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MONITORING CHILD WELL-BEING IN THE EUROPEAN UNION: MEASURING CUMULATIVE DEPRIVATION

Geranda Notten and
Keetie Roelen

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Correspondence should be addressed to:

UNICEF Innocenti Research Centre
Piazza SS. Annunziata, 12
50122 Florence, Italy
Tel: (+39) 055 20 330
Fax: (+39) 055 2033 220
Email: florence@unicef.org

Monitoring Child Well-being in the European Union: Measuring Cumulative Deprivation

Geranda Notten [a] and Keetie Roelen [b]

[a] University of Ottawa <Geranda.Notten@mail.uottawa.ca>
[b] Keetie Roelen, IDS, Centre for Social Protection <K.Roelen@ids.ac.uk>

Summary: The European Union is developing child specific indicators of well-being to complement the Laeken indicators on poverty and social exclusion. Though many child sensitive indicators have been proposed, none of the measures is sensitive to (changes in) cumulative deprivation, i.e. the degree to which a child simultaneously experiences a range of unfavourable conditions.

This paper describes and empirically tests a number of candidate measures of cumulative deprivation to monitor child well-being. The ideal measure is sensitive to (changes in) cumulative deprivation and, given its broad use in the policy community, has an intuitive interpretation. Using the 2007 wave of the EU-SILC data, we construct several headcount and adjusted-headcount measures of cumulative deprivation from a set of 13 deprivation indicators for Germany, France, The Netherlands and the United Kingdom. We test the impact of changes in the main methodological decisions: the exclusion of deprivation indicators, changes in the indicator threshold, changes in the cumulative deprivation threshold and changes in the weighting indicators. Our findings indicate that some measures are considerably more sensitive than others.

In the context of the search for child-specific indicators, we conclude that headcount and adjusted headcount measures of cumulative deprivation give relevant and complementary insights into child well-being and perform well in sensitivity tests. While the interpretation of headcount measures is somewhat easier, the adjusted-headcount is additionally able to monitor changes in cumulative deprivation and it is less sensitive to changes in the methodology. Within these two broad classes some non-trivial choices must be made and the adjusted-headcount with a cumulative deprivation threshold of one satisfies the evaluation criteria best. The relative measures of cumulative deprivation are problematic: not only are they very sensitive to changes in methodological decisions, but they are also more difficult to interpret. However, to monitor cumulative deprivation of children there is also a need for child specific indicators (rather than household level indicators) over a wider range of well-being domains.

Keywords: poverty measurement, multidimensional poverty, cumulative deprivation, child poverty, European Union

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1. INTRODUCTION

The European Union (EU) is currently in the process of developing child specific indicators of well-being that will be used, together with the Laeken indicators on poverty and social exclusion, to monitor progress towards achieving inclusive economic growth. Although a wide range of child sensitive indicators has been proposed in recent years, none of the measures is sensitive to (changes in) cumulative deprivation i.e. the degree to which a child simultaneously experiences a range of unfavourable conditions.[1] From a well-being perspective, information on cumulative deprivation is highly relevant for any population group: if 10% of the population lives in poor housing conditions and an equal percentage lives in a neighbourhood where there is a high crime/vandalism rate, persons experiencing both conditions *ceteris paribus* are worse off than persons experiencing only one condition. For children, this distinction is even more pertinent: children's current well-being is a key determinant of their future well-being; more often than not, well-being in one domain (e.g. health) is complementary to well-being in another domain (e.g. education); and children also have little control over, or responsibility for, the factors determining their own well-being.

This paper develops and tests a range of potential candidates for national benchmark indicators of cumulative deprivation that can be used to monitor child well-being. Such a measure should satisfy two criteria. First, it should be sensitive to cumulative deprivation and changes therein. Second, as monitoring progress on these and other measures will be of interest to policymakers, researchers, politicians and other interest groups, the measure should be intuitive / relatively easy to interpret for a broad audience. This paper uses the 2007 wave of the EU-SILC data to estimate a range of cumulative deprivation measures including 13 deprivation indicators in four EU member states: Germany, France, The Netherlands and the United Kingdom. The behaviour of the measures is tested by means of various sensitivity analyses. Given the potential policy uses, the results are analyzed both from a European and a national perspective.

This paper is structured as follows: section 2 describes the context in which child well-being enters the European agenda; section 3 discusses the potential measures, their calculation and their theoretical properties; section 4 sets out our choices regarding the operationalisation of the measures; section 5 reports the first estimates for the cumulative deprivation measures and investigates to what extent cumulative deprivation levels differ between the cumulative deprivation measures but also with respect to the EU's at-risk-of-poverty estimates; in section 6 we re-estimate the cumulative deprivation measures under a number of realistic alternative decision scenarios and we analyze the degree to which this would change the results; section 7

[1] To date, there is only one proposed child indicator measuring one aspect of cumulative deprivation: the primary indicator on material deprivation which is measured for the population as a whole and does also include an age breakdown for the population aged between 0 and 17 years (Guio, 2009; TARKI Social Research Institute, 2010); it measures the percentage of individuals (children) that have more than two (out of nine) deprivations.

synthesizes the findings, points out which of the measure(s) is most promising and discusses the broader relevance of these findings for multidimensional poverty measurement and their use in the policy domain.

2. CHILD WELL-BEING AND THE SOCIAL INDICATORS APPROACH

In order to evaluate potential candidates for an EU benchmark indicator of cumulative disadvantage to monitor child well-being it is important to better understand the context in which child well-being enters the European agenda. In this section we therefore discuss the context in which social indicators are used in European and national policy-making and we document progress in the more recent search for child-specific indicators of poverty and social inclusion.

The role of social indicators in the EU

The Lisbon Strategy reflects the European Union's desire to be a world leading knowledge-based economy. This goal is to be reached through smart, inclusive and sustainable economic growth.[2] Though an EU wide agenda since 2000, much of the implementation of those strategies occurs at national levels. This holds especially for the formulation, implementation and evaluation of policies directed towards reducing poverty and increasing social inclusion. "Since 2000, the European Union has provided, through the open method of coordination, a framework for national strategy development as well as for policy coordination between EU countries on issues relating to poverty and social exclusion. This coordinated action at European level is reflected in National Action Plans. It encourages EU countries to examine their policies critically, and highlights how some perform well in certain areas, spurring on others to perform better. It also creates a better basis for policy making by involving NGOs, social partners, local and regional authorities and those working with people in poverty."[3]

While participation in the open method of coordination is voluntary, the process receives considerable attention from the policy community. This is in part because of the National Action Plans as well as the dissemination of common social indicators[4] on poverty and social exclusion, the so-called Laeken indicators, facilitate comparisons between member states. In this context, social indicators are used to monitor progress on the social inclusion agenda and, in some cases, a specific target is set. For instance, to monitor progress, the European bureau of statistics

[2] European Commission. (n.d.). Lisbon strategy for growth - Towards a green and innovative economy. Retrieved February 2, 2011, from http://ec.europa.eu/archives/growthandjobs_2009/.
[3] European Commission. (n.d.). Employment, social affairs, and inclusion - Poverty and social exclusion. Retrieved February 2, 2011, from http://ec.europa.eu/social/main.jsp?catId=751&langId=en.
[4] Indicators on poverty and social inclusion are not the only theme covered by EU social indicators; there are indicators covering a wider range of life domains and welfare concepts (see for instance Berger-Schmitt and Noll (2000)).

(Eurostat) annually reports statistics on the number of EU residents that are "at-risk-of-poverty".[5] However, as social cohesion is one of the pillars in Europe's 2020 strategy, an additional target is set to reduce the number of people that are "at-risk-of-poverty" with 20 million by 2020.[6] Member States can additionally formulate their own national indicators; it is also their choice whether they set specific targets or not.

Indicators of child well-being in the EU: an afterthought?

When, in December 2001, the Laeken European Council adopted the first set of social indicators to monitor progress on poverty and social inclusion, none of the 18 indicators provided insights into the situation of children (European Commission, April 2003). However, the issue of child poverty gained in prominence during mid-2000: new research showed that in most European member states, families with children have a higher risk of income poverty (Hoelscher, 2004; Marlier, Atkinson, Cantillon, & Nolan, 2007). Moreover, following the example of the United Kingdom where in 1999 a commitment was made by the Blair government to eradicate child poverty in 20 years, child poverty increasingly became a priority on national policy agenda's (Marlier et al., 2007, p. 9). As a result, the importance of 'child mainstreaming' also became an objective of the EU agenda on poverty and social inclusion thereby also kick-starting the search for indicators of child well-being (European Commission, 2008; Marlier et al., 2007). This process resulted in two types of recommendations (European Commission, 2008; TARKI Social Research Institute, 2010): calculating age-breakdowns for existing indicators (i.e. at-risk-of-poverty rates for children aged between 0-17 years) and developing a set of child specific indicators. The search also revealed that the main source of information for poverty and social inclusion indicators, the European Union Statistics on Income and Living Conditions (EU-SILC), contained very little child specific information. The 2009 wave of the EU-SILC includes a child module; these data will soon become available, in time to incorporate the findings in the EU-SILC revision which is planned for 2011 (TARKI Social Research Institute, 2010).

The proposed child indicators are the product of a recent study performed by TARKI Social Research Institute (2010) and comprise indicators from various data sources over a range of well-being domains varying from monetary poverty to material deprivation, housing, employment of parents, education, health, exposure to risk and risk behaviour, social participation and family relations, and local environment. A few composite indicators, combining information from various single indicators for each child, are included. In the domain of material deprivation, the authors suggest a child specific age-breakdown (ages 0 to 17) of the 'primary indicator of material deprivation' as developed by Guio (2009). Using the EU-SILC data, this indicator is calculated as the percentage of children missing at least three out of nine

[5] In fact, Eurostat also publishes poverty rates for non-EU countries such as Iceland, Switzerland and Turkey.
[6] European Commission. (n.d.). Europe 2020 - EU-wide targets. Retrieved February 2, 2011, from http://ec.europa.eu/europe2020/targets/eu-targets/index_en.htm.

items[7] that are considered to be socially recognized necessities (TARKI Social Research Institute, 2010, Annex 3.5, p. 30). It should be noted that the items in the primary indicator are not child specific. In that same domain, but using the PISA data, another proposed index measures the percentage of children that have low educational resources at home including resources such as parent's education, books, a computer, access to newspapers and a study desk.

An interesting feature of the European discussion on child indicators is the strong emphasis put on 'investment' in children's future well-being (Marlier et al., 2007; TARKI Social Research Institute, 2010, Annex 3.5). Though it is acknowledged that a child relevant perspective requires a multidimensional approach to well-being, the rationale for developing such indicators, as well as the proposed indicators, seems to focus on 'red flags' threatening children's future social inclusion as adults, their cognitive development and factors contributing to the intergenerational transmission of poverty. Less attention is paid to children's current well-being including their contemporary social inclusion. In light of the Lisbon agenda, which focuses on a competitive and inclusive future Europe, the emphasis on investment makes sense. However, this operationalisation of child well-being in the EU implicitly implies that less importance is attributed to childhood as a state in and of itself (Ben-Arieh, 2000; Duncan & Brooks-Gunn, 1997; Fattore, Mason, & Watson, 2007; Moore, Lippman, & Brown, 2004; Qvortrup, 1997; Streeten, 1984, for a more elaborate discussion see Notten & Roelen, November 2010).

Concluding, it took a bit longer before the need for child-specific indicators in EU's portfolio of social indicators was recognized, but this has changed: the calculation of child sensitive age-breakdowns of social indicators has already been adopted and a range of child-specific indicators has recently been proposed (TARKI Social Research Institute, 2010). While the EU approach to child well-being is multidimensional, it emphasizes the investment aspect of children's welfare rather than children's current well-being. One of the indicators, the so-called primary indicator on material deprivation already reflects one aspect of cumulative deprivation, namely the percentage of children that lack more than two necessities. Limitations of this indicator are that i) the indicator does not include child specific items and ii) it only covers one domain of children's well-being. In the next section we discuss the calculation and properties of a range of potential measures of cumulative deprivation, including the class of measures to which the primary indicator on material deprivation belongs.

[7] The nine items are 1) arrears on mortgage or rent payments, utility bills, hire purchase instalments or other loan payments; 2) capacity to afford paying for one week's annual holiday away from home; 3) capacity to afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day; 4) capacity to face unexpected financial expenses; 5) household cannot afford a telephone; 6) household cannot afford a colour TV; 7) household cannot afford a washing machine; 8) household cannot afford a car and 9) ability of the household to pay for keeping its home adequately warm.

3. MEASURES OF CUMULATIVE DEPRIVATION

In our search for an appropriate measure of cumulative deprivation experienced by children in EU member states, this section discusses a number of potential candidates from a theoretical measurement perspective focusing on the following questions: How is the measure computed, what desirable properties does it (not) have and how does it compare with the other measures of poverty and social exclusion that are used in the EU context? As stated in the introduction, the measure should meet the following requirements: it should be sensitive to cumulative deprivation and changes therein, and it should have an intuitive interpretation.[8]

We start by defining the key terms used in this section. When a child's well-being in a specific aspect of well-being falls below a minimum, the child is considered *deprived*. This minimum is a so-called *deprivation threshold*; it is inspired by prevailing standards in the society in which the child resides. Furthermore, *cumulative* deprivation occurs when a child suffers from multiple deprivations at the same time; it thus reflects the *breadth* of deprivation at an individual level. A *cumulative deprivation threshold* expresses the minimum number of deprivations a child needs to have in order to be considered as cumulatively deprived. Finally, a *cumulative deprivation measure* is an aggregate index that provides a specific insight into the extent of cumulative deprivation as experienced by children in a given society.

This section will focus on children as the unit of analysis; we further assume that all *indicators* of deprivation are available for every country and every child population subgroup; this eliminates one potential source of variation in the measure between countries and subgroups.

The measures discussed below fall into two subgroups: headcounts and so-called deprivation-adjusted headcounts. Whereas the estimates in the first group can be interpreted as the percentage of cumulatively deprived persons in a population the estimates of the second group reflect the average percentage of deprivations experienced by a population. The other distinguishing characteristic between measures is whether the cumulative deprivation threshold depends on the distribution of deprivations in a society (i.e. whether it is relative) or not.

Cumulative Deprivation Headcount (CDH)

Analogous to the popular poverty headcount index, the CDH measures the number of cumulatively deprived children as a percentage of the child population (Foster, Greer and Thorbecke, 1984). Firstly, one calculates the breadth of deprivations at the level of the child:

[8] In the next sections, when we construct and test the measures, we need to add another binding requirement; namely that the measure can be calculated from existing data.

(CD_i) which is expressed at the ratio of the number of observed indicator deprivations over the maximum number of possible indicator deprivations:

$$CD_i = \frac{\sum_{d=1}^{D} I_i}{D} \qquad (1)$$

where I_i represents a dichotomous variable with value 1 if the child is below the deprivation indicator threshold (z_i) and thus deprived, and value of 0 if the child meets the threshold and is not deprived. A deprivation indicator is denoted with d and D represents the total number of possible deprivation indicators. A non-deprived child will have a value of $CD_i = 0$ while a child deprived in all indicators will have a value of $CD_i = 1$.

