgaria has, without controlling for any household-level or country-level variables, an average number of deprivations of 7.6 (on a scale ranging from 0 to 17), whereas for a child born in Sweden this figure is only 0.3.

The household-level variables are introduced in M2 (Table 5). The sign and magnitude of the coefficients are in line with the results from the single level analysis. The household-level variables explain a large share of the original unobserved between-country differences of the empty model (57+14=71%). Most of the between-country explanatory power of the household-level variables is driven by household income: it explains 57% of the original variation in random intercepts. The other household-level variables (i.e. cross-country *compositional differences* in education, (quasi-)joblessness, needs (and related costs), socio-demographics etc.) play a much smaller role: they account for only 19% of the unobserved between-country differences.

6.2.2. M3-M12: Assessing the explanatory power of institutional variables

Models 3 to 12 each add one institutional variable to M2. All ten institutional variables have a statistically significant negative relationship with child deprivation intensity, when they are introduced separately. The purpose of the current set of models is to assess whether social spending explains between-country differences, once differences in household determinants are taken into account. Several conclusions can be drawn.

The Shapley decompositions reveal that **in-kind social benefits** are a more important determinant in the reduction of child deprivation intensity than cash transfers. This is to be expected: in-kind social transfers are not included at the micro level, whilst cash transfers are included in household income. This result holds when transfers are expressed as a percentage of GDP and in PPS per head/child. In-kind benefits expressed as a percentage of GDP or in PPS per head explain, respectively, 28 and 35% of the unobserved between-country differences (M5 and M8). The corresponding figures for cash benefits are 8 and 23%. This shows that the provision of in-kind services freely (or at a reduced rate) is a crucial driver. It allows households to spend their resources on other goods and necessities (see Aaberge et al, 2017). However, one must not conclude that cash-transfers are, policy-wise, less important: in our model, their role is more limited, given the fact that we control for individual household incomes.

The model further indicates that **social spending targeted at families** reduces child deprivation intensity. Specifically, social spending devoted only to children and families explains 15% (% GDP, M9) and 19% (in PPS per head, M10) of the between-country differences. Whilst it is to be expected that in-kind transfers targeted at families reduce child deprivation, even when household incomes are included at the micro level, it is difficult to explain why cash transfers targeted at families would have this result. However, both measures of family targeting (in % of GDP or in PPS) are highly correlated with GDP (see Annex 3). The next round of models control for such differences between countries and test whether the coefficient of pro-families' transfers is still significant (Models M19-20).

The **pro-poorness of cash transfers** also reduces child deprivation intensity, even if it explains only a minor part of the between-country differences in child deprivation (9%, M11). Variables that capture the size of social spending are comparatively much more effective in reducing child deprivation.

Measures that reflect the **adequacy** of **minimum income** to attain the poverty threshold explain a non-negligible amount of between-country differences in child deprivation intensity (16%, M12).

Social benefits expressed in PPS per child explain between-country differences in child deprivation intensity more effectively than the social benefit concepts expressed as a percentage of GDP. This is easily explained: the latter concept captures the relative size of social benefits within the economy, whereas the former also captures differences in absolute living standards. The next round of models (M13-M22) will take these differences into account.

6.2.3. M13-M22: The role of GDP

In the models M13-22, we introduce GDP per capita levels and the unemployment rate to assess whether social benefits remain significant after controlling for macroeconomic circumstances.

These models show that **in-kind social benefits** (in % of GDP [M15] and in PPS per head [M18]), **pro-poorness of social transfers** (M21) **and the proportion in GDP of total social benefits** (which regroups in kind and in cash transfers [M13]) **have a significant negative relationship with the intensity of child deprivation([23])**. Family benefits and cash transfers (in PPS and in % of GDP) as well as the total social benefits (in kind plus in cash) in PPS per child and measures of adequacy of minimum income safety nets

([23]) If the figure in the p>z column of Table 5 is less than 0.05, then the result is statistically significant at 5%.([24]) A rough proxy for "volatility" might be the size of cash benefits in relation to GDP, as cash benefits tend to reduce volatility of incomes. We should immediately concede that we do not find convincing evidence for this hypothesis: cash benefits (as a % of GDP) have a negative, but weakly insignificant (p=0.11) relationship with child deprivation after controlling for GDP per capita [M14].

are not significant once differences in GDP are taken into account.

By looking at the explanatory power of the significant variables, we can conclude that:

a) In-kind services explain 21% (% GDP) to 24% (PPS/head) of between-country differences, once GDP is included in the model (as against 28% and 35% when it was not). This means that this variable remains an important predictor of child deprivation in the 31-country pooled dataset, even when differences in economic development (GDP) are taken into account.

b) The global generosity of the welfare state (total transfers in % of GDP) accounts for 16% of between-country differences and is mainly driven by social transfers in-kind, as social transfers in cash do not have significant relationship with child deprivation once the level of aggregated income (GDP) is controlled for.

c) Pro-poorness of social transfers explains 7% of between-country differences.

The models with social benefits expressed as a percentage of GDP provide a slightly better explanation of between-country differences *as a whole* than models with social benefit size expressed in PPS per head/child, but the difference is negligible. Relative indicators (in proportion of GDP) provide information on the way the country prioritise social transfers, whereas transfers expressed in PPS provide information on the level of such transfers.

GDP per capita is an important predictor of child deprivation intensity and explains 14 to 20% of the total unobserved between-country differences, depending on the social spending concept that is co-regressed. The unemployment rate coefficient is insignificant and explains only 5 to 8% of the unexplained country differences. In the interpretation of the latter result, it is important to stress that household (quasi-)joblessness is already regressed at the individual level and that the inclusion of the national unemployment rate mainly aims at accounting for the possible effect of the business cycle on the size and pro-poorness of social benefits.

The fact that GDP per capita has a negative association with child deprivation, while individual household income and other micro-drivers are controlled for, is not expected a priori and deserves further interpretation. Why should children with similar household socio-economic background and household income be better protected against deprivation if they live in more prosperous countries?

One reason could be that countries with higher GDP per capita provide more in-kind benefits, which would reduce deprivation for given income levels. We tested this and our results indicate that GDP per capita remains significant *after controlling for in-kind benefits* [M15]. This result implies that GDP per capita may also capture some "hidden" contextual variables which cannot be included in the model with the available data, such as the average household wealth and the size of gifts between households. One may also conjecture (though this hypothesis would need further examination) that richer countries have features that lead to less volatility of incomes, notably within the working-age population and at the bottom end of the income distribution: a larger public sector and better functioning automatic stabilisers in their welfare edifice reduce this volatility([24]). In other words, it seems plausible to argue that these contextual variables increase households' "permanent income", notably within the working-age population and at the bottom end of the income distribution, and therefore reduce child deprivation. Another possible reason might be that GDP per capita is a proxy for "qualitative" differences, such as the effectiveness of public support, notably the quality of public social services. Richest countries are expected to provide public services of better quality (education, childcare, public transport systems, etc.), which should increase permanent income and/or decrease household needs and related costs in the most effective way.

To sum up, it may be the case that GDP is a proxy for the overall "level of social development" of societies, which can only be partially measured by existing data: individual household income and the other micro-determinants of child deprivation are insufficient to measure the overall, societal "level of development" which has a statistically negative relationship with the intensity and individual risk of deprivation.

([24]) A rough proxy for "volatility" might be the size of cash benefits in relation to GDP, as cash benefits tend to reduce volatility of incomes. We should immediately concede that we do not find convincing evidence for this hypothesis: cash benefits (as a % of GDP) have a negative, but weakly insignificant (p=0.11) relationship with child deprivation after controlling for GDP per capita [M14].

6.2.4. M23-M26: Sensitivity to disposable income concepts

Models 23 to 25 confirm the **cushioning effect of cash transfers through individual household income**. These models replicate models M13-15, except that household's disposable income is no longer included. They show that all social spending concepts (total, cash, in-kind) have a statistically significant negative association with child deprivation intensity after controlling for the unemployment rate, GDP per capita, household-level risk factors (with the exception of individual household income) and the pro-poorness of cash social benefits. This is a very important result which explains and also questions some of the results published in the literature on the relationship of social transfers with deprivation without taking into account differences in individual household income.

In order to test the sensitivity of our results to the macroeconomic concept that is regressed to capture differences in standards of living in the EU, we replicate model M15 by replacing GDP per capita with **national median household equivalised income** [M26]. Models with national median household income levels explain 1% more of the original unobserved between-country differences than models with GDP per capita (84 versus 83% for, respectively, M15 and M26). However, median income levels make a much larger individual contribution to the between-country explained variance measure: they explain about 16% more (33% versus 27%) of the original unobserved differences, largely at the expense of the other independent variables. Indeed, another striking observation is that in-kind social spending levels have a statistically insignificant relationship with child deprivation when median income levels are co-regressed. In fact, no other country-level variable has a statistically significant relationship with deprivation, even when household income is omitted from the model (results not shown). An important nuance in the interpretation of this result is that median income levels are directly shaped by taxes and transfers. It is also strongly correlated with social transfers in-kind.

6.2.4. Cross-level interactions

Several multilevel deprivation studies have pointed out that the association of variables at the household level with deprivation should not be understood independently from variables at the country level. The general consensus in these studies is that the impact of certain risk factors at the individual level are mitigated by countries' level of affluence or welfare state generosity (Nelson, 2012; Bárcena-Martín et al, 2014; Visser et al, 2014; Saltkjel and Malmberg-Heimonen, 2017). We examine this relationship by introducing a series of cross-level interactions between GDP per capita and the household-level variables. We also add random slopes([25]) to the household-level variables to ensure that the coefficients of the cross-level interactions with GDP per capita are not influenced by other effects. All random slopes, with the exception of the age of the oldest child, are statistically different from zero. This confirms our findings from the single level analysis that the relationship of the household-level variables with child deprivation differs across countries. The results of our cross-level interactions give a more nuanced picture and are shown in Table 6. Specifically, we find that GDP per capita levels mitigate the impact of the household-level variables that relate to households' resources, while they increase the impact of variables that capture households' needs:

Variables that capture or directly influence households' ability to generate **resources** on the labour market have a slighter relationship with child deprivation intensity in the more affluent countries, except variables with regard to debt burden and migration background (see below). A positive cross-level interaction between GDP per capita and household income indicates that *the negative association of household income becomes smaller when GDP per capita increases*. So, household income has a larger effect in less affluent countries. In addition, the negative cross-level interaction between the low and medium education dummies and GDP per capita indicates that the negative relationship of low education with deprivation is smaller in the most affluent countries, i.e. children in *low-educated households are better protected from deprivation in the more affluent countries*. Whelan and Maître (2012) already showed for the whole population that the negative relationship with deprivation of lacking educational qualifications increases as GDP declines. However, in

([25]) A random slope allows the relationship between the explanatory variable and an independent variable at the household-level to be different for each country by adding a random term to the coefficient of the household-level variable. The covariance between the random intercepts and the random slopes were not estimated for computational reasons. We also conducted a robustness check of a model that does not include random slopes. The results indicate that none of the significant cross-level interactions lose their significancy or change singe. Two insignificant relationships (i.e. slight housing burden, number of children) become significant once the random slopes are dropped.

contrast to their results, in our model the interaction effects do not explain away the impact of GDP per capita as an independent variable. These results imply that the variables in our model that aim to capture households' command on resources have a relatively stronger association with child deprivation in countries with a low standard of living than in countries with a high standard of living. Finally, while the coefficient of (quasi-)joblessness varies across countries (i.e. the random slope is significant), it does not depend on GDP per capita.

The results indicate that the *deprivation-increasing (i.e., statistically positive) effect of variables related to household **needs*** (such as having a heavy housing cost burden, renting one's dwelling or having at least one household member struggling with bad health) *increases if GDP per capita increases*. The cross-level interaction with the light housing burden dummy is positive, but not significant. These results confirm the single level analysis, in which variables that measure household needs/costs contribute more to the fit in richer countries. As argued in the previous section, a plausible interpretation for this result is that households living in more affluent countries also face relatively higher personal costs related to housing and health.

The coefficients of being a single parent or having someone in the household with a migration background is larger in the more affluent countries. The cross-level interaction between GDP per capita and the number of children living in the household and the age of the oldest child is insignificant.

Sensitivity analyses

In order to test the sensitivity of the results, we carried out additional tests. Annex 6 presents the results using as dependent variable the official child deprivation rate, with a threshold set at 3+ lacks out of 17. Most of the conclusions in terms of sign, significance and relative between-country explanatory power of the variables are in line with the results from the negative binomial model. There are, however, some exceptions. A main difference in results lies in the impact of the non-income household-level variables. In the negative binomial model, the non-income household-level variables decrease the unobserved between-country differences, whereas they increase the unobserved between-country differences in the logistic regression model. Next, total social benefit levels (% of GDP) have an insignificant relationship with child deprivation rate when the variable is co-regressed with GDP per capita levels (Annex 6, M13). This insignificance holds even when individual household income is omitted (Annex 6, M23). In addition, cash benefit levels (% of GDP) remain insignificant when household income is dropped (Annex 6, M24). Model M26 also confirm that national median income levels (of households with children) makes a much larger contribution to the between-country explained variance measure than GDP per capita.

Table 5: Negative binomial model, Multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014

	M1			M2		
	Coeff.	p>z	Shapley R²	Coeff.	p>z	Shapley R²
Household-level variables						
Household income						0.57
Household income				-0.03	0.00	
Other						0.14
Self-employment				-0.19	0.00	
(Quasi-)joblessness				0.32	0.00	
Low education				0.75	0.00	
Medium education				0.41	0.00	
Bad health				0.35	0.00	
Heavy housing burden				1.51	0.00	
Light housing burden				0.75	0.00	
Rent				0.33	0.00	
Debt burden				0.41	0.00	
Number of dependent children				0.14	0.00	
Single parent				0.07	0.00	
Age of oldest child				0.01	0.00	
Migrant				0.30	0.00	
Constant	0.34	0.03		-1.11	0.00	
Random Estimates						
Random intercept	0.70	0.00		0.20	0.00	
Explained between-country variance				0.71		
Over-dispersion parameter	1.91	0.00		0.66	0.00	
Model information						
N of observations		88901			88901	
N of countries		31			31	

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Table 5: Negative binomial model, Multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M3			M4			M5			M6			M7		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables															
Household income			0.45			0.51			0.42			0.37			0.41
Other			0.13			0.15			0.1			0.13			0.15
Country-level variables															
Total social benefits, % of GDP	-0.04	0.00	0.20												
Cash social benefits, % of GDP				-0.04	0.04	0.08									
In kind social benefits, % of GDP							-0.09	0.00	0.28						
All social benefits, in PPS per child										-0.12	0.00	0.31			
Cash social benefits, in PPS per child													-0.19	0.00	0.23
Random Estimates															
Random intercept	0.15	0.00		0.18	0.00		0.14	0.00		0.14	0.00		0.15	0.00	
Explained between-country variance	0.78			0.75			0.80			0.81			0.78		
Over-dispersion parameter	0.66	0.00		0.66	0.00		0.66	0.00		0.66	0.00		0.66	0.00	
Model information															
N of observations	88901			88901			88901			88901			88901		
N of countries	31			31			31			31			31		

Note: The coefficients of the household-level variables (with the exception of income) are not shown and are very similar to the coefficients in M2.
Source: EU-SILC 2014 cross-sectional data, authors' computation.

Table 5: Negative binomial model, Multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M8			M9			M10			M11			M12		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables															
Household income			0.35			0.48			0.44			0.52			0.51
Other			0.12			0.12			0.14			0.14			0.07
Country-level variables															
In kind social benefits, in PPS per child	-0.24	0.00	0.35												
Family cash social benefits, % of GDP				-0.20	0.04	0.15									
Family cash social benefits, PPS per head							-0.24	0.00	0.19						
Pro-poorness bottom 50										-0.02	0.02	0.09			
Adequacy of minimum-income													-0.01	0.03	0.16
Random Estimates															
Random intercept	0.13	0.00		0.18	0.00		0.16	0.00		0.17	0.00		0.18	0.00	
Explained between-country variance	0.82			0.75			0.77			0.75			0.75		
Over-dispersion parameter	0.66	0.00		0.66	0.00		0.66	0.00		0.66	0.00		0.71	0.00	
Model information															
N of observations	88901			88901			88901			88901			88901		
N of countries	31			31			31			31			29		

Note: The coefficients of the household-level variables (with the exception of income) are not shown and are very similar to the coefficients in M2.
Source: EU-SILC 2014 cross-sectional data, authors' computation.

Table 5: Negative binomial model, Multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M13			M14			M15			M16			M17		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables															
Household income			0.30			0.33			0.30			0.29			0.32
Other			0.12			0.14			0.09			0.12			0.13
Country-level variables															
GDP per capita	-0.01	0.03	0.18	-0.02	0.01	0.19	-0.02	0.01	0.17	-0.01	0.60	0.14	-0.02	0.12	0.15
Unemployment rate	0.00	0.74	0.07	0.01	0.57	0.08	-0.01	0.58	0.06	-0.01	0.65	0.05	0.00	0.88	0.06
Total social benefits, % of GDP	-0.03	0.03	0.16												
Cash social benefits, % of GDP				-0.03	0.11	0.07									
In kind social benefits, % of GDP							-0.06	0.01	0.21						
All social benefits, in PPS per child										-0.10	0.13	0.20			
Cash social benefits, in PPS per child													-0.06	0.59	0.14
Random Estimates															
Random intercept	0.12	0.00		0.13	0.00		0.12	0.00		0.13	0.00		0.14	0.00	
Explained between-country variance	0.83			0.81			0.83			0.81			0.80		
Over-dispersion parameter	0.66	0.00		0.66	0.00		0.66	0.00		0.66	0.00		0.66	0.00	
Model information															
N of observations	88901			88901			88901			88901			88901		
N of countries	31			31			31			31			31		

Note: The coefficients of the household-level variables (with the exception of income) are not shown and are very similar to the coefficients in M2.
Source: EU-SILC 2014 cross-sectional data, authors' computation.