Secondly, to identify whether the individual is cumulatively deprived, the degree of individual cumulative deprivation (CD_i) needs to be compared with a cumulative deprivation threshold (z_{cd}); only children with a number of deprivations above this threshold are considered cumulatively deprived (q). The value of z_{cd} is expressed as a fraction of the maximum possible amount of deprivations (D); z_{cd} can thus vary from 1/ D to 1.[9] The Cumulative Deprivation Headcount can then be calculated as:

$$CDH = \frac{\sum_{i=1}^{q} (CD_i)^0}{N} \; for \; CD_i \geq z_{cd} \qquad (2)$$

where the numerator represents the sum of cumulatively deprived individuals and the denominator, N, the total child population. The EU 'primary indicator of material deprivation' belongs to this class; the cumulative deprivation threshold is set at 3 (out of 9) material deprivations (Guio, 2009).

The CDH is has a clear intuitive interpretation but the drawback is that it is not sensitive to changes in the number of deprivations experienced by a child; if a child becomes deprived in one more domain, the index does not change. In other words, the measure does not satisfy the axiom of dimensional monotonicity (Alkire and Foster, May 2008).

Cumulative Deprivation Index (CDI)

Rather than counting the percentage of cumulatively deprived children, the next measure, the CDI, counts deprivations of cumulatively deprived children.[10] The breadth of individual level

[9] Though, strictly speaking, to be *cumulatively* deprived one would only have to count children with at least two deprivations.

[10] This measure is also known as the *dimension adjusted headcount (M0)* and has been introduced in a unified framework by Alkire and Foster (February 2007).

deprivations (CD_i) is aggregated over q cumulatively deprived children and averaged over the total child population (N):

$$CDI = \frac{\sum_{i=1}^{q}(CD_i)^1}{N} \; for \; CD_i \geq z_{cd} \qquad (3)$$

In case the cumulative threshold (z_{cd}) is 1/D meaning that also children with a single deprivation are included, the interpretation of the CDI is straightforward: a value of 0.2 means that, on average, children are deprived in 20% of deprivation indicators. When the cumulative threshold is set at a higher number of deprivations, individuals with fewer deprivations than the threshold, though included in the denominator will no longer be included in the numerator. This comes at a loss of intuitive interpretation; the resulting number will show the number of deprivations suffered by the cumulatively poor averaged over the total population.

A slightly different perspective would be provided by the CDI *of the cumulative poor*; rather than dividing by the total population we divide by the poor population (q):

$$CDI\_poor = \frac{\sum_{i=1}^{q}(CD_i)^1}{q} \; for \; CD_i \geq z_{cd} \qquad (4)$$

The advantage is that the CDI of the poor focuses only on the poor population and thus the resulting index will represent the average percentage of deprivations experienced by the poor. A problem with this measure, however, is that it could deteriorate while the overall level of well-being in society increases: if, for instance, the person closest under the cumulative poverty line escapes from poverty, *ceteris paribus*, the CDI of the cumulative poor will deteriorate while one person's well-being improved.

In all cases the CDI and the CDI of the poor measures satisfy dimensional monotonicity; if a cumulatively deprived child becomes deprived in one more domain, the index deteriorates.

Relative Cumulative Deprivation Threshold (RCDH, RCDI)

Monitoring poverty and social exclusion in a European Union context automatically involves taking a cross-national comparative perspective. If one were to approach cumulative deprivation as an indicator of social exclusion, one might object that the CDH and CDI are not sensitive to the 'normal' level of deprivations in the benchmark society. From a relative perspective, can a person who is deprived in two indicators be considered socially excluded if being deprived in two indicators is rather common in that society? Given that indicator deprivation rates in Greece are much higher than those in The Netherlands, is a Greek child less disadvantaged vis-à-vis its Greek peers than its Dutch counterpart if both live in a household that is not able to afford an annual one-week vacation? An affirmative answer to this question implies that a measure of cumulative deprivation should also take typical deprivation levels of a country into account. A

straightforward way to do this is to follow standard practise in relative income poverty measurement: the cumulative deprivation threshold (z_{rcd}) is now set relative to the median or average (fraction of) deprivations in the child population (μ):

$$z_{rcd} = (1 + k)\mu \qquad (5)$$

where k typically reflects a value between zero and one. For instance, if the median or average number of deprivations in a population is two out of a total of D deprivations (μ=2/D) and k is set at 0.5, the relative cumulative deprivation threshold is set at 3/D; hence children with three or more deprivations are in cumulative deprivation.

One can use z_{rcd} to compute the relative counterparts of the CDH and CDI.[11] Essentially, these relative measures compare the cumulative disadvantage of a child relative to that of her peers. A drawback of this class of measures is that the so-called focus axiom is not satisfied: this axiom states that changes in the non-poor population should not affect the measure. However, relative measures by definition also take the non-poor population into account: as the distribution of deprivations is used to establish the relative cumulative threshold (z_{rcd}), changes in the number of non-cumulatively deprived distribution can affect the threshold and thus the relative cumulative deprivation measure. In line with the CDI, RCDI is sensitive to changes in the breadth of deprivations.

Concluding, the measures discussed fall into two broad categories: headcount indices (counting the percentage of cumulatively deprived persons) and cumulative deprivation indices (measuring the breadth of deprivations). A further distinguishing characteristic is that the cumulative deprivation threshold could be set in a relative manner i.e. the relative cumulative deprivation threshold depends on the typical breadth of deprivations in society. The overview in Table 1 summarizes whether each of the measures discussed has the desired properties: only two variations of the CDI measure satisfy both properties. On the other hand, the relative measures seem to fit well in an EU poverty and social exclusion indicators context. Whereas the other measures allow making cross-national comparisons regarding the (absolute) degree of cumulative deprivation among common indicators (i.e. reflecting a common threshold across the EU), the RCDH allows for a cross-national comparison in the degree of relative cumulative deprivation (i.e. respecting national differences between levels of cumulative deprivation). The aim of the remaining sections is to operationalise, calculate and test these measures.

[11] In our calculations in sections 4 and 5 the value of k is set at 0.5 of the median fraction of deprivations.

Table 1: Comparison properties of cumulative deprivation measures

	Intuitive interpretation	Sensitive to changes in the breadth of deprivations of the cumulatively deprived
CDH	Yes	No
CDI if z_{cd}=1/D	Yes	Yes
CDI if z_{cd}>1/D	No	Yes
CDI of the poor	Yes	Yes
RCDH	Yes	No
RCDI	No	Yes

4. OPERATIONALISATION

To operationalise the above-discussed cumulative deprivation in the context of child well-being in the European Union, a range of choices has to be made, each of which will influence the estimates. Evidently, the availability of data represents a key constraint in this process. In our view, the empirical implementation as presented below reflects a reasonably good starting point but one that can certainly be improved when more data become available. In this section we motivate our choices and we flag which aspects will be tested in our sensitivity analyses.

Data

To measure cumulative deprivation at an individual level it is necessary to have the information on all indicators available in a single dataset. Furthermore, the information needs to be comparable between EU member states. We therefore chose to work with the EU Community Statistics on Income and Living Conditions (EU-SILC) data. These data have been collected in the EU member states since 2004; we work with the 2007 wave as this was the most recent available at the beginning of the research project. The EU-SILC data provide both cross-sectional and longitudinal information on a range of indicators; they are the source of many EU social indicators.

We focus our analysis on a subgroup of four member states (Germany, France, The Netherlands and the United Kingdom) for two practical reasons. Firstly, an analysis with all available countries is rather time consuming and, to understand the behaviour of the measures, we do not need the full sample. Secondly, the EU-SILC data are constructed *ex post* by harmonizing the information from the multi-purpose national surveys that feed into the EU-SILC; differences between variables across countries may arise due to differences in the formulation of questions and data collection processes in general. We want to minimize this potential source of variation; our selection of countries is thus based on a comparison of the questionnaires and the analysis of descriptive statistics for our (pre)selection of indicators. The selected countries have comparable living standards. Nevertheless, they are different in terms of their demographics, the economy

and labour market, social policies and tax systems (e.g. Whelan and Maître, 2010; Whelan, Nolan and Maître, June 2008). It is thus reasonable to expect that such differences will lead to sufficient variation in child well-being outcomes to test the empirical behaviour of the cumulative deprivation measures.

Indicators, thresholds and domains

Table 2 lists the selected indicators within their respective domains (for a more elaborate discussion see Notten and Roelen, November 2010, p. 10-15). Our selection of indicators has been guided conceptually by the acknowledgement that child well-being is multidimensional, that it incorporates a child's current well-being in addition to her well-becoming and that a single indicator can reflect aspects of well-being and well-becoming at the same time (for a more elaborate discussion see Notten and Roelen, November 2010, p. 8-10). For instance, when a child lives in a family that cannot afford a computer s/he might be affected in several ways. Firstly, access to a key resource used in social interactions with peers is (more) difficult. Secondly, s/he has fewer opportunities to gain proficiency in using computers and their software.

Table 2: Deprivation indicators: definitions

Housing	Dwelling has leaking roof, damp walls/floors/foundation, or rot in window frames or floor
	Dwelling is not comfortably warm during winter time
	Dwelling is overcrowded (threshold: see notes under this table)
Neighbourhood	Pollution, grime or other environmental problems
	Crime/violence or vandalism in the area
Basic services	Access to primary health care services (threshold: some/great difficulty)
	Access to compulsory school (threshold: some/great difficulty)
Financial resources	Household has payment arrears on mortgage/rent, utility bills, instalments/loan payments
	Household cannot afford meal with meat, chicken, fish, vegetarian equivalent every 2nd day
	Household cannot afford one week annual holiday away from home
	Household cannot afford a computer for financial reasons
	Household cannot afford a car for financial reasons
	Ability to make ends meet (threshold: with difficulty or great difficulty)

Note: Most indicators come from the household data (H-file) of the 2007 wave of the EU-SILC; three indicators (dwelling is not comfortably warm during winter time, accessibility of primary health care services and compulsory school) have been retrieved from the 2007 module on housing conditions. The threshold for the overcrowding indicator is based upon the number of rooms in the dwelling and the age, number of and relationships between household members (following TARKI Social Research Institute, 2010).

Without further information, the exact nature of the relationship between these two aspects of well-being cannot be established. Our selection has further been guided by normative

considerations and the principle of universality. Firstly, as deprivation indicators are inherently normative, "an indicator should identify the essence of the problem and have a clear and accepted normative interpretation" (Atkinson et al., 2002, p. 21).[12] Secondly, the principle of universality implies that the indicators should be relevant across our sub-group of EU member states (Ruggeri Laderchi, Saith, Stewart, 2003, p. 244).

Confirming the lack of child specific indicators as discussed in section 2, we find that the EU-SILC only covers a limited number of the pieces that one would ideally want to include in a multidimensional analysis of child deprivation. While there is a fair amount of information on the physical environment and material and financial resources, information in well-being domains such as health, education, leisure and relationships is much more limited or is not collected at all. We found no appropriate child specific indicators; all indicators are measured at the household level. This, however, does not mean that they are not relevant indicators of child well-being (Gordon et al, 2003) but it implies that we have to assume that household level conditions affect all individuals living in the household, including children.[13]

In an ideal world, the choices of domains, indicators and thresholds represent separate and consecutive methodological steps that researchers take when constructing a multidimensional poverty measure (Alkire and Santos, 2009). However, the practice of working with secondary data means that these choices are highly interdependent; particularly when the information is stored in ordinal variables. For instance, respondents to the survey question "[Can] the household afford a meal with meat, chicken or fish (or vegetarian equivalent) every second day" reflects a possible outcome that could result from insufficient financial means (European Commission, March 2009). Respondents can either answer the question with "yes", "no" or they can refuse to answer. In the extreme, this implies that the choice on whether or not to include this information means that one considers all three methodological steps simultaneously: the choice of domain (financial resources); the choice of indicator (capacity to afford meat, chicken or fish) and the choice of threshold (deprived if household responds affirmatively; deprivation in the sense of financial strain). For nine of our indicators the question was formulated in this way. With three indicators there were several options for setting the deprivation threshold; our sensitivity analysis in section 5 will test the impact of that decision on the cumulative deprivation measures.
We grouped the deprivation indicators into four domains: housing conditions, neighbourhood conditions, access to basic services and financial means. The demarcation was obtained through

[12] The 2007 Eurobarometer survey on Poverty and Social Exclusion aimed at assessing which items European citizens deem as social necessities (Dickes, Fusco, Marlier, 2008). Many of the indicators in Table 2 are perceived as social necessities by 50% or more of the respondents. A computer was only seen as a social necessity by 38%, varying between 20-26% for our subgroup but we believe that this item has increased in importance over the past 4 years, particularly for families with children. The survey also included social necessities that we chose not to include because very few, if any, households in our sample were deprived of it (i.e. fridge, washing machine). Finally, two indicators - access to basic services and ability to make ends meet - were not represented in the Eurobarometer.
[13] Of course, the ways and degree to which those conditions affect individual members of the household can differ but this information problem cannot be resolved with these data.

an intuitive grouping of indicators rather than the identification of latent domains of poverty using tools such as factor analysis or latent class modelling (see Dewilde, 2004; Whelan et al., 2001). This tension between "[…] the power of sophisticated methods […] and the transparency required to serve the needs of policy-makers and inform public debate" has been acknowledged in the literature (Nolan and Whelan, 2010). Given the aim of this paper, we opted for the transparency of an intuitive approach.[14]

Descriptive statistics

Table 3 below lists the sample statistics for the selected countries; the analysis in this paper focuses on the children aged 0 to 17 years and the characteristics of the households in which they live.

Table 3: Sample size [15]

	DE	**FR**	**NL**	**UK**
	total	**total**	**total**	**total**
households	14,153	10,498	10,219	9,275
individuals	31,709	25,907	25,905	21,942
children 0-17	6,185	6,314	6,948	4,927

Source: authors' calculations with EU-SILC, wave 2007.

Table 4 summarizes the indicator deprivation rates and their confidence intervals. Deprivation rates differ considerably across indicators: indicators referring to the affordability of a holiday, the experience of pollution or environmental problems and the presence of leaks or damp in the house display relatively high deprivation rates (13-32 per cent) while indicators referring to the affordability of assets such as a computer or car are considerably lower (2-7 per cent).[16]

[14] While the indicators used in this study show considerable overlap with those used in other European studies, the definition of domains differs among studies (Bradshaw and Richardson, 2009; Dewilde, 2004; Whelan et al. 2001). DeWilde (2004) has similar indicators in financial strain domain but her latent variable analysis for the UK and Belgium (1994-1999 panels) suggests that these indicators should be divided over two domains which she labels as 'limited financial means' and 'financial stress'. Using factor analysis, Whelan, Layte, Maître and Nolan, (2001, p. 361) find five domains that seem to work for all countries in the European Community Household Panel (1994-2000). Their two lifestyle domains overlap with our financial strain domain and the authors sometimes also group both domains in one. Their environment domain overlaps with our neighborhood domain while our housing indicators are spread between their housing and environment domain. Bradshaw and Richardson (2009) use in part the same indicators and data as this article (in addition to other data sources). These authors group monetary poverty, economic strain and lack of consumer durables in one 'material domain'. They also group the housing and neighbourhood indicators in one domain (labeled 'housing and environment').