Table 5: Negative binomial model, Multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M18			M19			M20			M21			M22		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables															
Household income			0.28			0.35			0.34			0.34			0.36
Other			0.10			0.12			0.13			0.13			0.10
Country-level variables															
GDP per capita	0.00	0.71	0.14	-0.02	0.01	0.18	-0.02	0.05	0.17	-0.02	0.00	0.20	-0.02	0.00	0.19
Unemployment rate	-0.01	0.52	0.05	0.00	0.92	0.06	0.00	0.90	0.06	0.00	0.99	0.07	-0.01	0.61	0.05
In kind social benefits, in PPS per child	-0.23	0.03	0.24												
Family cash social benefits, % of GDP				-0.02	0.86	0.09									
Family cash social benefits, PPS per head							-0.03	0.83	0.11						
Pro-poorness bottom 50										-0.02	0.05	0.07			
Adequacy of minimum-income													-0.01	0.32	0.10
Random Estimates															
Random intercept	0.13	0.00		0.14	0.00		0.14	0.00		0.13	0.00		0.14	0.00	
Explained between-country variance	0.82			0.80			0.80			0.82			0.80		
Over-dispersion parameter	0.66	0.00		0.66	0.00		0.66	0.00		0.66	0.00		0.71	0.00	
Model information															
N of observations	88901			88901			88901			88901			88901		
N of countries	31			31			31			31			31		

Note: The coefficients of the household-level variables (with the exception of income) are not shown and are very similar to the coefficients in M2.
Source: EU-SILC 2014 cross-sectional data, authors' computation.

Table 5: Negative binomial model, Multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M23			M24			M25			M26		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables												
Household income												0.24
Other			0.17			0.20			0.13			0.09
Country-level variables												
GDP per capita	-0.03	0.00	0.26	-0.03	0.00	0.28	-0.03	0.00	0.26			
Unemployment rate	0.01	0.40	0.09	0.02	0.24	0.11	0.00	0.81	0.07	-0.01	0.52	0.07
Total social benefits, % of GDP	-0.04	0.01	0.19									
Cash social benefits, % of GDP				-0.05	0.03	0.09						
In kind social benefits, % of GDP							-0.09	0.01	0.25	-0.03	0.37	0.18
Pro-poorness bottom 50	-0.02	0.16	0.07	-0.02	0.05	0.08	-0.02	0.18	0.07			
Median income										-0.05	0.00	0.33
Random Estimates												
Random intercept	0.15	0.00		0.17	0.00		0.16	0.00		0.11		
Explained between-country variance	0.78			0.77			0.78			0.84		
Over-dispersion parameter	0.83	0.00		0.83	0.00		0.83	0.00		0.66	0.00	
Model information												
N of observations	88901			88901			88901			88901		
N of countries	31			31			31			31		

Note: The coefficients of the household-level variables (with the exception of income) are not shown and are very similar to the coefficients in M2.
Source: EU-SILC 2014 cross-sectional data, authors' computation.

Table 6: Negative binomial model with cross-level interactions, Multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014

	Main effects		Interaction with GDP		Random estimates	
	Coeff.	p>z	Coeff.	p>z	Coeff.	p>z
Household-level variables						
Household income						
Household income	-0.04	0	0.003	0.03	0.00008	0
Other						
Self-employment	-0.21	0.02	0.003	0.93	0.02	0
Quasi-joblessness	0.25	0	0.02	0.58	0.03	0
Low education	0.94	0	-0.08	0.02	0.04	0
Medium education	0.53	0	-0.05	0.03	0.01	0
Debt burden	0.1	0.28	0.13	0	0.04	0
Bad health	0.18	0	0.07	0	0.01	0.04
Heavy housing burden	1.18	0	0.1	0.05	0.06	0
Light housing burden	0.49	0	0.08	0.13	0.06	0
Rent	-0.08	0.38	0.16	0	0.04	0
Number of dependent children	0.11	0	0.01	0.17	0	0
Single parent	-0.1	1.1	0.07	0	0.01	0.02
Age of oldest child	0.01	0	-0.0004	0.77	0.00002	0.16
Migrant	0.12	0.27	0.06	0.09	0.04	0
Constant	0.37	0.71			0.28	0
Country-level variables						
GDP per capita	-0.39	0				
Unemployment rate	0.03	0.2				
Total social benefits, % of GDP	-0.02	0.38				
Pro-poorness (bottom 50)	0	0.85				
Model information						
Over-dispersion parameter	0.55	0				
N of observations	88901					
N of countries	31					

Note: GDP per capita is expressed in PPS per 10,000, instead of in PPS per 1,000.
Source: EU-SILC 2014 cross-sectional data, authors' computation.

7 Conclusions

Our analyses show that the factors which are important in explaining child deprivation within countries are not necessarily the same as those explaining variation between countries. They demonstrate that both single and multilevel models are useful and complementary to explain child deprivation in the 31 countries analysed (all 28 EU countries as well as Iceland, Serbia and Switzerland).

In regard to *within-country* differences in child deprivation, the single level model is the most effective in explaining child deprivation in countries with the lowest share of child deprivation (Austria, Belgium, Denmark, Netherlands and Sweden). Conversely, the countries where the single level model has a lower explanatory power are Bulgaria, Cyprus, Estonia, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Serbia and Slovakia. In the child deprivation typology, we have suggested that these countries belong to clusters 1, 2 or 3 (high to very high levels of child deprivation) except for Estonia (cluster 4). In these countries the general standard of living is lower and children are therefore more likely to be deprived.

In all countries analysed, the results confirm the combined relationship of variables related to the "longer-term command over resources" (current household income, parents' education, household labour market attachment, burden of debts, migration status) and variables indicating household needs (costs related to housing, tenure status and bad health) with child deprivation. The three most powerful predictors are: housing cost burden, household income and educational level of parents. However, our results also clearly illustrate that the explanatory power of the household-level variables differs between countries. In the richest countries, the explanatory power of the variables related to household needs is the largest, whereas in the most deprived countries, the explanatory power of resources is generally greater (with the exception of debt and migration). This means that countries not only differ in terms of socio-economic composition (as stated in most papers explaining differences in deprivation between countries), but also in terms of the association of each variable with the child deprivation risk, i.e. household income, (quasi-)joblessness, housing cost burden do not have the same relationship with child deprivation across countries. Our results highlight that the age of the oldest child has no significant relation with the child deprivation in two thirds of the countries studied. This is an important result as it indirectly confirms that the composition of the deprivation basket does not lead to systematic differences between age groups.

In regard to *between-country* differences, we ran a large number of multilevel models and compared them systematically, to identify those results which remain robust to alternative specifications (i.e. total, cash and in-kind social spending as a % of GDP and in PPS per head/child, total and cash social spending on families and children as a % of GDP and in PPS per head/child, pro-poorness of social spending, adequacy of minimum income benefit schemes; with and without controlling for aggregate income levels or household income). Our results indicate that all social spending concepts have a statistically significant negative relationship with child deprivation (i.e. they reduce it), when GDP per capita is omitted. However, once GDP per capita and the household-level variables (including household income) are controlled for, only the level of in-kind social benefits provided and the pro-poorness of social transfers have a significant negative relationship with child deprivation. This confirms our expectation that only social transfers not included in household income at micro-level play a role in predicting child deprivation. The between-country explanatory power of the pro-poorness of social transfers is limited, whereas in-kind social benefits level is a crucial variable. We further showed

that the impact of cash benefits operates mainly through household income (i.e. aggregated cash transfer levels are only significant when household income is omitted from the model). This explains and also qualifies the conclusions of papers which have analysed the relationship of social transfers with differences in deprivation in the EU, using multilevel models but without controlling for individual household income. This should not lead to the conclusion that cash transfers are unrelated to child deprivation; what our model shows is, quite logically, that cash transfers don't have an association independently from the distribution of household income at the micro level.

We also show that the choice of the macro-variables used to reflect differences in national affluence partly shapes the conclusions. Although the current practice in the literature is to include GDP per capita, our results show that national median income levels (of households with children) makes a much larger contribution to the between-country explained variance measure than GDP per capita. This might be due to the fact that median income of households with children (based on EU-SILC data) is better fit to measure the national context of these households, as compared to GDP per capita. Median income is indeed the most effective variable in capturing differences in child deprivation. All other country-level variables (i.e. social spending size (total, cash, in-kind), pro-poorness of social benefits, unemployment rate) have a statistically insignificant relationship with child deprivation when median income levels are co-regressed. In total, individual household income and national median income capture, respectively, 24% and 27% of between-country differences in the EU. The compositional effect of the other household (micro-) variables accounts for only 11% of these differences.