[15] Germany joined the EU-SILC data in the 2005 round. Ex-post quality comparisons between the 2005 rounds of Microcensus, GSOEP and EU-SILC data suggest that population groups such as very young children (age 0-4), those with low education levels and certain groups of foreign residents, are under-represented in the EU-SILC (Hauser, 2008). Currently it is not clear to what extent these issues have been resolved in the 2007 survey round.

[16] Tables A1 and A2 in the appendix summarize the pair wise correlations between the indicators: higher positive correlations are a first indication of a higher likelihood of double deprivation.

Table 4: Indicator deprivation rates, children age 0-17 [confidence intervals]

	DE	FR	NL	UK
	%	%	%	%
Housing problems				
leaks/damp present in house	16.1	15.7	20.1	17.3
	[14.7,17.6]	[14.2,17.4]	[18.2,22.2]	[15.5,19.2]
unable to keep house warm	6.4	4.6	1.9	5.2
	[5.5,7.4]	[3.8,5.5]	[1.2,3.0]	[4.0,6.6]
overcrowding	9.1	14.9	4.7	12.0
	[7.9,10.4]	[13.2,16.9]	[3.6,6.2]	[10.3,13.9]
Neighbourhood problems				
experienced pollution/environmental problems	20.9	15.4	13.4	13.1
	[19.3,22.5]	[13.6,17.4]	[11.9,15.0]	[11.6,14.6]
experienced crime/violence/vandalism	12.3	15.5	17.7	28.3
	[11.1,13.7]	[13.9,17.3]	[16.1,19.5]	[26.3,30.4]
Difficult access to basic services				
difficult to access primary health care	12.5	7.6	8.8	4.7
	[11.2,13.9]	[6.5,8.9]	[7.7,10.1]	[3.7,5.8]
difficult to access compulsory school	16.4	6.8	7.2	8.1
	[15.0,17.9]	[5.8,7.9]	[5.9,8.7]	[6.8,9.7]
Financial strain				
combined arrears indicator	7.7	12.9	5.1	14.0
	[6.7,8.9]	[11.4,14.4]	[4.1,6.4]	[12.3,15.9]
not able to afford holiday	30.1	32.5	13.7	30.4
	[28.2,31.9]	[30.5,34.6]	[11.9,15.9]	[28.2,32.7]
cannot afford meat etc. every second day	11.2	6.4	1.1	4.8
	[9.9,12.5]	[5.4,7.6]	[0.8,1.6]	[3.8,6.0]
cannot afford a computer	2.2	7.0	0.6	5.5
	[1.7,2.8]	[6.0,8.1]	[0.2,1.6]	[4.5,6.7]
cannot afford a car	4.1	3.5	4.6	6.7
	[3.4,4.8]	[2.7,4.6]	[3.4,6.2]	[5.5,8.3]
difficult to make ends meet	6.7	20.3	12.1	20.2
	[5.8,7.7]	[18.5,22.2]	[10.4,14.2]	[18.3,22.3]
Number of households	14,153	10,498	10,219	9,275
Number of children (age 0-17)	6,185	6,314	6,948	4,927

Source: authors' calculations with EU-SILC, wave 2007. Standard errors take account of the survey sampling design.

Overall, indicator deprivation rates tend to be lower in the Netherlands but they can differ quite considerably across countries. For example, whilst the UK presents the highest crime deprivation rates (28 per cent) and the lowest deprivation rate with respect to pollution (13 per cent), this picture is completely opposite for Germany (12 versus 21 per cent). Furthermore, the problem of being unable to afford a holiday is almost twice as high as crime deprivation in Germany and France, whilst crime is perceived as a greater problem in the Netherlands than the ability to afford a holiday. In sum, results at an indicator level point towards a diverse picture of child deprivation across indicators; one cannot identify indicators that display consistently high or low deprivation rates across all countries[17] and one cannot rank countries consistently on the basis of their performance with respect to the different indicators (see Roelen and Notten (2011) for an elaborate analysis and discussion of child poverty at a domain level).

Table 5: Distribution of indicator deprivations, as a percentage share of children age 0-17

Number of deprivations	**DE**	**FR**	**NL**	**UK**
0	34.0	34.8	42.8	31.4
1	25.2	25.0	29.8	26.9
2	17.9	14.9	14.1	15.0
3	10.2	10.1	6.4	11.1
4	6.2	5.9	3.8	6.1
5	3.1	4.6	1.6	4.5
6	1.7	2.5	0.9	2.8
7	0.8	1.2	0.4	1.3
8	0.4	0.6	0.1	0.7
9	0.3	0.2	0.2	0.2
10	0.2	0.1	0	0
11	0	0.1	0	0
12	0	0	0	0
13	0	0	0	0
Total	100 %	100 %	100 %	100 %
Relative Cumulative Threshold (1.5 times the median number of indicator deprivations)	1.5	1.5	1.5	1.5

Source: authors' calculations with EU-SILC, wave 2007. Estimates take account of the survey sampling design.

Table 5 provides some first insights into the degree of cumulative deprivation experienced by children in these EU member states: about three in every ten of the French, German and British children are not deprived in any of the indicators; for Dutch children this is about four in every

[17] Indicator deprivation rates can also show a clear trend over time; home computers, for example, have become more affordable in quite a short period of time.

ten. On the flip side this means that it is quite common for children to live in households that are deprived in one or more indicators. The largest share of children is deprived according to a single indicator (ranging from 25-29%) but the shares of double and triple deprivation are still considerable (ranging from six to 18%). Less than five per cent of children live in households suffering from 6 or more deprivations.

From the table it is also relatively easy to see what the levels of Cumulative Deprivation Headcount (CDH) would be: for a cumulative deprivation threshold of one, respectively 68.6%, 65.2%, 66.0% and 57.2% of British, French, German and Dutch children would be cumulatively deprived. Not surprisingly, cumulative deprivation rates drop considerably as the cumulative deprivation threshold increases.

Moreover, the deprivation distribution is also the reference for establishing the relative cumulative deprivation threshold. In this study we focus on the median number of deprivations (i.e. the number of deprivation experienced by the 50^{th} percentile of the population): for all countries this coincides with a single deprivation. For the purpose of this study we set the cumulative deprivation threshold at 50 per cent of the median (thus 1.5 deprivations); as the deprivation counts only integers this effectively this means that children with two or more deprivations are counted as relative cumulative deprived. We choose 50% of the median as this closely corresponds to the relative threshold of the EU at-risk-of-poverty indicators which is set at 60 per cent.[18]

Aggregation to cumulative deprivation measures: weights

All the cumulative deprivation measures discussed in this paper are so-called composite indices meaning that they are constructed using more than one indicator. In the aggregation process, the construction of a composite index faces more decisions regarding weights than single indicator indices. Whereas a single indicator index only requires choosing whether shortfalls to the threshold are weighed equally or not, a composite indicator additionally faces choices regarding the weight of indicators and domains of well-being. In all cases the choice will influence the estimates of the composite index.

Given the structure of our data, (most of) our deprivation indicators are binominal (i.e. one if deprived and zero if not deprived) implying that, for a given indicator, each deprived person will have an equal weight even though there might be differences in the degree to which they are deprived (but unfortunately this is not registered in the data). We can, however, choose in what way we weigh the indicators and domains. The range of weighting options is well summarized and compared in a recent working paper by DeCancq and Lugo (August 2010), and Guio (2009,

[18] Unless the median number of deprivations is 10, the cumulative deprivation thresholds will be the same with a 50% or 60% threshold.

section 4, pp. 13-24) tests three of those methods on two EU indicators of material deprivation: equal weights, frequency-based weights and stated preferences weights. The first method is a normative method in the sense that the researcher decides on the relative importance of each indicator and dimension; the equal weights option is a popular method reflecting the value judgement that each indicator is equally important. The frequency weights method is a data-driven method, the indicator receives a lower weight (typically the inverse of the deprivation rate) if many people are deprived in that item and a higher weight if only a few are deprived. This method implicitly makes the value judgement that deprivation is judged from a relative perspective; it is worse to be deprived if most people are not. The stated preferences weights are determined by prevailing norms in society as typically measured by opinion surveys such as the Eurobarometer; items that are valued more highly by the average population get a higher weight than those that are less valued. As four of our indicators do not feature in the Eurobarometer, we cannot test the stated preferences weights but we can test the frequency weight method. Our primary choice though is the equal weights method simply because the interpretation of the estimates is more intuitive.

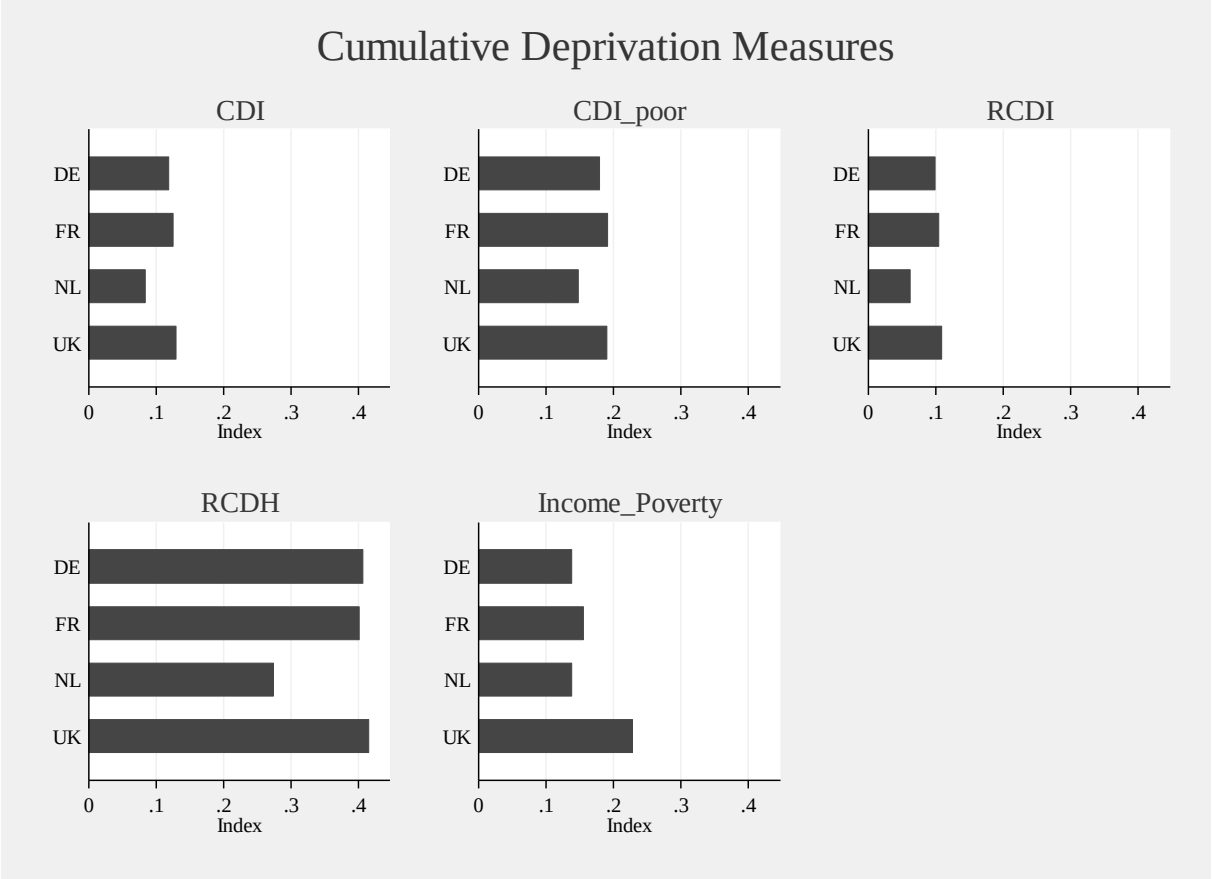
However, even when using the equal weight method we have to choose whether we want to put an equal weight on every *indicator* or on every *domain*; unless one has an equal amount of indicators in each domain this is not a trivial choice. In their recent study comparing a new multidimensional poverty index for 104 developing countries, Alkire and Santos (July 2010, p. 17) use equal weights (33.3%) for every domain (education, health, standard of living) and, consequently, different relative weights for the deprivation indicators within those domains (varying from 5.6% to 16.7%). While this approach is preferable with such distinct and relevant domains of well-being, we do not think that would be appropriate in our case: there is considerably less agreement about the demarcation of the domains for our selection of indicators (see the discussion in footnote 14) and, as we already acknowledged, from a multidimensional child well-being perspective many relevant domains are not covered by the data (they thus implicitly have a weight of zero in our index). We therefore use equal indicator weights as our default.

Finally, it should be noted that even when equal weights are specified, indicators with higher deprivation rates will have a larger contribution to the composite index (Alkire & Santos, July 2010). As can be seen in Table 4 above, quite some families cannot afford a one week vacation but only few families cannot afford a computer; the contribution of the holiday deprivation indicator to the cumulative deprivation estimate will thus be higher. It is therefore important to also test the impact of excluding a deprivation indicator from the cumulative deprivation measures.

5. CUMULATIVE DEPRIVATION MEASURES: BENCHMARK ESTIMATES

This section reports the first round of estimates for the cumulative deprivation measures and investigates to what extent the level of cumulative deprivation differs between the cumulative deprivation measures but also with respect to the EU's at-risk-of-poverty estimates (income poverty). As estimates such as these are used for both national and international comparative purposes, we briefly comment on within and between country differences as well as differences between different groups of children. In the next section, these estimates will serve as a benchmark for comparison in the sensitivity tests.

Figure 1: Cumulative deprivation measures and income poverty



Source: authors' calculations with EU-SILC, wave 2007. Estimates take account of the survey sampling design.

The measures in Figure 1 can be divided into two subgroups: headcounts and deprivation-adjusted headcounts. The Income Poverty and Relative Cumulative Deprivation Headcount

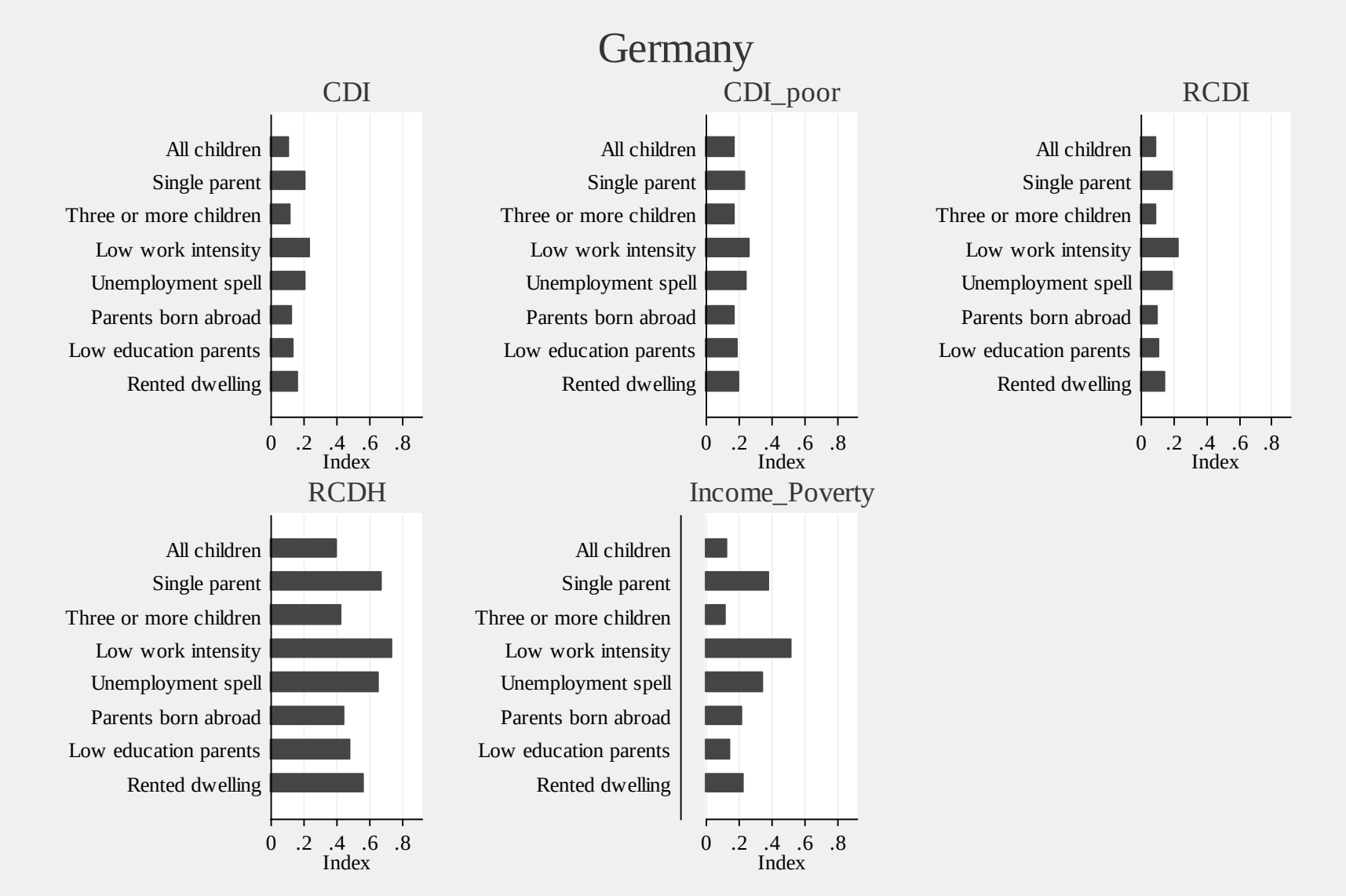
(RCDH) measures reflect the percentage of children that are respectively living in income poor[19] or cumulatively deprived households. As explained in the previous section (see also Table 5), the RCDH includes a child as relatively cumulatively deprived if s/he lives in a family that has 50% more deprivations that of the median child; for all the countries in this paper this is when a child suffers from two or more deprivations. The higher scores of the RCDH suggest that cumulative deprivation is a much more common phenomenon in our societies than income poverty: 28% for the Netherlands and 40-42% for Germany, France and the United Kingdom while income poverty rates differ respectively from 14 to 23%. This means that a considerable group of cumulatively deprived children must be part of a household that has an income above the poverty line; in spite of this, the resources do not suffice to prevent cumulative deprivation. In Roelen and Notten (2011) this overlap between monetary poverty and non-monetary dimensions of deprivation is further analyzed; the study not only confirms the above result but it also shows that part of the income poor households are *not* deprived in non-monetary dimensions.

The headcount measures do not provide any insights into the depth and breadth of poverty and deprivation while all three Cumulative Deprivation Indices in Figure 1 take the breadth of deprivations into account (but not the depth). The Cumulative Deprivation Index (CDI) counts every deprivation of every child and thus also includes single deprived children; the estimate reflects the average percentage of deprivations experienced by all the children. As our analysis includes 13 deprivation indicators, a score of 0.077 means that children, on average, experience one deprivation (1/13=0.077); a score of 0.154 indicates an average of two deprivations. The CDI's of the countries in this paper lie in between these two scores: 0.085 for the Netherlands, 0.120 for Germany, 0.126 for France and 0.131 for the United Kingdom. The CDI of the poor also counts every deprivation of every child but rather than including all children in the denominator it shows the average percentage of deprivations as experienced by *poor* children. This explains why the scores of the CDI of the poor are higher than those of the CDI: the CDI of the poor ranges from 0.15 in the Netherlands to 0.18-0.19 in Germany, France and the United Kingdom. Thus, on average, poor children experience two deprivations. The Relative CDI only counts every deprivation if a child lives in a household experiencing 50% more deprivation than the median household. As a group of deprived children is then excluded, the resulting scores of the RCDI are lower than those of the CDI and the CDI of the poor: they range from 0.06 in the Netherlands to 0.10-0.11 in the other three countries. Given this exclusion, the RDCI looses the intuitive (average) interpretation of the other two CDI measures.

[19] A household and all its individuals is income poor if its adult equivalent income is less than 60% of the national median income. It should also be noted that while the relative deprivation threshold is determined on the basis of what is observed for households with children, the income poverty threshold is calculated according to the median income of the overall population, i.e. also including households without children. This has implications if households with children are dissimilar from the median household in the population as a whole. For instance if households with children have a higher median number of deprivation the relative threshold will be higher than for the population as a whole; as a consequence relative cumulative deprivation rates will be lower.

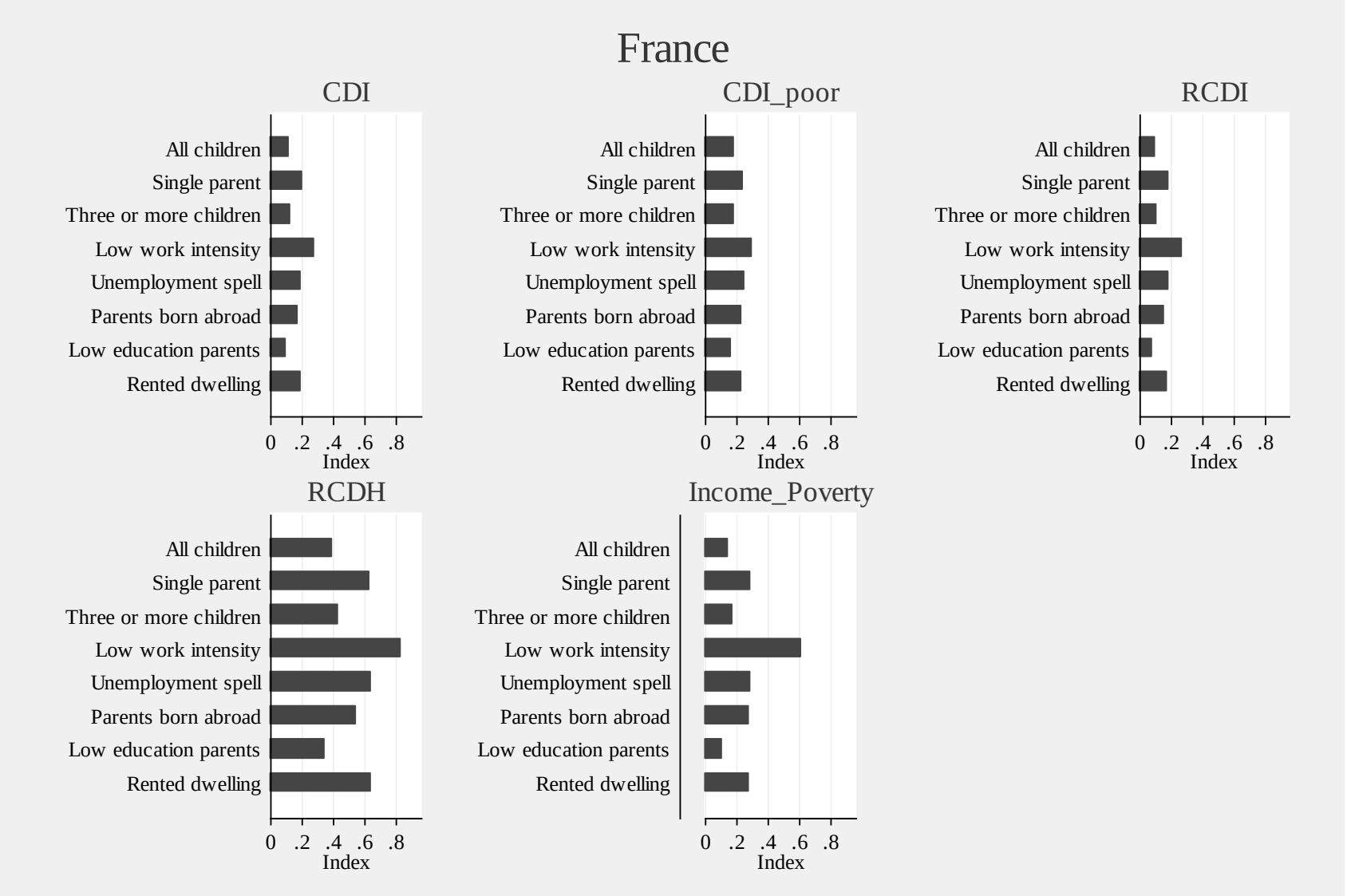
Taking an international comparative perspective, the Netherlands has the lowest level of cumulative deprivation according to all indices and it has the lowest income poverty rate. When moving from Germany to France and the United Kingdom, cumulative deprivation levels and income poverty increase without any reversal of the ranking in countries. Even though the United Kingdom performs worst according to all measures (in comparison to the other countries), it performs much worse in income poverty and less badly in cumulative deprivation. Though we do not further investigate the underlying reason for this result, a potential explanation could be that despite the larger dispersion of the (adult equivalent) income distribution, British households with children have enough access to (public and financial) resources to prevent a concurrent level of deprivations.

Figure 2: Poverty profile Germany



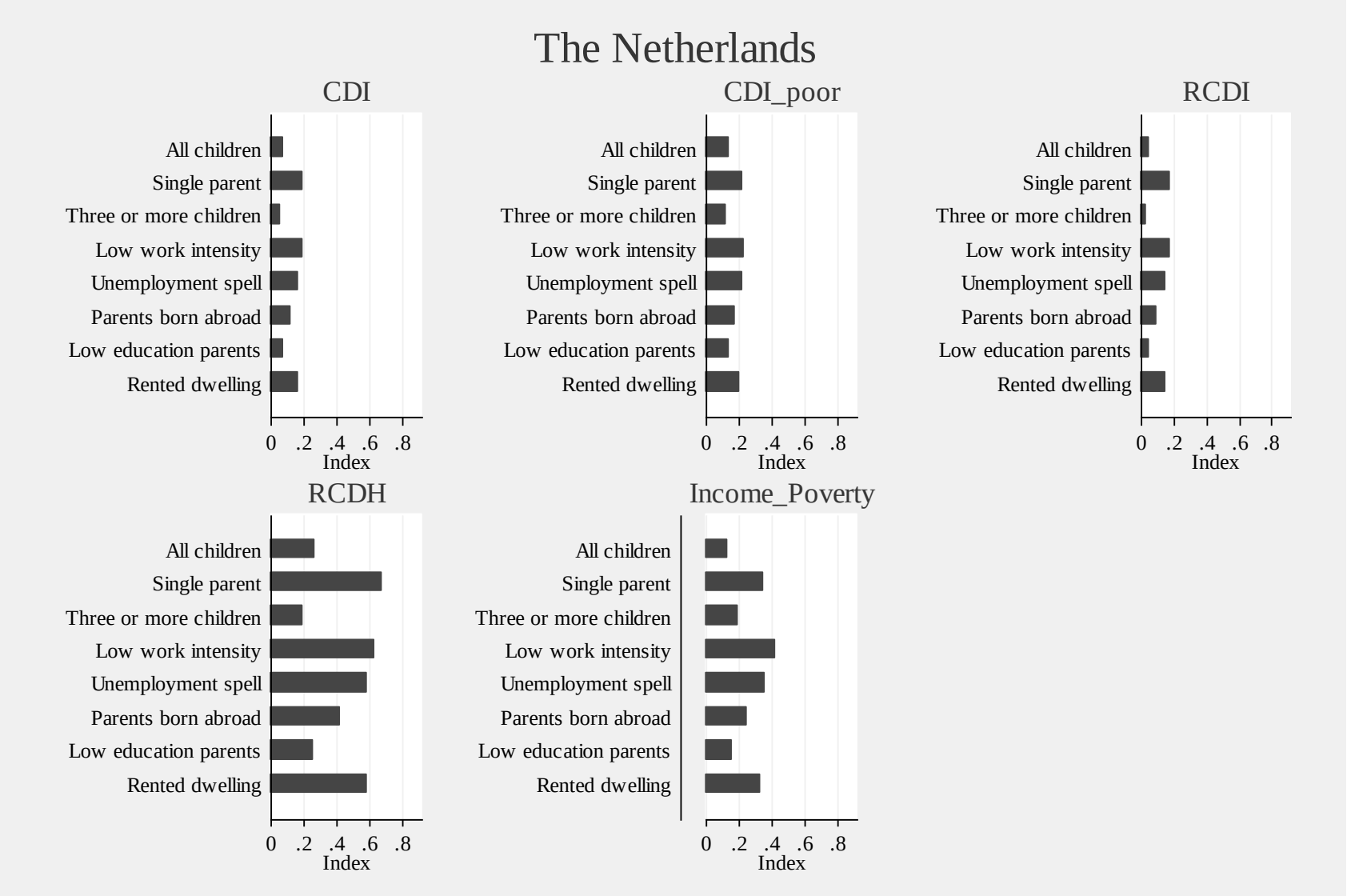
Source: authors' calculations with EU-SILC, wave 2007. Estimates take account of the survey sampling design.