The observation that GDP per capita or national median household income reduce child deprivation, while individual household income and other micro-drivers are controlled for, is not expected a priori. It seems that both GDP per capita and national median household income correlate with "hidden" contextual factors, which are not available from our dataset. The following factors come to mind: household wealth, between-households support in kind, the quality and affordability of education, childcare, healthcare and public transport systems. In other words, national median household income and GDP are proxies for the "level of social development" of societies, and child deprivation correlates negatively with the "level of social development", so conceived. An additional hypothesis to explain this result, is that the notion of "affordability" changes with the average level of incomes; we cannot pursue this hypothesis in the context of this paper, but it needs further research.

Finally, crossed-effects in multilevel models also indicate that the impact of certain individual risk factors is mitigated by countries' level of affluence. We find that GDP per capita levels mitigate the impact of household-level variables that relate to households' resources (except for debt and migration status, which we construe as components of "longer-term resources"), while they increase the impact of variables that capture households' needs. These results confirm the findings from the single level analysis and illustrate the importance of looking at national drivers of child deprivation. However, in contrast to Whelan and Maître (2012), in our model the interaction effects do not explain away the impact of GDP per capita as a significant independent variable.

Finally, our tests of the sensitivity of our results to the choice of the child deprivation variable (rate versus count) show that most of our conclusions in terms of sign, significance and relative between-country explanatory power of the variables are confirmed.

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Annexes

Annex 1: Descriptive statistics, dependent and independent variables, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014

Country	Child Deprivation rate (% child population)	Average number of deprivation (deprived children)	Average number of deprivation	Average household income (1000 PPS per child)	Income poverty rate (% child population)	Low education of parents (% child population)	High Education of parents (% child population)	(Quasi-) jobless (% child population)	Debt burden (% child population)	Parent(s) self employed (% child population)	Migrant (% child population)	Bad health of parents (% child population)	Renter (% child population)	Heavy housing burden (% child population)	Light housing burden (% child population)	Average number of dependent children (child population)	Average age of oldest child (child population)	Single parent (% child population)
Belgium	0.16	6.4	1.24	45.03	0.20	0.13	0.34	0.14	0.15	0.13	0.22	0.10	0.29	0.39	0.34	2.43	9.42	0.16
Bulgaria	0.69	10.6	7.53	15.74	0.28	0.30	0.43	0.16	0.10	0.13	0.01	0.16	0.23	0.48	0.48	2.04	10.03	0.07
Czechia	0.15	5.5	1.24	26.55	0.11	0.04	0.66	0.08	0.08	0.21	0.02	0.06	0.23	0.31	0.63	2.12	9.37	0.12
Denmark	0.04	5.0	0.38	56.96	0.04	0.03	0.30	0.03	0.04	0.14	0.10	0.03	0.17	0.13	0.37	2.31	10.40	0.07
Germany	0.10	4.7	0.76	46.81	0.11	0.04	0.43	0.07	0.08	0.06	0.15	0.05	0.39	0.22	0.62	2.13	9.85	0.14
Estonia	0.17	4.9	1.18	25.68	0.26	0.11	0.46	0.08	0.07	0.11	0.12	0.09	0.20	0.28	0.54	2.28	9.61	0.08
Ireland	0.26	4.8	1.79	42.00	0.13	0.12	0.27	0.23	0.18	0.13	0.10	0.04	0.36	0.48	0.45	2.60	9.92	0.15
Greece	0.44	5.8	3.04	21.06	0.24	0.15	0.42	0.13	0.20	0.34	0.12	0.07	0.26	0.53	0.45	2.12	9.60	0.05
Spain	0.27	6.1	2.04	32.62	0.26	0.30	0.22	0.16	0.16	0.19	0.15	0.07	0.22	0.61	0.37	2.05	9.51	0.08
France	0.16	5.1	1.14	45.80	0.15	0.09	0.41	0.09	0.14	0.12	0.13	0.08	0.35	0.34	0.25	2.38	10.11	0.14
Croatia	0.23	6.0	1.81	19.54	0.18	0.12	0.68	0.14	0.31	0.14	0.19	0.24	0.15	0.70	0.28	2.26	10.19	0.03
Italy	0.21	6.0	1.59	35.80	0.17	0.19	0.52	0.08	0.12	0.28	0.12	0.07	0.28	0.61	0.38	1.98	9.60	0.09
Cyprus	0.37	5.2	2.47	43.95	0.14	0.08	0.39	0.08	0.50	0.11	0.20	0.04	0.22	0.82	0.15	2.29	9.86	0.06
Latvia	0.41	6.8	3.21	20.10	0.25	0.10	0.47	0.10	0.10	0.11	0.12	0.15	0.25	0.41	0.48	2.20	9.73	0.15
Lithuania	0.30	5.7	2.21	19.78	0.22	0.06	0.48	0.09	0.05	0.13	0.08	0.10	0.13	0.35	0.56	2.08	10.33	0.12
Luxembourg	0.09	4.8	0.67	64.32	0.11	0.25	0.38	0.05	0.21	0.08	0.23	0.10	0.29	0.44	0.43	2.21	9.52	0.13
Hungary	0.50	8.0	4.32	17.01	0.19	0.21	0.53	0.15	0.14	0.05	0.00	0.16	0.15	0.44	0.49	2.39	10.33	0.11
Malta	0.23	5.6	1.76	35.07	0.21	0.45	0.25	0.13	0.08	0.14	0.13	0.02	0.17	0.60	0.32	2.11	9.89	0.09
Netherlands	0.05	4.3	0.43	48.35	0.05	0.06	0.33	0.04	0.02	0.15	0.07	0.02	0.13	0.10	0.43	2.37	9.88	0.10
Austria	0.11	4.4	0.71	47.46	0.09	0.08	0.45	0.07	0.06	0.17	0.20	0.09	0.39	0.18	0.60	2.22	9.98	0.14
Poland	0.26	5.7	1.83	22.86	0.21	0.07	0.60	0.06	0.11	0.25	0.01	0.14	0.20	0.66	0.31	2.18	9.79	0.06
Portugal	0.39	5.9	2.72	23.39	0.26	0.49	0.26	0.12	0.11	0.14	0.12	0.13	0.28	0.47	0.46	1.92	9.97	0.11
Romania	0.70	8.7	6.27	9.00	0.29	0.22	0.60	0.05	0.06	0.25	0.00	0.10	0.05	0.43	0.53	2.16	10.80	0.04
Slovenia	0.11	5.1	0.95	37.19	0.14	0.06	0.47	0.04	0.17	0.16	0.16	0.04	0.28	0.35	0.57	2.19	9.55	0.05
Slovakia	0.25	7.6	2.32	23.00	0.15	0.07	0.58	0.09	0.16	0.19	0.00	0.13	0.16	0.39	0.53	2.35	9.55	0.05
Finland	0.04	3.9	0.42	51.87	0.09	0.02	0.32	0.04	0.06	0.30	0.04	0.02	0.14	0.25	0.58	2.73	9.98	0.08
Sweden	0.04	4.5	0.28	47.89	0.10	0.05	0.34	0.04	0.05	0.13	0.18	0.03	0.23	0.07	0.37	2.45	9.41	0.09
United Kingdom	0.23	4.7	1.50	36.11	0.11	0.19	0.30	0.16	0.17	0.12	0.16	0.06	0.44	0.38	0.44	2.29	9.43	0.23
Iceland	0.05	3.9	0.61	48.36	0.06	0.10	0.25	0.03	0.17	0.19	0.06	0.04	0.20	0.32	0.55	2.50	10.45	0.10
Serbia	0.47	6.5	3.55	12.84	0.26	0.20	0.59	0.19	0.25	0.23	0.11	0.32	0.22	0.75	0.24	2.29	9.85	0.03
Switzerland	0.04	4.0	0.32	64.94	0.05	0.04	0.34	0.03	0.06	0.11	0.18	0.02	0.42	0.28	0.61	2.27	9.77	0.08
Average	0.23	5.53	1.74	36.36	0.16	0.14	0.42	0.10	0.12	0.16	0.12	0.08	0.29	0.41	0.42	2.21	9.80	0.12

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 1: Descriptive statistics, dependent and independent variables, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014 (continued)