Figure 3: Poverty profile France



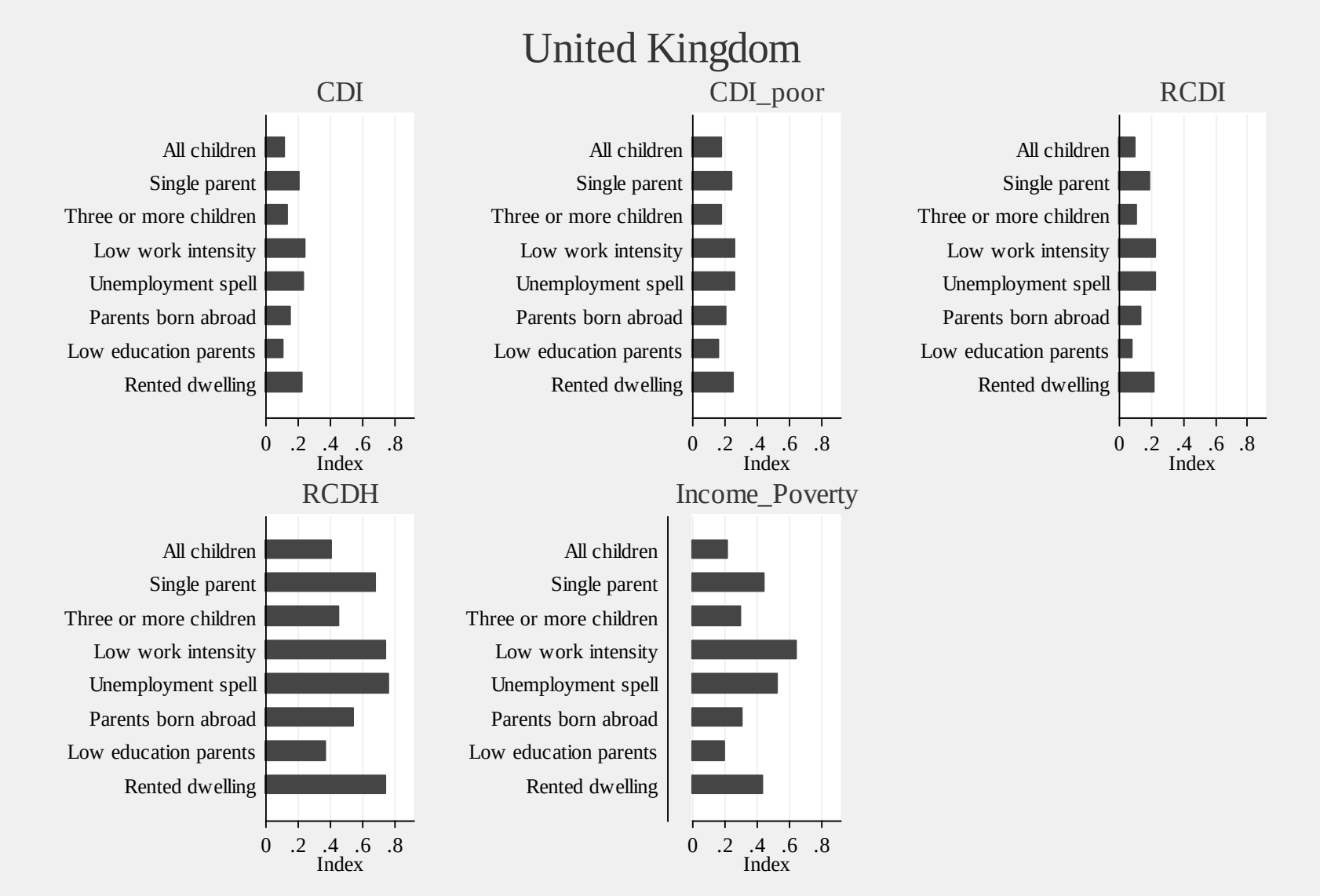
Source: authors' calculations with EU-SILC, wave 2007. Estimates take account of the survey sampling design.

Figure 4: Poverty profile The Netherlands



Source: authors' calculations with EU-SILC, wave 2007. Estimates take account of the survey sampling design.

Figure 5: Poverty profile United Kingdom



Source: authors' calculations with EU-SILC, wave 2007. Estimates take account of the survey sampling design

Figures 2 to 5 compare the national scores to those of subgroups in the population. Rather than an in depth exploration of the characteristics associated with a high or low risk of cumulative deprivation, this paper aims to test and compare a range of cumulative deprivation measures: it is thus not necessary to provide a complete poverty profile. This analysis focuses on a number of characteristics that are typically associated with a higher risk of income poverty: single parenthood, households with many children (three or more), low work intensity households (the extent to which adult household members are working), an unemployment spell experienced by the parents in the past year, both parents are born abroad, low education (neither parent has post-secondary education) and living in a rented dwelling.[20]

We are interested in finding out whether these high risk income poverty characteristics are also associated with an increased risk of cumulative deprivation: single parenthood, low work intensity, an unemployment spell and rented accommodation are high risk characteristics for every measure in every country including income poverty. Parents born abroad represent a somewhat higher risk according to some cumulative deprivation measures in some countries; in all countries such households are at risk of income poverty. In most cases, no post-secondary education or a large number of children are not high risk characteristics.

Relative to other French families with high risk characteristics, French children living in a low work intensity household have by far the highest chance of income poverty and cumulative deprivation. The relative risk of income poverty, however, is much larger than those of the cumulative deprivation measures (triple rather than double the average deprivation rate). For high risk characteristics in the other countries, the relative risk of income poverty also seems considerably higher than that of the cumulative deprivation measures. Interestingly, in the Netherlands this phenomenon not only occurs for income poverty but also for the other relative measures (RCDI and RCDH). Without further investigation is not possible to say whether this feature can be explained predominantly by methodological factors[21] or by real differences between the income and cumulative deprivation distributions.

In sum, this section has shown that the levels of cumulative deprivation vary considerably among one another (especially between headcount and adjusted-headcount measures) and with income

[20] Table A3 in the appendix summarizes the population shares for each of these groups.

[21] For instance, in this paper the equivalence scales used for the income poverty and the cumulative deprivation measures are different. To calculate income poverty, household income is adjusted with the modified OECD equivalence scales which assume that an additional adult member will only require 50% more of the resources than a single adult household while children require only 30% extra resources. To calculate cumulative deprivation we use household level indicators and do not make any adjustments with respect to the size of the household; this means that no extra resources are required for larger families. In practise, larger households are likely to have more resources than smaller households, but it is a priori not clear whether this will make them more or less likely to be deprived at an indicator level and a cumulative deprivation level. Car or computer ownership might be more likely while the larger family might be more likely to have an overcrowded dwelling or have (more) trouble financing a family vacation.

poverty. Country rankings appear relatively stable as do the high risk poverty characteristics of single parenthood, low work intensity, unemployment spells and rented dwelling. Nevertheless, differences were found in other high risk characteristics and in the relative risk between income poverty and (some of the) cumulative deprivation measures.

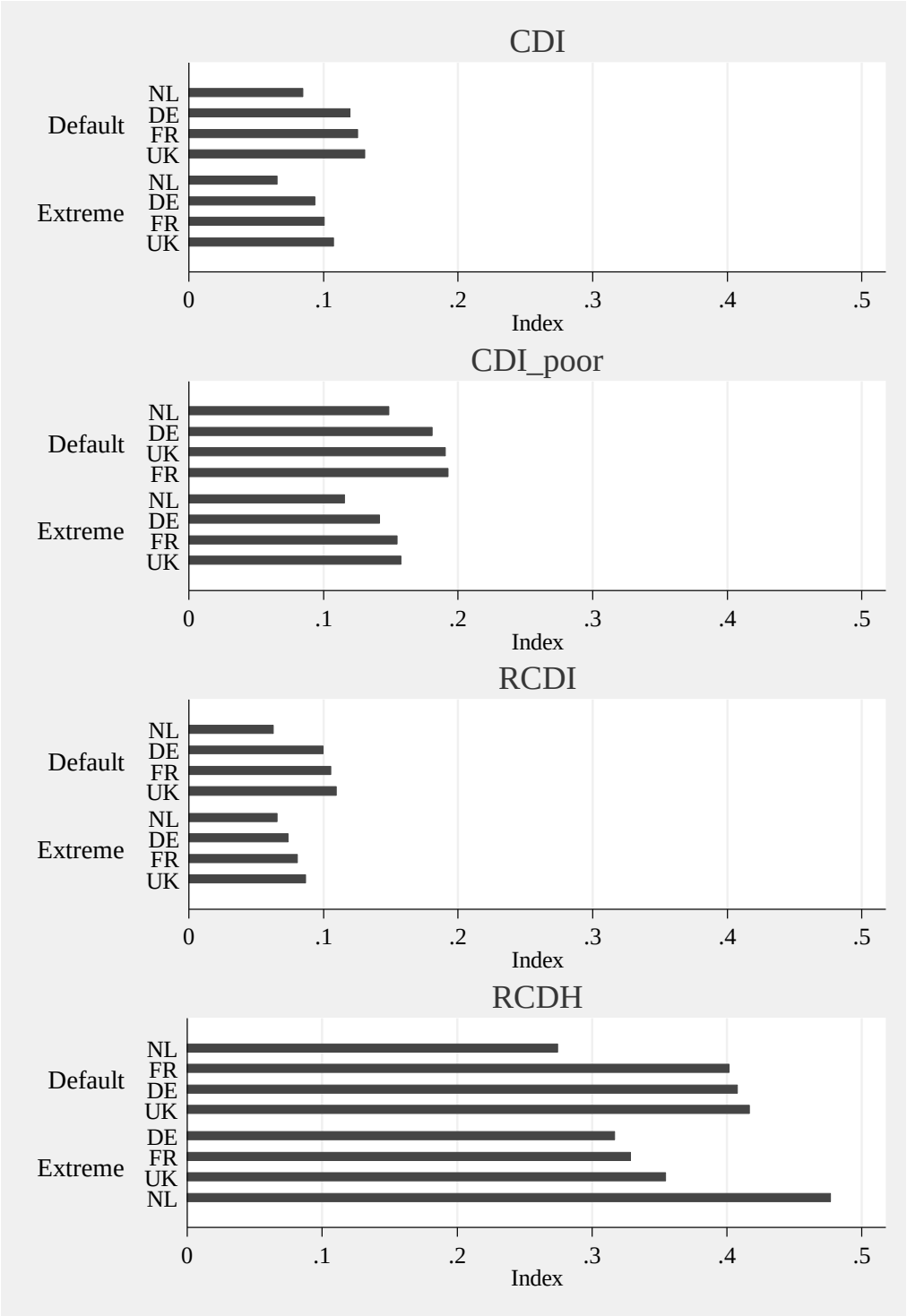
6. CUMULATIVE DEPRIVATION MEASURES: SENSITIVITY ANALYSIS

An effective welfare measure must be able to track changes in levels of well-being over time and between groups i.e. it needs to be responsive. However, a measure whose estimates are highly sensitive to even small adjustments in the construction methodology is problematic, particularly if those adjustments lead to inconsistencies in the interpretation of the results. For instance, an improvement in welfare is not picked up by the measure, or rankings between groups or countries are reversed. So, while the cumulative deprivation measure must have that first type of responsiveness, we should also test how these measures perform in terms of the latter type of responsiveness. Here, we revisit the key methodological decisions we took in section 4; we re-estimate the cumulative deprivation measures under a number of realistic alternative decision scenarios; and we analyze the degree to which this would change the results. The sensitivity analyses will focus on i) changes in the indicator thresholds, ii) the exclusion of indicators from the cumulative deprivation measure, iii) changes in the cumulative deprivation threshold and iv) changes in the weighting of indicators. Thereafter, the findings from each sensitivity test are compared to find out which cumulative deprivation measure has the best overall performance.

Sensitivity to indicator thresholds

While most of the deprivation indicators in the EU-SILC are binominal, a household is either deprived or not, we could have chosen a different deprivation threshold for four of the indicators: overcrowding, access to school, access to primary health care and the ability to make ends meet. For all four indicators it is possible to choose a more stringent deprivation threshold: we re-estimate the cumulative deprivation measures by simultaneously using a more stringent deprivation threshold for all four indicators.

Figure 6: Deprivation indicator thresholds: impact on cumulative deprivation indices



Source: authors' calculations with EU-SILC, wave 2007. Estimates take account of the survey sampling design
Notes: This figure shows the impact using simultaneously the more stringent threshold for four deprivation indicators: access to primary health care, access to compulsory school, ability to make ends meet and overcrowding. In each sub-graph the countries are ranked in increasing order of their outcome in the default deprivation measure.

In the case of overcrowding our benchmark threshold states that there should be enough rooms in the dwelling so that every couple, single adult, two children under age 12, two same-sex children between age 12 and 17 can have their own room.[22] One possibility for a more restrictive criterion would be to argue that it would also be acceptable to have two teenagers of different gender sharing a room. For the other three variables a more stringent threshold is to consider only those deprived households that respond it is 'very difficult' to have access to basic services and to make ends meet, rather than also including households responding that it is 'difficult'.

The results of the sensitivity test are summarized in Figure 6: in each sub-graph the countries are ranked in increasing order of their outcome in the default deprivation measure. Using more stringent indicator thresholds means that some children are now not considered deprived in one or several indicators and one would thus expect that the cumulative deprivation measures should decline. That is indeed the general pattern that occurs for most cumulative deprivation measures, though with one important exception.[23] For the Netherlands the RCDH shows a large *increase* rather than a decline (from 28% of Dutch children to 48%). How is this possible? By making some of the indicator deprivation thresholds more stringent, fewer Dutch children are indicator deprived and this also affects the distribution cumulative deprivation: rather than a median number of deprivations of one, the median Dutch child does not have any deprivation. As a result, the relative cumulative deprivation declines from 1.5 (thus ≥ 2) to 0.5 (thus ≥ 1) and thus now also single deprived children are counted: according to the RCDH the Netherlands are now performing worst of all. Though the sensitivity of the estimates is much smaller, being a relative measure, the RCDI shows similar behaviour: though there is no country rank reversal for the RCDI, the estimate of the Netherlands increases from 0.063 to 0.066 while it decreases for all the other countries. We further discuss the desirability of this phenomenon at the end of this section but from the above discussion it is clear that we could expect the relative deprivation measures to show similar behaviour in the other sensitivity tests.

Sensitivity to the exclusion of deprivation indicators

Ideally, we would have liked to have information on other aspects of children's well-being and well-becoming but the data constrained this choice: we selected 13 indicators because these were the only ones that could be constructed and that passed our selection criteria. Including or excluding indicators will impact the cumulative deprivation measures but *a priori* it is not clear in which direction this will influence the estimates. Firstly, the rate of indicator deprivation determines the effective weight that this indicator has in determining the value of the cumulative deprivation measures: an indicator that has a high percentage of deprived children will make a larger contribution to the cumulative deprivation measure than one for which the percentage of deprived is much smaller. Secondly, all CDI measures measure the number of experienced deprivations relative to that of the total experienced deprivations; excluding an indicator reduces

[22] It should be noted that the survey does not provide information about which household members actually share a room. This deprivation indicator is created by using household information such as age, gender, relationship and the number of rooms in the dwelling.

[23] Germany and France also switch ranks for the RCDH but this is because their cumulative deprivation levels are very close and a small change could easily lead to a rank reversal.

the amount in the denominator while adding another indicator will increase it (see equation 1 in section 3). Thirdly, the relative cumulative deprivation threshold may change as a result of adding or excluding an indicator.