Country	Total social benefits (% of GDP)	In-kind social benefits (% of GDP)	In-cash social benefits (% of GDP)	Total social benefits (in PPS per head)	Cash social benefits (in PPS per child)	In-kind social benefit (in PPS per head)	Family social benefits (% of GDP)	Average gross cash benefits (1000 PPS per child)	Pro-poorness of cash social benefits (bottom 50, child population)	Adequacy of minimum income (% of median income)	GDP per capita (1000 PPS)	Unemployment rate (% of working age population)	Median equivalised income (1000 PPS per child)
Belgium	29.00	9.20	19.80	6.35	3.43	2.92	2.20	1.94	71.33	38.08	33.00	8.50	19.63
Bulgaria	17.90	5.60	12.30	2.07	1.30	0.77	1.90	0.45	55.49	20.37	12.80	11.40	5.86
Czechia	19.10	6.30	12.80	3.07	1.53	1.54	1.70	0.71	77.12	41.61	23.80	6.10	10.68
Denmark	32.20	12.70	19.50	6.17	2.69	3.48	3.60	1.26	79.64	63.15	35.10	6.60	20.27
Germany	27.80	10.60	17.20	7.44	3.69	3.75	3.10	2.56	66.27	54.09	34.60	5.00	18.35
Estonia	15.00	4.60	10.40	2.88	1.91	0.96	1.60	1.33	55.99	35.35	20.90	7.40	10.54
Ireland	19.40	7.30	12.10	6.95	4.65	2.31	2.50	2.46	76.96	64.12	37.70	11.30	15.51
Greece	25.50	5.00	20.50	2.04	1.08	0.96	1.10	0.35	76.15	7.88	19.40	26.50	8.01
Spain	24.90	7.60	17.30	3.60	1.91	1.69	1.30	0.07	70.29	22.78	24.70	24.50	12.44
France	32.20	11.70	20.50	6.76	3.32	3.43	2.50	1.72	71.82	38.73	29.60	10.30	18.34
Croatia	21.20	7.00	14.20	2.49	1.37	1.12	1.50	0.58	70.68	33.03	16.10	17.20	7.13
Italy	28.90	7.10	21.80	3.45	1.63	1.82	1.60	0.54	64.55	0.00	26.60	12.70	13.65
Cyprus	22.10	3.40	18.70	3.24	2.49	0.75	1.40	0.95	64.47		22.40	16.10	15.24
Latvia	14.30	4.00	10.30	2.03	1.36	0.67	1.30	0.70	60.51	41.86	17.50	10.80	7.27
Lithuania	14.00	4.60	9.40	2.45	1.50	0.95	1.10	0.62	59.41	40.91	20.70	10.70	7.15
Luxembourg	22.40	6.90	15.50	9.76	5.23	4.53	3.50	3.75	62.52	49.16	74.50	6.00	24.23
Hungary	19.70	6.30	13.40	3.23	2.10	1.13	2.30	1.50	64.06	23.93	18.70	7.70	6.61
Malta	18.80	6.50	12.30	3.32	1.96	1.35	1.20	0.92	77.86	35.94	24.90	5.80	14.51
Netherlands	28.90	10.20	18.70	5.36	2.12	3.24	0.90	1.04	74.08	50.07	36.00	7.40	18.17
Austria	29.20	8.90	20.30	7.39	4.43	2.96	2.80	2.63	66.54	49.93	35.70	5.60	18.77
Poland	18.50	4.30	14.20	2.17	1.29	0.88	1.40	0.34	75.19	43.35	18.60	9.00	8.71
Portugal	25.50	6.80	18.70	2.81	1.49	1.32	1.20	0.29	76.84	29.33	21.20	14.10	9.57
Romania	14.40	4.30	10.10	1.29	0.62	0.67	1.20	0.25	59.31	23.45	15.30	6.80	3.23
Slovenia	23.70	7.60	16.10	3.77	2.10	1.67	1.90	1.45	70.71	41.73	22.80	9.70	14.19
Slovakia	17.90	6.10	11.80	2.80	1.53	1.27	1.70	0.79	65.87	28.62	21.30	13.20	8.72
Finland	31.10	11.80	19.30	6.85	3.62	3.24	3.20	2.25	71.28	48.34	30.50	8.70	18.85
Sweden	29.00	13.50	15.50	7.68	3.96	3.71	3.10	2.20	70.70	41.98	34.10	7.90	19.72
United Kingdom	27.10	10.30	16.80	6.31	3.45	2.86	2.80	1.91	84.71	56.86	29.90	6.10	14.74
Iceland	23.70	11.10	12.60	6.36	2.96	3.41	2.70	1.07	78.51	52.10	32.50	5.00	18.45
Serbia	22.80	6.00	16.80	1.64	1.04	0.60	1.20	0.26	62.18		10.10	19.20	4.05
Switzerland	24.40	8.00	16.40	6.85	3.62	3.23	1.50	1.77	71.45	40.19	45.00	4.90	22.61
Average	26.04	8.64	17.41	4.97	2.57	2.40	2.10	1.28	71.27	36.58	27.58	10.43	14.20

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 2: Correlation coefficients between household variables, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014

	Average number of deprivation	Household income	Jobless	Self-employed	Debt burden	Low education	Medium educcation	Rent	Heavy housing burden	Light housing burden	Age of the oldest child	Bad health	Number of dependent children	Migrant	Single parent
Average number of deprivation	1	-0.34	0.31	-0.04	0.17	0.3	0.09	0.2	0.37	-0.21	0.09	0.18	0.11	0.1	0.11
Household income	-0.34	1	-0.22	0.02	0.08	-0.21	-0.22	-0.18	-0.26	0.07	0.04	-0.09	0.08	-0.03	-0.18
Jobless	0.31	-0.22	1	-0.13	0.04	0.27	0	0.24	0.17	0.12	0.02	0.16	0.08	0.07	0.27
Self-employed	-0.04	0.02	-0.13	1	-0.01	-0.01	0.01	-0.13	-0.01	0.01	0.04	0	0.02	-0.04	-0.11
Debt burden	0.17	0.08	0.04	-0.01	1	0.04	0.06	0.07	0.25	-0.16	0.02	0.07	0.02	0.03	0.04
Low education	0.3	-0.21	0.27	-0.01	0.04	1	-0.35	0.17	0.19	-0.11	0.08	0.13	0.1	0.09	0.1
Medium educcation	0.09	-0.22	0	0.01	0.06	-0.35	1	0.06	0.09	-0.02	0.07	0.05	-0.03	-0.03	0.03
Rent	0.2	-0.18	0.24	-0.13	0.07	0.17	0.06	1	0.1	-0.08	-0.08	0.03	0.01	0.19	0.26
Heavy housing burden	0.37	-0.26	0.17	-0.01	0.25	0.19	0.09	0.1	1	-0.71	0.05	0.13	0.03	0.08	0.06
Light housing burden	-0.21	0.07	0.12	0.01	-0.16	-0.11	-0.02	-0.08	-0.71	1	-0.03	-0.07	-0.03	-0.05	-0.04
Age of the oldest child	0.09	0.04	0.02	0.04	0.02	0.08	0.07	-0.08	0.05	-0.03	1	0.07	0.34	0.01	0.06
Bad health	0.18	-0.09	0.16	0	0.07	0.13	0.05	0.03	0.13	-0.07	0.07	1	0.01	0.01	-0.01
Number of dependent children	0.11	0.08	0.08	0.02	0.02	0.1	-0.03	0.01	0.03	-0.03	0.34	0.01	1	0.1	-0.07
Migrant	0.1	-0.03	0.07	-0.04	0.03	0.09	-0.03	0.19	0.08	-0.05	0.01	0.01	0.1	1	0.01
Single parent	0.11	-0.18	0.27	-0.11	0.04	0.1	0.03	0.26	0.06	-0.04	0.06	-0.01	-0.07	-0.01	1

Note: For the meaning of the variables, see Table 3.
Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 3: Correlation coefficients between country-level variables, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014

	GDP per capita	Median income	Total social benefits, % of GDP	In-kind social benefits, % of GDP	Cash social benefits, % of GDP	Total social spending, in PPS per head	In-kind social benefits, in PPS per head	Cash social benefits, in PPS per child	Family cash social benefits, % of GDP	Family cash social benefits, PPS per head	Pro-poorness of cash social benefits (bottom 50)	Adequacy of minimum-income benefit	Unemployment rate
GDP per capita	1	0.85	0.39	0.45	0.26	0.88	0.84	0.84	0.61	0.81	0.16	0.49	-0.43
Median income	0.85	1	0.67	0.7	0.49	0.92	0.91	0.85	0.65	0.76	0.31	0.56	-0.46
Total social benefits, % of GDP	0.39	0.67	1	0.81	0.9	0.62	0.7	0.5	0.51	0.38	0.44	0.19	-0.03
In-kind social benefits, % of GDP	0.45	0.7	0.81	1	0.47	0.75	0.84	0.6	0.71	0.5	0.47	0.5	-0.36
Cash social benefits, % of GDP	0.26	0.49	0.9	0.47	1	0.38	0.43	0.3	0.24	0.19	0.3	-0.07	0.23
Total social spending, in PPS per head	0.88	0.92	0.62	0.75	0.38	1	0.96	0.96	0.81	0.9	0.27	0.63	-0.49
In-kind social benefits, in PPS per head	0.84	0.91	0.7	0.84	0.43	0.96	1	0.84	0.77	0.78	0.33	0.59	-0.5
Cash social benefits, in PPS per child	0.84	0.85	0.5	0.6	0.3	0.96	0.84	1	0.78	0.94	0.18	0.63	-0.45
Family social spending benefits, % of GDP	0.61	0.65	0.51	0.71	0.24	0.81	0.77	0.78	1	0.79	0.18	0.57	-0.48
Family cash social benefits, PPS per head	0.81	0.76	0.38	0.5	0.19	0.9	0.78	0.94	0.79	1	0.03	0.59	-0.54
Pro-poorness bottom 50	0.16	0.31	0.44	0.47	0.3	0.27	0.33	0.18	0.18	0.03	1	0.38	-0.06
Adequacy of minimum income benefit	0.49	0.56	0.19	0.5	-0.07	0.63	0.59	0.63	0.57	0.59	0.38	1	-0.59
Unemployment rate	-0.43	-0.46	-0.03	-0.36	0.23	-0.49	-0.5	-0.45	-0.48	-0.54	-0.06	-0.59	1

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 4: Logistic model, single level model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014

	Intercept		Household income		(Quasi-)joblessness		Self-employment		Debt burden		Low education		Medium education		Rent	
	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|
Belgium	-2.9	***	-0.07	***	0.56	***	-1.35		0.7	***	1.07	***	0.22		0.89	***
Bulgaria	-1.65	***	-0.04	**	0.74	**	0.77	***	0.38		2.08	***	0.99	***	-0.14	
Czechia	-5.27	***	-0.09	***	0.83	**	-0.18		0.64	**	2.66	***	0.95	***	0.57	***
Denmark	-2.12	**	-0.06	***	0.59		-2.02	*	1.95	***	0.16		-0.54		1.44	***
Germany	-4.32	***	-0.04	***	0.58	**	-0.04		0.58	***	1.54	***	0.61	***	1.26	***
Estonia	-4.34	***	-0.03	***	1.19	***	-1.49	***	0.21		1.47	***	0.72	***	-0.45	**
Ireland	-4.46	***	-0.04	***	0.81	***	-0.97	***	0.69	***	0.61	***	0.2		0.55	***
Greece	-14.12	***	-0.09	***	0.38	*	-0.1		0.75	***	1.95	***	0.61	***	0.31	**
Spain	-2.54	***	-0.06	***	1.19	***	-0.28	*	0.89	***	0.98	***	0.92	***	0.54	***
France	-3.03	***	-0.07	***	0.56	***	-0.35		0.68	***	0.89	***	0.18		0.53	***
Croatia	-14.51	***	-0.08	***	0.34		-0.45	*	0.39	**	1.78	***	0.55	*	0.54	***
Italy	-2.14	***	-0.05	***	0.45	***	-0.51	***	0.88	***	1.13	***	0.43	***	0.53	***
Cyprus	-3.28	***	-0.06	***	1.71	***	0.05		1.08	***	1.26	***	0.22		-0.29	*
Latvia	-3.02	***	-0.06	***	0.47	**	-0.89	***	0.94	***	1.14	***	0.35	**	0.24	
Lithuania	-4.87	***	-0.08	***	0.19		-0.84	**	0.3		1.81	***	0.68	**	0.3	
Luxembourg	-19.56	***	-0.02	***	-0.38		0.15		0.93	***	1.3	***	0.94	**	1.17	***
Hungary	-3.32	***	-0.1	***	0.02		-0.83	***	0.48	***	3.22	***	1.07	***	0.37	*
Malta	-5.49	***	-0.03	***	1.16	***	-0.85	***	1.4	***	1.92	***	1.04	***	0.67	***
Netherlands	-3.52	***	-0.07	***	-0.15		-0.48		1.5	***	0.83	**	0.3		1.28	***
Austria	-5.04	***	-0.03	***	0.27		-0.15		1.54	***	2.57	***	0.92	***	1.53	***
Poland	-3.61	***	-0.06	***	0.25		-0.71	***	0.78	***	2.25	***	1.43	***	0.73	
Portugal	-2.34	***	-0.09	***	0.35		-0.9	***	0.52	**	1.54	***	0.75	***	0.39	
Romania	-1.18	**	-0.13	***	0.33		0.11		1.14	***	1.06	***	0.92	***	0.32	
Slovenia	-3.75	***	-0.07	***	0.71	***	-1.32	***	0.8	***	2	***	0.86	***	0.37	**
Slovakia	-4.04	***	-0.03	***	1.18	***	-0.39	*	0.59	***	1.66	***	0.6	***	0.29	
Finland	-4.03	***	-0.04	***	1.29	***	0.03		0.78	***	1.45	***	0.61	**	0.61	**
Sweden	-7	***	-0.03	***	1.54	***	-0.19		2.63	***	-0.27		0.79	**	0.62	
United Kingdom	-4.29	***	-0.02	***	1.18	***	-0.25		0.83	***	0.68	***	0.71	***	1.51	***
Iceland	-4.11	***	-0.06	***	0.85	*	-0.75		0.9	***	0.25		0.42		0.07	
Serbia	-2.63	***	-0.1	***	0.73	***	-0.45	***	0.32	**	1.66	***	0.65	***	0.1	
Switzerland	-21.7	***	-0.05	***	1.97	***	0.09	***	0.47		0.89	**	-0.1		1.94	***
Pooled	-2.72	***	-0.07	***	0.62	***	-0.38	***	0.72	***	1.12	***	0.57	***	0.57	***

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 4: Logistic model, single level model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014 (continued)

	Heavy housing burden		Light housing burden		Age of oldest child		Bad health		Number of dependent children		Migrant		Single parent	
	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|	Estimate	Pr>|t|
Belgium	2.26	***	1.17	**	-0.02		0.75	***	0.45	***	-0.2		0.28	
Bulgaria	1.85	***	0.81	**	0.07	***	0.32		0.15		0.12		0.32	
Czechia	3.77	***	2.06	***	-0.05	**	0.79	***	0.84	***	0.33		-0.34	
Denmark	1.98	***	1.59	***	0.02		0.44		-0.22		1.25	***	1.22	***
Germany	1.88	***	0.85	***	0.04	*	1.17	***	0.34	***	0.04		0.14	
Estonia	3.2	***	1.28	***	0.05	**	0.59	**	0.04		0.16		0.19	
Ireland	4.61	***	3.23	***	0.01		0.79	**	0		0.65	***	0	
Greece	14.41	***	13.22	***	0.07	***	0.98	***	0.17	**	0.17		-0.15	
Spain	1.87	***	0.25	***	0.01		0.44	**	0.11		0.89		-0.4	*
France	2.01	***	1.27	***	0.07	***	0.41	**	0.4	***	0.19		-0.49	***
Croatia	12.9	***	11.36	***	0.02		0.73	***	0.25	***	0.49	**	-0.18	
Italy	1.04	*	-0.39	***	0.02	*	1.32	***	0.32		0.62	***	-0.53	***
Cyprus	3	***	1.8	*	0.03		1.06	***	0.34	***	0.8		0.5	**
Latvia	2.59	***	1.37		0.03	*	0.84	***	0.41	***	0.25		0.05	
Lithuania	3.82	***	2.46		0.01		1.05	***	0.57		1.2	***	0.47	
Luxembourg	15.93	***	14.62	***	-0.06	*	1.14	***	0.16		1.14	***	1.48	***
Hungary	4.12	***	2.23		-0.02		0.5	**	0.26	***	0.81		0.66	**
Malta	2.11	***	0.06	***	0		1.63	***	0.71	***	0.04		0.63	**
Netherlands	3.23	***	1.74	***	-0.01		1.53	***	0.27	**	1.52	***	0.28	
Austria	1.78	***	0.7	**	-0.01		0.92	***	0.41	***	0.22		-0.08	
Poland	1.62	***	0.23		0.01		0.5	***	0.37	***	1.09	***	0.5	**
Portugal	2.28	***	1.16		0.02		0.8	***	0.16	*	0.52	***	-0.42	*
Romania	2.37	***	1.1		0.04	*	0.99	***	0.2	***	-5	***	1.6	***
Slovenia	1.89	***	0.13	***	0.04	**	1.22	***	0.34	***	0.4	**	-0.39	
Slovakia	2.56	***	0.58		0.03		0.92	***	0.35	***	13.13	***.	0.64	**
Finland	2.23	***	0.49	***	-0.02		-0.07		0.2	***	1.3	***	-0.03	
Sweden	2.42	***	1.52		0.08		0.69		0.2	*	2.04	***	0.62	
United Kingdom	2.19	***	1.01	***	0.04	**	0.65	***	0.06		0.21		-0.28	**
Iceland	2.61	***	1.16		-0.02		1.36	***	0.46	***	-0.96		0.08	
Serbia	2.34	***	0.73		0.01		1	***	0.18	***	0.02		0.3	
Switzerland	16.45	***	14.78	***	0.04		0.7		1.02	***	1.12	***	0.21	
Pooled	2.07	***	1.04	***	0.04	***	0.71	***	0.26	***	0.31	***	-0.32	***

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 5: Country-level residual estimates in the negative binomial multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014