Figures 7 to 10 show how much the estimates will change by excluding one of the indicators at a time. The CDI and CDI of the poor estimates (Figures 7 and 8) either increase or decrease: the exclusion of the high incidence indicators such as inability to afford a one week vacation reduces the estimates while the exclusion of a lower incidence indicators, such as inability to afford a car increases it. Though the estimates are clearly affected, the difference between the highest and lowest estimate is not very large with an order of about 0.02 for the CDI and 0.035 for the CDI of the poor (see Table A5 in the appendix). The country rankings are rather robust for the CDI:[24] out of 13 different CDI scenarios, rankings change for 2 indicators (experienced crime/violence/vandalism, and ability to make ends meet). For the CDI of the poor the UK now regularly performs somewhat better than France and in one case Germany performs worst of all countries (ability to make ends meet).

The relative measures are displayed in Figures 9 (RCDI) and 10 (RCDH). In four of the 13 cases, the exclusion of an indicator triggers a change in the cumulative deprivation threshold in the Netherlands resulting in a large increase in the relative measures, especially in comparison to the three other countries.

[24] Figures 7-10 give a 'within-country' perspective; a reversal in ranking is much easier to spot in a figure that provides a 'between-country' perspective. We can make the 'between-country' perspective available on request.

Figure 7: Exclusion of deprivation indicators: impact on CDI

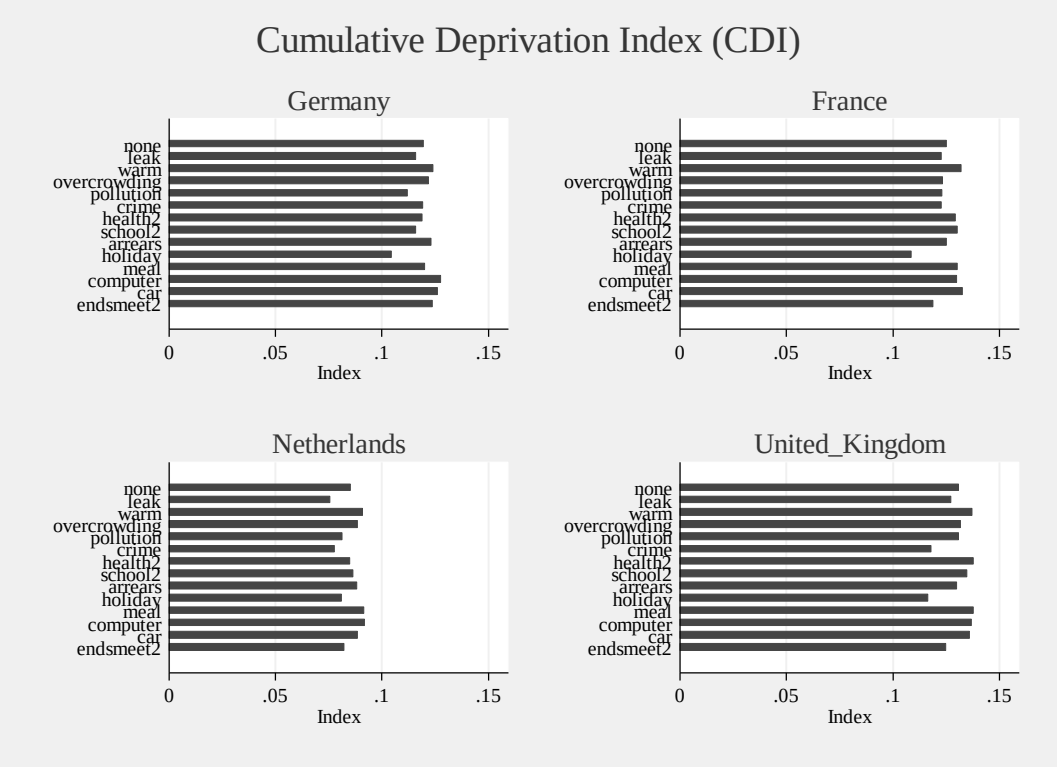


Figure 8: Exclusion of deprivation indicators: impact on CDI of the poor

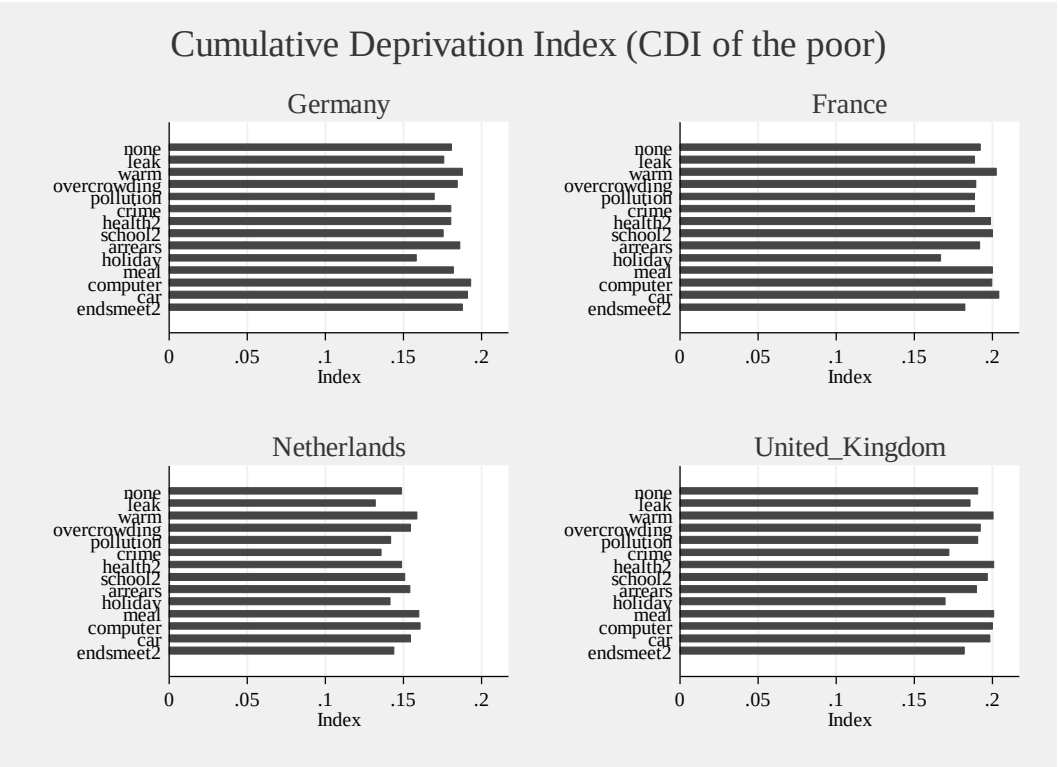


Figure 9: Exclusion of deprivation indicators: impact on RCDI

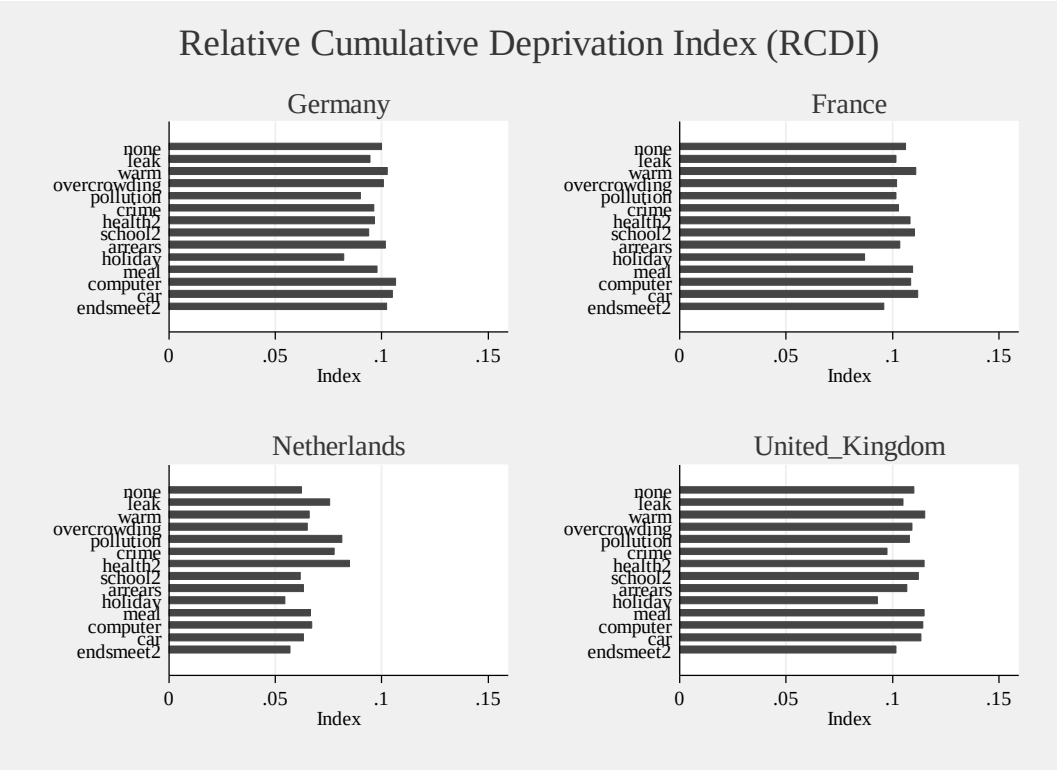
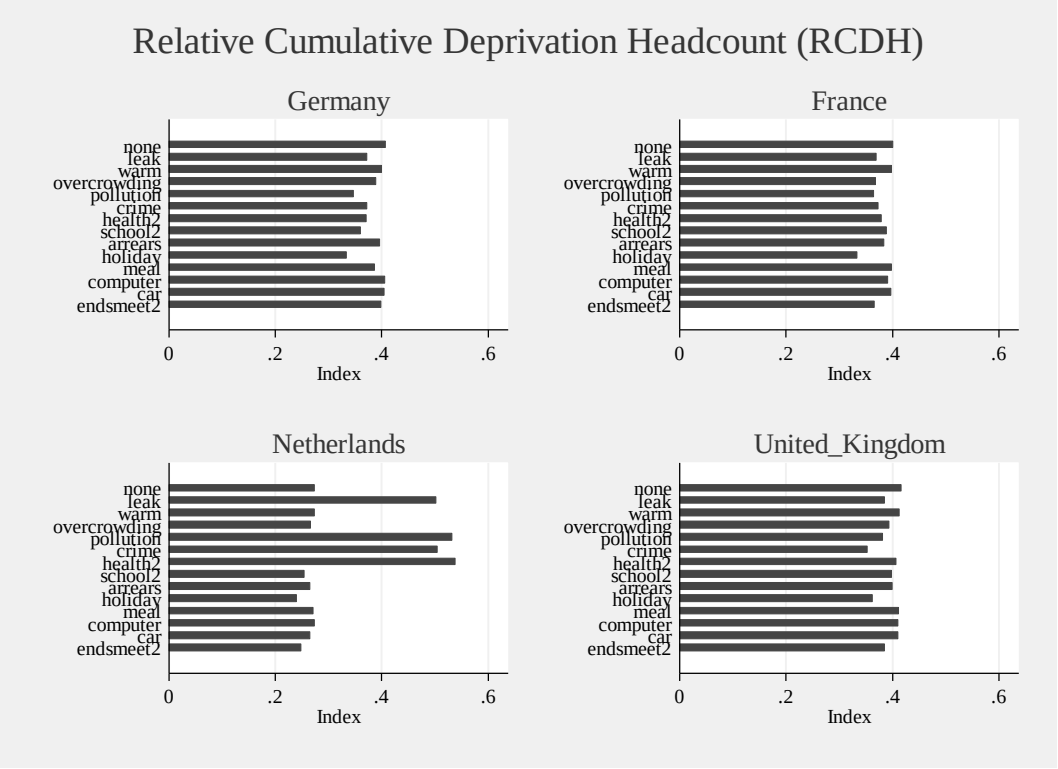


Figure 10: Exclusion of deprivation indicators: impact on RCDH



Sensitivity to cumulative deprivation thresholds

For the CDI and the CDI of the poor our default cumulative deprivation threshold is one because it makes the interpretation of the estimate more intuitive i.e. one can interpret the estimates as the average percentage of experienced deprivations by the population or the poor. For the relative indicators the cumulative deprivation threshold is distribution dependent but we could still change the fraction (k) that determines when the number of deprivations is unacceptably large in comparison to what is typical in that country. Thus, irrespective of the approach, the cumulative deprivation threshold can lie at one or more deprivations. In the poverty measurement literature this choice is also known as the choice between a union (k=1), dual cut-off ($2 \geq k \leq 12$) and intersection (k=13) approach (see for instance Alkire & Santos, 2009, p. 143). Union and dual cut-off approaches are more prevalent than intersection approaches; a person does not need to be deprived in all dimensions or indicators before she is considered multi-dimensionally or cumulatively deprived. Moreover, in our case an intersection approach would yield no cumulative deprivation in any of the four countries as none of the children live in households experiencing all 13 deprivations; in fact, very few children experience 5 or more deprivations (see Table 5). We therefore limit the sensitivity test to cut-offs 1 to 4 which we estimate for the CDI, CDI of the poor and the Cumulative Deprivation Headcount (CDH). The results are displayed in Figures 11 to 13.

Figure 11: Cumulative deprivation threshold: impact on CDI

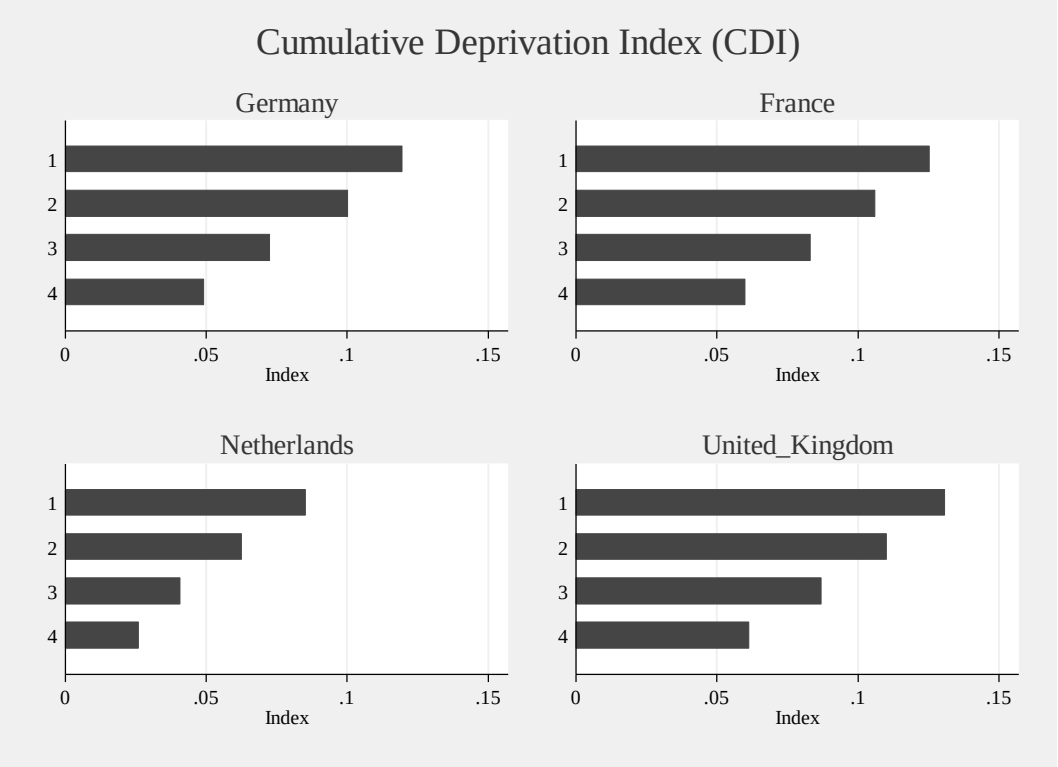


Figure 12: Cumulative deprivation threshold: impact on CDI of the poor

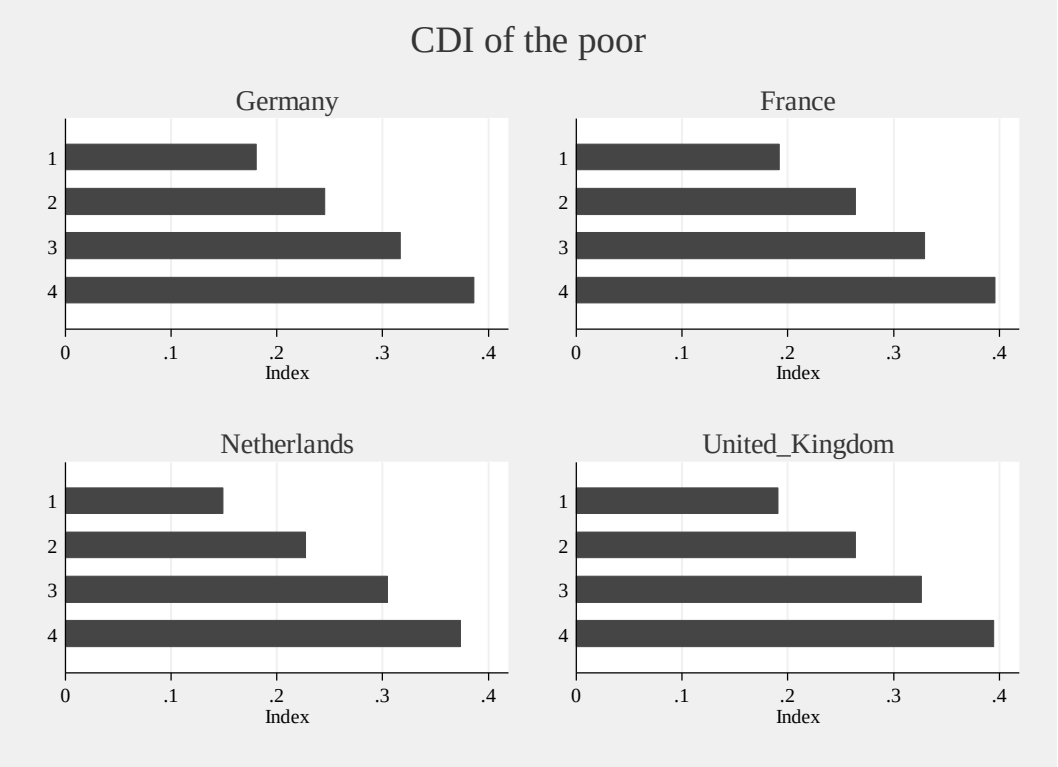
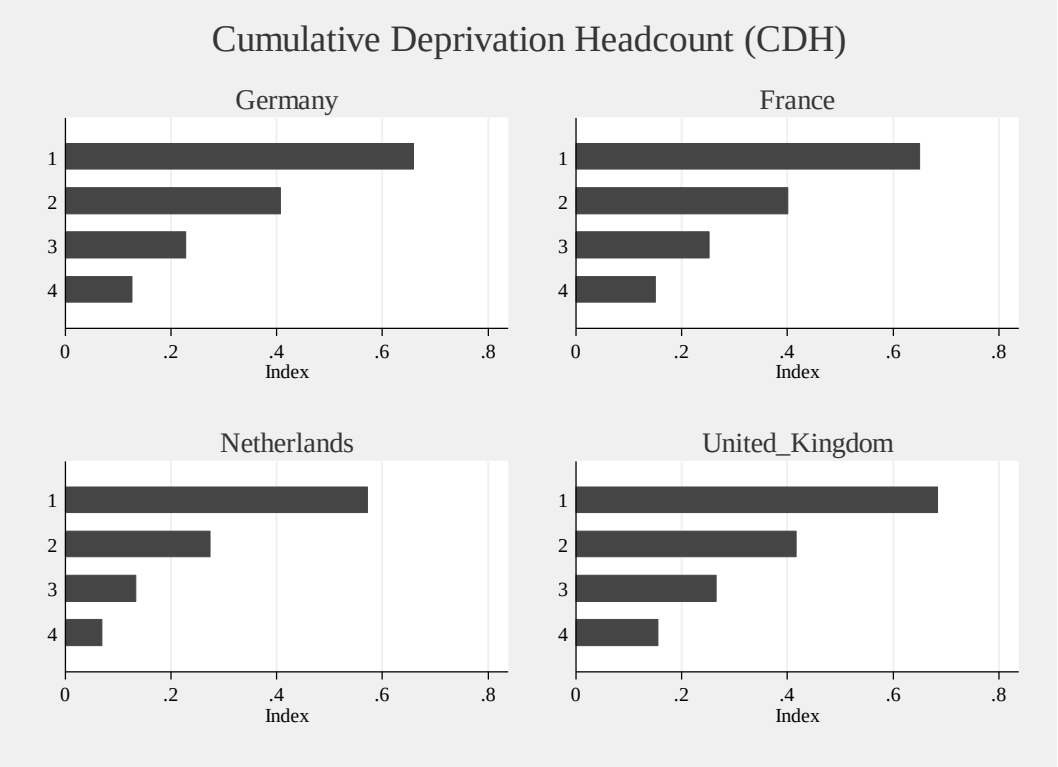


Figure 13: Cumulative deprivation threshold: impact on CDH



As the cumulative deprivation threshold becomes higher, fewer children will be considered deprived even though they might experience deprivation in some indicators. As a result, the CDI and CDH measures will decline as the cumulative deprivation threshold increases (fewer children are included in the numerator while the child population in the denominator will stay constant) while the CDI of the poor will increase (only the poorest children are included in both numerator and denominator). The spread in estimates between the highest and lowest threshold is high for all measures; a change in the cumulative deprivation measure has a very large impact (the indices double or triple in value). In spite of this high sensitivity in levels, for the CDI and CDI of the poor a simultaneous change in threshold for all countries does not influence the ranking; for the CDH Germany and France switch ranks for k=2.

Sensitivity to weighting indicators

Our benchmark estimates give an equal weight to each of the indicators in the cumulative deprivation measure: there are 13 indicators, so each of them has a weight of 0.077 (1/13). In section four we identified two alternatives, of which the frequency weights method is the only one that can be tested with this selection of indicators. Frequency weights depend on the proportion of non-deprived people over the total population; the weight is lower if deprivation rates are higher and vice versa. Under the frequency weighting scheme the indicator weight now varies from 0.059 for the holiday indicator to 0.085 for the car indicator (see Table A4 in the appendix for a complete summary of the changes in weights for every indicator in every country).[25] As the incidence of deprivation differs between the population as a whole and the child population, we have calculated frequency weights based on the deprivation incidence of the total population as well as that of the total child population.

Table 6 summarizes the results: the CDI, CDI of the poor and the RCDI are slightly lower under a frequency weighting scheme; they are exactly the same for the RCDH. These findings correspond with those found by Guio (2009, p. 21) who finds that frequency weights have little impact on countries with relatively low deprivation rates; indicator weights under the frequency method are not very different from that of an equal weighting scheme. For countries with higher deprivation rates, the difference becomes larger: the weights of prevalent deprivation indicators decline thus reducing the estimates under a frequency-based weighting scheme. From an international comparative perspective, this means that the differences in cumulative deprivation will become smaller between richer and poorer countries.[26]

[25] We calculate the weights as proposed in Guio (2009, p. 14).

[26] Guio (2009, p. 21) also tests the impact of consensus weights which are dependent on the average public opinion regarding the necessity of items (if more people find the item a necessity, the weight increases): her findings suggest that consensus weights typically yield estimates below those of equal weights but above those of frequency weights.

Table 6: Cumulative deprivation measures under various weighting schemes

	Equal weights	Frequency weights	
		Population	Children
	CDI		
DE	0.120	0.115	0.114
FR	0.126	0.120	0.119
NL	0.085	0.082	0.081
UK	0.131	0.125	0.123
	CDI of the poor		
DE	0.181	0.174	0.172
FR	0.193	0.183	0.182
NL	0.149	0.142	0.142
UK	0.191	0.182	0.179
	RCDI		
DE	0.100	0.097	0.096
FR	0.106	0.101	0.101
NL	0.063	0.060	0.060
UK	0.110	0.106	0.104
	RCDH		
DE	0.408	0.408	0.408
FR	0.402	0.402	0.402
NL	0.275	0.275	0.275
UK	0.417	0.417	0.417

Summing up the sensitivity analyses: so what's the real confidence interval?

We have tested and analyzed the sensitivity of the four candidates for an EU cumulative deprivation measure with respect to indicator thresholds, the exclusion of indicators, cumulative deprivation thresholds, and weighting schemes. Though we separately tested for each aspect the impact of one or several reasonably alternative choices, we did not exhaust all possible options: we could have tested more extreme choices (such as a cumulative deprivation threshold of 5 or 6 or the exclusion of several indicators at a time) and we could have tested the joint impact of changing several aspects at the same time (such as a change in cumulative threshold and the exclusion of an indicator). In spite of this, the tests have deepened our understanding of how each of these methodological choices affects the empirical behaviour of each measure. Now it is time to synthesize these test results and answer the question: what do they mean for the suitability of the proposed measures and their relevance in both national and EU policy making contexts? One could interpret the range of estimates in this section as the 'real' confidence

interval i.e. the range within which one can reasonably expect to find an estimate of a cumulative deprivation measure. As with statistical confidence intervals, a wider confidence interval means less precision and thus an increased likelihood that differences between groups (be they countries or subgroups in the population) are either not consistent or insignificant. A wide confidence interval makes the measure less reliable and thus less useful for policy makers: Does group A really need more attention than group B? Is country C indeed more successful in reducing cumulative deprivation than country D? In sum, a cumulative measure that comes out of the sensitivity tests with a narrower range and more consistency in country and subgroup rankings is thus a more reliable measure.

Table 7: Maximum range of point estimates over all sensitivity tests

Country	Measure	Point estimates		
		Minimum	Benchmark	Maximum
DE	CDI	0.049	0.120	0.128
	CDI_poor	0.074	0.181	0.387
	RCDI	0.082	0.100	0.107
	RCDH	0.317	0.408	0.408
	CDH	0.127	no default	0.660
FR	CDI	0.060	0.126	0.133
	CDI_poor	0.081	0.193	0.397
	RCDI	0.087	0.106	0.112
	RCDH	0.329	0.402	0.402
	CDH	0.151	no default	0.652
NL	CDI	0.026	0.085	0.092
	CDI_poor	0.066	0.149	0.374
	RCDI	0.055	0.063	0.085
	RCDH	0.240	0.275	0.539
	CDH	0.070	no default	0.572
UK	CDI	0.062	0.131	0.138
	CDI_poor	0.087	0.191	0.396
	RCDI	0.093	0.110	0.115
	RCDH	0.353	0.417	0.417
	CDH	0.156	no default	0.686

Table 7 shows the 'confidence interval' by summarizing for each measure the highest and lowest estimate from all sensitivity tests as well as the benchmark estimate. For instance, in our sensitivity tests the CDI estimates for Germany range from 0.049 to 0.128. Table A5 in the appendix does the same but then for each of the sensitivity tests separately: the 0.049 CDI estimate occurred when testing the cumulative deprivation threshold and the 0.128 value occurred when testing the exclusion of deprivation indicators. Table 8, finally, summarizes how each test influenced the international ranking of these countries from lowest to highest

cumulative deprivation levels: the country ranking does not change for the minimum, benchmark and maximum estimates of the CDI. This does not necessarily mean that the ranking is stable across the whole interval; countries can still leap frog one another for other values.

The CDI values differ between the tested alternatives but they vary over a rather narrow range and the country rankings are relatively stable. For the CDI of the poor the range is much broader but the country rankings are also relatively stable: Table A5 shows that the estimates are especially sensitive to changes in the cumulative deprivation threshold but are much less sensitive to changes in other parts of the methodology. The range of RCDI values and country rankings are very similar to those of the CDI but the analysis in previous sub-sections has shown that a small change in methodology lead to a considerable change in the estimate for the Netherlands (in comparison to other countries). The range of both headcount measures (RCDH and CDH) is very large and, in one case, an extreme reversal in country ranking occurs.

As explained earlier in this section, underlying this behaviour of the relative measures is the distribution dependent cumulative deprivation threshold: a slight change in the methodology can change the median number of deprivations and thus the cumulative threshold but to what extent is this problematic? If we take a relative perspective on welfare and it is agreed that we care about inequalities between residents, then it makes sense that we choose a national, distribution-dependent threshold to compare residents of the same country. An improvement in the overall well-being thus represents a valid reason for adjusting the relative standard of cumulative deprivation; if deprivation becomes less common in a society, those who are still deprived are now relatively worse off. In that sense, the cumulative deprivation measure should show an increase.[27] The problem is that any welfare changes, be they real or due to methodological changes, could lead to very large changes in estimates. As the cumulative deprivation measure will be used to monitor changes over time and between countries, this is a serious defect. In an EU context with 27 member states, a change in the relative cumulative deprivation threshold would lead to frequent and considerable rank reversals. Moreover, some of the EU member states are seeing rapid change in their living standards; their relative cumulative deprivation indices are thus more likely to show disproportionately large jumps from one year to another, especially in comparison to the actual change in living standards. Be it for national or cross-national comparative policy purposes, this is not a desirable characteristic of a cumulative deprivation measure.

[27] Guio (2009, p. 22) also tests a relative cumulative deprivation headcount by setting the threshold at 300% of the average deprivation and finds that the most deprived countries have the lowest rates and vice versa for the least deprived countries. She argues that a relative measure occults the 'absolute' nature of deprivation.