Country	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13
Belgium	-0.12	-0.23	0.01	-0.04	-0.08	-0.01	-0.04	-0.02	-0.18	-0.06	-0.18	-0.22	0.03
Bulgaria	1.68	1.28	1.05	1.13	1.10	1.00	1.06	0.98	1.26	1.09	0.95	1.08	0.91
Czechia	-0.12	-0.21	-0.39	-0.34	-0.33	-0.37	-0.38	-0.33	-0.27	-0.34	-0.03	-0.16	-0.36
Denmark	-1.31	-0.19	0.18	-0.02	0.27	0.01	-0.14	0.15	0.14	-0.18	0.05	0.13	0.20
Germany	-0.61	-0.18	0.01	-0.11	0.09	0.16	0.06	0.22	0.04	0.13	-0.26	0.02	0.08
Estonia	-0.17	-0.23	-0.57	-0.46	-0.50	-0.41	-0.33	-0.48	-0.30	-0.21	-0.55	-0.25	-0.55
Ireland	0.24	0.28	0.12	0.13	0.26	0.57	0.70	0.35	0.39	0.57	0.46	0.61	0.32
Greece	0.78	0.40	0.50	0.62	0.17	0.12	0.15	0.15	0.23	0.19	0.56	0.05	0.28
Spain	0.38	-0.09	-0.02	-0.02	-0.09	-0.19	-0.19	-0.17	-0.22	-0.36	-0.07	-0.26	-0.14
France	-0.20	0.11	0.48	0.32	0.48	0.37	0.28	0.44	0.21	0.22	0.17	0.13	0.40
Croatia	0.26	-0.56	-0.64	-0.62	-0.61	-0.78	-0.76	-0.77	-0.65	-0.71	-0.53	-0.62	-0.81
Italy	0.13	-0.12	0.11	0.15	-0.17	-0.24	-0.27	-0.17	-0.20	-0.29	-0.24	-0.57	0.02
Cyprus	0.57	0.48	0.43	0.61	0.10	0.34	0.49	0.17	0.37	0.41	0.36	.	0.35
Latvia	0.83	0.51	0.13	0.27	0.18	0.22	0.30	0.18	0.37	0.38	0.29	0.56	0.10
Lithuania	0.46	0.32	-0.06	0.05	0.05	0.09	0.15	0.07	0.15	0.17	0.08	0.37	-0.04
Luxembourg	-0.73	-0.54	-0.58	-0.55	-0.60	0.06	-0.02	0.05	-0.24	0.04	-0.70	-0.40	0.14
Hungary	1.13	0.54	0.39	0.44	0.43	0.40	0.48	0.33	0.61	0.60	0.41	0.38	0.33
Malta	0.23	-0.02	-0.21	-0.17	-0.12	-0.16	-0.11	-0.18	-0.18	-0.10	0.18	-0.03	-0.17
Netherlands	-1.17	-0.27	-0.04	-0.14	-0.04	-0.17	-0.33	0.01	-0.48	-0.32	-0.16	-0.11	0.03
Austria	-0.68	-0.30	-0.05	-0.10	-0.18	0.03	0.07	-0.08	-0.14	0.02	-0.37	-0.15	0.01
Poland	0.27	-0.14	-0.33	-0.20	-0.43	-0.40	-0.35	-0.41	-0.25	-0.35	0.00	-0.06	-0.39
Portugal	0.67	0.15	0.24	0.28	0.08	-0.04	-0.03	-0.02	0.00	-0.08	0.32	0.06	0.11
Romania	1.50	1.08	0.71	0.84	0.79	0.72	0.74	0.76	0.93	0.85	0.84	0.92	0.67
Slovenia	-0.39	-0.26	-0.24	-0.24	-0.26	-0.34	-0.33	-0.35	-0.28	-0.21	-0.23	-0.21	-0.31
Slovakia	0.51	0.19	-0.03	0.02	0.06	0.00	0.02	0.01	0.14	0.08	0.10	0.08	-0.06
Finland	-1.21	-0.42	-0.09	-0.25	-0.04	-0.14	-0.19	-0.13	-0.17	-0.18	-0.37	-0.28	-0.13
Sweden	-1.60	-0.73	-0.49	-0.74	-0.21	-0.36	-0.44	-0.34	-0.51	-0.51	-0.70	-0.69	-0.46
United Kingdom	0.07	-0.01	0.16	0.04	0.24	0.21	0.19	0.19	0.16	0.15	0.36	0.23	0.16
Iceland	-0.82	-0.16	-0.14	-0.29	0.15	0.06	-0.06	0.16	-0.02	-0.20	0.05	0.03	-0.05
Serbia	0.93	-0.02	-0.04	0.03	-0.17	-0.35	-0.29	-0.36	-0.18	-0.26	-0.20	.	-0.33
Switzerland	-1.48	-0.67	-0.62	-0.63	-0.63	-0.39	-0.44	-0.39	-0.76	-0.54	-0.62	-0.63	-0.35

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 5: Country-level residual estimates in the negative binomial multilevel model, Child population, EU-28 Member States and non-EU countries covered by EU-SILC, 2014 (continued)

Country	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26
Belgium	0.02	-0.05	-0.02	-0.08	-0.02	-0.11	-0.10	-0.09	-0.14	0.00	0.73	0.83	1.05
Bulgaria	0.92	0.93	0.97	0.98	0.95	0.99	0.98	0.76	0.90	0.78	-0.53	-0.65	-0.62
Czechia	-0.33	-0.38	-0.39	-0.33	-0.37	-0.29	-0.30	-0.14	-0.29	-0.19	-0.05	0.03	0.01
Denmark	0.10	0.23	0.00	-0.05	0.13	0.00	-0.04	0.13	0.09	0.27	-0.69	-0.67	-0.57
Germany	0.04	0.09	0.11	0.00	0.19	-0.02	-0.01	-0.10	0.02	0.04	0.18	0.27	0.18
Estonia	-0.48	-0.54	-0.44	-0.37	-0.52	-0.37	-0.35	-0.58	-0.39	-0.71	0.57	0.43	0.50
Ireland	0.33	0.43	0.59	0.58	0.39	0.51	0.52	0.61	0.67	0.36	-0.16	0.12	-0.14
Greece	0.30	0.23	0.23	0.23	0.27	0.25	0.25	0.38	0.20	0.50	-0.28	-0.04	-0.02
Spain	-0.19	-0.02	-0.10	-0.13	-0.05	-0.13	-0.15	-0.12	-0.11	-0.19	-0.34	-0.22	-0.09
France	0.31	0.41	0.34	0.20	0.43	0.17	0.17	0.19	0.16	0.39	-0.82	-0.65	-0.64
Croatia	-0.84	-0.72	-0.77	-0.78	-0.74	-0.78	-0.78	-0.74	-0.75	-0.77	0.46	0.43	0.39
Italy	0.05	-0.15	-0.21	-0.17	-0.15	-0.14	-0.15	-0.22	-0.35	-0.07	-0.05	0.09	-0.06
Cyprus	0.45	0.17	0.37	0.42	0.22	0.38	0.39	0.30	.	-0.09	-0.09	-0.20	-0.39
Latvia	0.17	0.12	0.22	0.29	0.17	0.30	0.30	0.17	0.34	0.03	-0.10	-0.18	-0.21
Lithuania	0.01	0.03	0.09	0.16	0.06	0.17	0.18	0.02	0.22	-0.05	0.35	0.28	-0.58
Luxembourg	0.26	0.11	0.21	0.37	0.15	0.43	0.43	0.20	0.40	0.25	0.07	0.10	0.13
Hungary	0.35	0.31	0.36	0.38	0.28	0.37	0.38	0.29	0.26	0.45	0.40	0.55	0.12
Malta	-0.13	-0.16	-0.17	-0.10	-0.22	-0.09	-0.09	0.08	-0.11	-0.20	0.10	0.07	-0.04
Netherlands	0.00	0.01	-0.15	-0.15	0.00	-0.12	-0.12	-0.03	-0.05	0.13	-0.09	-0.36	-0.33
Austria	0.03	-0.12	-0.01	-0.06	-0.11	-0.12	-0.11	-0.20	-0.11	-0.10	0.00	-0.13	0.01
Poland	-0.31	-0.49	-0.41	-0.34	-0.44	-0.32	-0.33	-0.19	-0.28	-0.25	0.40	0.21	0.24
Portugal	0.12	0.03	-0.02	0.00	0.00	0.02	0.01	0.17	0.01	0.33	0.89	0.87	0.71
Romania	0.73	0.66	0.69	0.78	0.70	0.82	0.82	0.68	0.73	0.85	-0.40	-0.36	-0.04
Slovenia	-0.32	-0.34	-0.36	-0.36	-0.37	-0.35	-0.34	-0.32	-0.33	-0.41	-0.08	0.08	-0.03
Slovakia	-0.06	0.02	0.01	0.05	0.02	0.07	0.07	0.02	0.04	-0.06	0.43	0.41	0.16
Finland	-0.23	-0.11	-0.18	-0.30	-0.15	-0.33	-0.33	-0.32	-0.30	-0.21	0.27	0.35	0.48
Sweden	-0.60	-0.27	-0.40	-0.54	-0.35	-0.58	-0.58	-0.58	-0.60	-0.47	-0.41	-0.45	-0.24
United Kingdom	0.11	0.18	0.16	0.09	0.15	0.06	0.06	0.31	0.13	0.41	0.43	0.41	0.16
Iceland	-0.13	0.11	0.02	-0.06	0.12	-0.05	-0.08	0.09	-0.01	-0.08	-0.04	-0.32	0.11
Serbia	-0.34	-0.33	-0.34	-0.37	-0.33	-0.37	-0.37	-0.47	.	-0.34	-0.69	-0.25	-0.49
Switzerland	-0.31	-0.41	-0.37	-0.32	-0.38	-0.33	-0.32	-0.31	-0.35	-0.59	0.05	-0.31	0.43

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 6: Logistic model, multilevel, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014

	M1			M2		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables						
Household income						0.655
Household income				-0.052	0.000	
Other						-0.224
Self-employment				-0.412	0.000	
(Quasi-)joblessness				0.704	0.000	
Low education				1.228	0.000	
Medium education				0.610	0.000	
Bad health				0.676	0.000	
Heavy housing burden				2.187	0.000	
Light housing burden				0.959	0.000	
Rent				0.538	0.000	
Debt burden				0.728	0.000	
Number of dependent children				0.265	0.000	
Single parent				0.045	0.166	
Age of oldest child				0.020	0.000	
Migrant				0.428	0.000	
Constant	-1.139	0.000		-3.229	0.000	
Random Estimates						
Random intercept	0.933	0.000		0.531	0.000	
Explained between-country variance	0.000			0.431		
Model information						
N of observations		88901			88901	
N of countries		31			31	

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 6: Logistic model, multilevel, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M3			M4			M5			M6			M7		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables															
Household income			0.469			0.557			0.439			0.377			0.436
Other			-0.153			-0.182			-0.184			-0.139			-0.151
Country-level variables															
Total social benefits, % of GDP	-0.056	0.012	0.220												
Cash social benefits, % of GDP				-0.050	0.159	0.099									
In kind social benefits, % of GDP							-0.136	0.001	0.320						
All social benefits, in PPS per child										-0.169	0.001	0.340			
Cash social benefits, in PPS per child													-0.266	0.009	0.245
Random Estimates															
Random intercept	0.433	0.000		0.491	0.000		0.397	0.000		0.394	0.000		0.438	0.000	
Explained between-country variance	0.536			0.474			0.575			0.578			0.530		
Model information															
N of observations	88901			88901			88901			88901			88901		
N of countries	31			31			31			31			31		

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 6: Logistic model, multilevel, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M8			M9			M10			M11			M12		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables															
Household income			0.368			0.154			0.467			0.526			0.546
Other			-0.152			-0.185			-0.169			-0.161			-0.221
Country-level variables															
In kind social benefits, in PPS per child	-0.352	0.000	0.385												
Family cash social benefits, % of GDP				-0.310	0.051	0.154									
Family cash social benefits, PPS per head							-0.333	0.016	0.222						
Pro-poorness bottom 50										-0.041	0.011	0.175			
Adequacy of minimum-income													-0.021	0.018	0.178
Random Estimates															
Random intercept	0.372	0.000		0.477	0.000		0.520	0.000		0.430	0.000		0.464		
Explained between-country variance	0.601			0.489			0.448			0.540			0.503		
Model information															
N of observations	88901			88901			88901			88901			88901		
N of countries	31			31			31			31			29		

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 6: Logistic model, multilevel, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M13			M14			M15			M16			M17		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables															
Household income			0.329			0.370			0.327			0.319			0.369
Other			-0.125			-0.134			-0.146			-0.122			-0.136
Country-level variables															
GDP per capita	-0.022	0.055	0.197	-0.025	0.032	0.215	0.044	0.044	0.192	-0.009	0.655	0.151	-0.025	0.168	0.169
Unemployment rate	0.009	0.707	0.013	0.012	0.638	0.024	0.728	0.728	-0.003	-0.005	0.832	-0.001	0.002	0.940	0.001
Total social benefits, % of GDP	-0.037	0.107	0.185	-0.033	0.352	0.103									
Cash social benefits, % of GDP							0.029	0.029	0.251						
In kind social benefits, % of GDP										-0.134	0.211	0.235			
All social benefits, in PPS per child													-0.055	0.761	0.160
Cash social benefits, in PPS per child															
Random Estimates															
Random intercept	0.374	0.000		0.394	0.000		0.354	0.000		0.389	0.000		0.408	0.000	
Explained between-country variance	0.599			0.578			0.620			0.583			0.563		
Model information															
N of observations	88901			88901			88901			88901			88901		
N of countries	31			31			31			31			31		

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 6: Logistic model, multilevel, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M18			M19			M20			M21			M22		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables															
Household income			0.309			0.411			0.397			0.371			0.421
Other			-0.138			-0.144			-0.141			-0.118			-0.169
Country-level variables															
GDP per capita	-0.004	0.817	0.155	-0.028	0.026	0.202	-0.030	0.072	0.172	-0.025	0.016	0.213	-0.027	0.020	0.206
Unemployment rate	-0.010	0.679	-0.002	0.002	0.940	-0.004	0.004	0.882	-0.002	0.005	0.836	0.005	-0.011	0.692	-0.003
In kind social benefits, in PPS per child	-0.341	0.061	0.283												
Family cash social benefits, % of GDP				-0.031	0.873	0.096									
Family cash social benefits, PPS per head							0.018	0.940	0.136						
Pro-poorness bottom 50										-0.032	0.037	0.143			
Adequacy of minimum-income													-0.012	0.264	0.125
Random Estimates															
Random intercept	0.367	0.000		0.409	0.000		0.409	0.000		0.360	0.000		0.392	0.000	
Explained between-country variance	0.607			0.562			0.562			0.614			0.580		
Model information															
N of observations	88901			88901			88901			88901			88901		
N of countries	31			31			31			31			31		

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 6: Logistic model, multilevel, Child population, EU-28 Member States and non-EU countries covered by EU-SILC (pooled data), 2014 (continued)

	M23			M24			M25			M26		
	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2	Coeff.	p>z	Shapley R^2
Household-level variables												
Household income												0.217
Other			-0.113			-0.111			-0.140			-0.116
Country-level variables												
GDP per capita	-0.047	0.000	0.283	-0.050	0.000	0.309	-0.049	0.000	0.274			
Unemployment rate	0.021	0.392	0.026	0.030	0.274	0.046	-0.003	0.919	-0.002	-0.004	0.851	0.003
Total social benefits, % of GDP	-0.058	0.031	0.217									
Cash social benefits, % of GDP				-0.065	0.111	0.119						
In kind social benefits, % of GDP							-0.131	0.020	0.285	-0.025	0.668	0.172
Pro-poorness bottom 50	-0.033	0.073	0.133	-0.041	0.021	0.157	-0.030	0.102	0.133	-0.018	0.277	0.080
Median income										-0.061	0.027	0.282
Random Estimates												
Random intercept	0.424	0.000		0.448	0.000		0.420	0.000		0.337	0.000	
Explained between-country variance	0.545			0.520			0.550			0.638		
Model information												
N of observations	88901			88901			88901			88901		
N of countries	31			31			31			31		

Source: EU-SILC 2014 cross-sectional data, authors' computation.

Annex 7: Countries' official abbreviations

BE	Belgium	NL	Netherlands
BG	Bulgaria	AT	Austria
CZ	Czechia	PL	Poland
DK	Denmark	PT	Portugal
DE	Germany	RO	Romania
EE	Estonia	SI	Slovenia
IE	Ireland	SK	Slovakia
EL	Greece	FI	Finland
ES	Spain	SE	Sweden
FR	France	UK	United Kingdom
HR	Croatia		
IT	Italy		
CY	Cyprus	***Other (non-EU) EU-SILC countries***	
LV	Latvia	IS	Iceland
LT	Lithuania	RS	Serbia
LU	Luxembourg	CH	Switzerland
HU	Hungary		
MT	Malta		

Note: "Pooled data" refers to data pooled for all 31 countries covered in the paper, i.e. EU-28 countries plus Iceland, Serbia and Switzerland. In the "Average", the 31 countries are weighted by their population sizes.

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Micro- and macro-drivers of child deprivation in 31 European countries

This paper analyses child deprivation in 31 European countries, using the scale officially adopted in March 2018 to measure child-specific deprivation at EU level. It combines single level and multilevel models to get a full picture of child deprivation drivers in EU countries. With regard to within-country differences, our results confirm the combined impact of variables related to the 'longer-term command over resources' and variables indicating 'household needs'. However, our results also show that the relationship of these variables with child deprivation differs between countries. In the richest countries, the explanatory power of the variables related to household needs is the largest, whereas in the most deprived countries, the explanatory power of resource variables is generally greater. With regard to between-country differences, the specification of the model needs careful consideration. We argue that multilevel models should include household income at the micro level, if the aim is to fully gauge the impact of households' 'longer-term command over resources' at the micro level. The multilevel model then assesses how much country-level features that are not reflected in household income and other individual characteristics at the micro level contribute to explaining differences across countries in deprivation. We find that public spending on in-kind social benefits is significant in this respect. Public spending on cash transfers plays only a limited role, when household incomes at the micro level are included; they play a significant role when household income is excluded. This does not diminish the importance of cash transfers in fighting child deprivation, but it qualifies the conclusions of papers which have analysed the relationship of social transfers on deprivation, using multilevel models but without controlling for individual household income. Finally, we find a significant relationship of GDP per capita, even when individual household incomes are included. This is not self-evident: it shows that GDP per capita is a proxy for important contextual variables which are not reflected in individual incomes and other individual characteristics.

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