Table 8: Summary sensitivity tests: impact on country rankings

		Germany			France			Netherlands			United Kingdom		
		Min	Def	Max	Min	Def	Max	Min	Def	Max	Min	Def	Max
CDI	Indicator threshold	2	2	NC	3	3	NC	1	1	NC	4	4	NC
	Exclusion indicator	2	2	2	3	3	3	1	1	1	4	4	4
	Cum. deprivation threshold	2	2	2	3	3	3	1	1	1	4	4	4
	Indicator weights	2	2	2	3	3	3	1	1	1	4	4	4
CDI_poor	Indicator threshold	2	2	NC	3	4	NC	1	1	NC	4	3	NC
	Exclusion indicator	2	2	2	3	4	4	1	1	1	4	3	3
	Cum. deprivation threshold	2	2	2	4	4	4	1	1	1	3	3	3
	Indicator weights	2	2	2	4	4	4	1	1	1	3	3	3
RCDI	Indicator threshold	2	2	NC	3	3	NC	NC	1	1	4	4	NC
	Exclusion indicator	2	2	2	3	3	3	1	1	1	4	4	4
	Cum. deprivation threshold	NC	2	NC	NC	3	NC	NC	1	NC	NC	4	NC
	Indicator weights	2	2	2	3	3	3	1	1	1	4	4	4
RCDH	Indicator threshold	1	3	NC	2	2	NC	NC	1	4	3	4	NC
	Exclusion indicator	2	3	2	2	2	1	1	1	4	4	4	3
	Cum. deprivation threshold	NC	3	NC	NC	2	NC	NC	1	NC	NC	4	NC
	Indicator weights	3	3	3	2	2	2	1	1	1	4	4	4
CDH	Cum. deprivation threshold	2	NC	3	3	NC	2	1	NC	1	4	NC	4

Note: NC means not calculated

7. CONCLUSION

In the light of the current search for child sensitive social indicators in the European Union, this paper compared potential candidate measures of cumulative deprivation. The aim was to find a measure that is able to capture changes in the breadth of deprivations (i.e. the degree to which a child is experiencing multiple deprivations) and that has an intuitive interpretation. Section 2 examined the role of social indicators in the EU context and showed that the development of child focused indicators substantially lags behind that of population based indicators of poverty and social inclusion. Recent efforts have proposed a wide range of child specific single indicators but only one, not child specific, composite indicator has been proposed and adopted. Drawing from the multidimensional poverty measurement literature, section 3 subsequently discussed potential measures, their calculation and their theoretical properties and four candidates were retained for the empirical analysis. Section 4 set out our choices regarding the operationalisation of the measures with the 2007 wave of the EU-SILC. While the data were the best choice available it constrained our choices: all selected indicators are household level indicators, no relevant child specific indicators were available; while the indicators cover domains such as financial deprivation, housing, neighbourhood and access to basic services, there is no relevant information on domains such as children's health, education and social relations. Section 5 analyzed and compared the benchmark estimates. It showed that cumulative deprivation levels differ considerably among the measures (especially between headcount and adjusted-headcount measures) and with income poverty. Country rankings appear relatively stable across measures as do the high risk poverty characteristics of single parenthood, low work intensity, unemployment spells and rented dwelling. Nevertheless, differences were found in other high risk characteristics and in the relative risk between income poverty and (some of the) cumulative deprivation measures. Section 6 interpreted and discussed the results from a battery of sensitivity analyses: though each sensitivity test impacted the estimates, some measures were found to be considerably more sensitive than others. The Cumulative Deprivation Index (CDI) measure performed well: while estimates differed between the alternatives tested, they varied over a rather narrow range and the country rankings were also relatively stable. The CDI of the poor generally performed well but it was very sensitive to changes in the cumulative deprivation threshold. The two relative measures, the Relative CDI (RCDI) and the Relative Cumulative Deprivation Headcount (RCDH), were more problematic: relatively minor changes in the methodology could lead to very large changes in estimates and lead in one case to an extreme reversal in ranking; moreover, a small change in 'real' welfare could have a similarly large impact.

While currently the only measure of cumulative deprivation in the EU is a headcount measure (TARKI Social Research Institute, 2010), our findings show that the CDI has a number of advantages as a measure of cumulative deprivation thus making it a good complement to a headcount measure. Firstly, unlike all headcount measures, the CDI is sensitive to changes in the

breadth of deprivation. Secondly, if the cumulative deprivation threshold is set at one, thus also counting single deprived children, the values are easily interpreted as the average percentage of deprivations experienced by children. Thirdly, it is also not over-sensitive to small changes in the methodology or welfare. The CDI of the poor could also be an interesting complementary indicator as it focuses only on deprived children, especially when the cumulative deprivation threshold is also set at one deprivation. Measures that use a relative deprivation threshold are not recommended because the estimates are over-sensitive to changes in welfare and methodology. Instead, a potentially more promising way to take account of cross-national differences in deprivation levels would be to further investigate the use of either prevalence weights or consensus weights in determining the relative weight of each indicator in the composite measure. This, however, would come at the loss of intuitive interpretation of the estimates.

These conclusions are relevant beyond the context of the present EU discussion on child specific indicators; they also contribute to our understanding of multidimensional poverty measures and their potential to contribute to making better policy decisions. Firstly, while stochastic dominance tests are relatively easy to perform for a single income poverty indicator, performing similar tests for composite indicators constructed out of non-continuous single indicators is not only much more challenging but it is also considerably less likely to yield useful information for policymakers as the range over which 'dominance' can be established becomes much narrower. Secondly, while using a relative income poverty line often makes a lot of sense in international poverty comparisons, this research shows that setting a relative cumulative deprivation threshold leads to over-sensitivity in the estimates due to discontinuities in the indicator and cumulative deprivation distributions.

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APPENDIX

Table A1: Correlation between deprivation indicators (only displayed if significant ≤ 5%)

Germany (DE)													
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00												
2	0.19	1.00											
3	0.09	0.10	1.00										
4	0.06	0.07	0.04	1.00									
5	0.11	0.12	0.08	0.33	1.00								
6	0.07	0.03	-0.03			1.00							
7	0.08	0.05				0.34	1.00						
8	0.12	0.24	0.06	0.07	0.11	0.04		1.00					
9	0.18	0.27	0.15	0.04	0.10	0.07	0.07	0.25	1.00				
10	0.10	0.31	0.14	0.05	0.12	0.06	0.09	0.19	0.31	1.00			
11	0.04	0.14	0.11		0.05	0.03		0.08	0.16	0.18	1.00		
12	0.06	0.17	0.13	0.06	0.12			0.17	0.20	0.19	0.31	1.00	
13	0.13	0.28	0.09	0.04	0.08	0.03	0.07	0.25	0.29	0.28	0.11	0.14	1.00
France (FR)													
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00												
2	0.14	1.00											
3	0.15	0.08	1.00										
4	0.11	0.11	0.11	1.00									
5	0.12	0.09	0.11	0.26	1.00								
6				0.04	0.03	1.00							
7	0.06	0.03			0.05	0.05	1.00						
8	0.16	0.19	0.16	0.10	0.11			1.00					
9	0.19	0.22	0.21	0.10	0.13	0.03	0.03	0.33	1.00				
10	0.10	0.29	0.18	0.09	0.11			0.26	0.28	1.00			
11	0.11	0.15	0.16	0.10	0.11			0.23	0.27	0.21	1.00		
12	0.11	0.06	0.12	0.11	0.07			0.19	0.19	0.16	0.21	1.00	
13	0.16	0.26	0.23	0.15	0.13	0.06	0.04	0.43	0.50	0.33	0.30	0.19	1.00

1: Dwelling has leaking roof, damp walls/floors/foundation, or rot in window frames or floor
2: Dwelling is not comfortably warm during winter time
3: Dwelling is overcrowded
4: Pollution, grime or other environmental problems
5: Crime violence or vandalism in the area
6: Accessibility of primary health care services
7: Accessibility of compulsory school
8: Household has payment arrears on mortgage/rent, utility bills, instalments/loan payments
9: Household cannot afford a meal with meat, chicken, fish (or vegetarian equivalent) every 2nd day
10: Household cannot afford paying for one week annual holiday away from home
11: Household cannot afford a computer for financial reasons
12: Household cannot afford a car for financial reasons
13: Ability to make ends meet (very difficult)

Table A2: Correlation between deprivation indicators (only displayed if significant ≤ 5%)

The Netherlands (NL)													
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00												
2	0.12	1.00											
3		0.04	1.00										
4	0.08	0.04	-0.03	1.00									
5	0.08	0.03		0.13	1.00								
6	0.03	0.04		0.06	0.03	1.00							
7		0.04	-0.04	0.06		0.14	1.00						
8	0.07	0.14			0.05		0.04	1.00					
9	0.12	0.30	0.04	0.06	0.06	0.04	0.08	0.30	1.00				
10		0.27				0.06		0.09	0.14	1.00			
11	0.06	0.05		0.03	0.06			0.12	0.10		1.00		
12	0.09	0.19	0.08	0.03	0.05	0.03		0.18	0.30	0.12	0.11	1.00	
13	0.12	0.27	0.04	0.04	0.05	0.04	0.07	0.23	0.46	0.14	0.10	0.26	1.00
United Kingdom (UK)													
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00												
2	0.11	1.00											
3	0.09	0.09	1.00										
4	0.10			1.00									
5	0.09		0.04	0.16	1.00								
6	0.09	0.10	0.06	0.06	0.04	1.00							
7	0.04	0.03	0.05	0.06	0.10	0.08	1.00						
8	0.18	0.10	0.11	0.05	0.12	0.06	0.08	1.00					
9	0.20	0.21	0.18	0.06	0.10	0.11	0.03	0.38	1.00				
10		0.29	0.12	0.04	0.04			0.21	0.28	1.00			
11	0.06	0.07	0.10	0.05	0.04	0.06	0.03	0.20	0.24	0.13	1.00		
12	0.11	0.11	0.14		0.06	0.04		0.21	0.29	0.17	0.22	1.00	
13	0.12	0.22	0.14	0.05	0.09	0.13	0.08	0.35	0.42	0.22	0.17	0.21	1.00

1: Dwelling has leaking roof, damp walls/floors/foundation, or rot in window frames or floor
2: Dwelling is not comfortably warm during winter time
3: Dwelling is overcrowded
4: Pollution, grime or other environmental problems
5: Crime violence or vandalism in the area
6: Accessibility of primary health care services
7: Accessibility of compulsory school
8: Household has payment arrears on mortgage/rent, utility bills, instalments/loan payments
9: Household cannot afford a meal with meat, chicken, fish (or vegetarian equivalent) every 2nd day
10: Household cannot afford paying for one week annual holiday away from home
11: Household cannot afford a computer for financial reasons
12: Household cannot afford a car for financial reasons
13: Ability to make ends meet (very difficult)

Notes on Table A1 and A2:

Tables A1 and A2 summarize the pair wise correlations between the indicators: higher positive correlations are a first indication of a higher likelihood of double deprivation. The correlations are generally significant and positive; higher correlations can be found between 'make ends meet' and some of the other financial strain indicators; France has much higher correlations than the other countries; correlations in the Netherlands are generally lower; in France and Germany the correlation between the neighbourhood variables is considerably higher than that in the Netherlands and the UK; Germany has a higher correlation between the two access variables but for the other countries this correlation is very low.

Table A3: Population shares of high poverty risk children (as a % of all children)

	DE	FR	NL	UK
Single parent household, at least 1 dependent child	14.0	12.1	10.1	18.2
Two adults, 3 or more dependent children	22.7	28.2	31.8	20.5
Low work intensity household	11.3	10.9	9.4	17.8
At least one parent had unemployment spell last year	13.7	18.0	11.6	6.0
Both parents were born in foreign country	9.9	20.4	10.8	18.6
Both parents have no post-secondary education	25.5	29.6	40.8	40.1
Household lives in rented dwelling	37.3	36.5	22.5	30.5

Table A4: Indicator weights under various weighting schemes

Weighting scheme	Equal	Frequency							
		National population				National child population			
Indicator	All	DE	FR	NL	UK	DE	FR	NL	UK
leaks/damp present in house	0.077	0.075	0.074	0.068	0.073	0.073	0.074	0.067	0.073
unable to keep house warm	0.077	0.081	0.082	0.082	0.082	0.082	0.084	0.083	0.084
overcrowding	0.077	0.080	0.077	0.081	0.080	0.079	0.075	0.080	0.078
experienced pollution / environmental problems	0.077	0.067	0.072	0.072	0.074	0.069	0.074	0.073	0.077
experienced crime / violence / vandalism	0.077	0.075	0.072	0.069	0.062	0.077	0.074	0.069	0.063
difficult to access primary health care	0.077	0.076	0.081	0.076	0.080	0.076	0.081	0.077	0.084
difficult to access compulsory school	0.077	0.077	0.084	0.081	0.083	0.073	0.082	0.078	0.081
combined arrears indicator	0.077	0.081	0.078	0.080	0.078	0.081	0.077	0.080	0.076
not able to afford holiday	0.077	0.065	0.060	0.072	0.067	0.061	0.059	0.073	0.062
cannot afford meat etc every second day	0.077	0.077	0.081	0.082	0.082	0.078	0.082	0.083	0.084
cannot afford a computer	0.077	0.083	0.081	0.082	0.082	0.085	0.082	0.084	0.084
cannot afford a car	0.077	0.082	0.084	0.079	0.081	0.084	0.085	0.080	0.083
difficult to make ends meet	0.077	0.081	0.073	0.075	0.074	0.082	0.070	0.074	0.071

Table A5: Summary sensitivity tests: range of point estimates

		Germany			France			Netherlands			United Kingdom		
		Min	Def	Max	Min	Def	Max	Min	Def	Max	Min	Def	Max
CDI	All sensitivity tests	0.049	0.12	0.128	0.06	0.126	0.133	0.026	0.085	0.092	0.062	0.131	0.138
	Indicator threshold	0.094	0.12	NC	0.101	0.126	NC	0.066	0.085	NC	0.108	0.131	NC
	Exclusion indicator	0.105	0.12	0.128	0.109	0.126	0.133	0.076	0.085	0.092	0.117	0.131	0.138
	Cum. depr. threshold	0.049	0.12	0.12	0.06	0.126	0.126	0.026	0.085	0.085	0.062	0.131	0.131
	Indicator weights	0.114	0.12	0.12	0.119	0.126	0.126	0.081	0.085	0.085	0.123	0.131	0.131
CDI_poor	All sensitivity tests	0.074	0.181	0.387	0.081	0.193	0.397	0.066	0.149	0.374	0.087	0.191	0.396
	Indicator threshold	0.142	0.181	NC	0.155	0.193	NC	0.116	0.149	NC	0.158	0.191	NC
	Exclusion indicator	0.158	0.181	0.194	0.167	0.193	0.204	0.132	0.149	0.161	0.17	0.191	0.201
	Cum. depr. threshold	0.181	0.181	0.387	0.193	0.193	0.397	0.149	0.149	0.374	0.191	0.191	0.396
	Indicator weights	0.172	0.181	0.181	0.182	0.193	0.193	0.142	0.149	0.149	0.179	0.191	0.191
RCDI	All sensitivity tests	0.082	0.1	0.107	0.087	0.106	0.112	0.055	0.063	0.085	0.093	0.11	0.115
	Indicator threshold	0.074	0.1	NC	0.081	0.106	NC	NC	0.063	0.066	0.087	0.11	NC
	Exclusion indicator	0.082	0.1	0.107	0.087	0.106	0.112	0.055	0.063	0.085	0.093	0.11	0.115
	Cum. depr. threshold	NC	0.1	NC	NC	0.106	NC	NC	0.063	NC	NC	0.11	NC
	Indicator weights	0.096	0.1	0.1	0.101	0.106	0.106	0.06	0.063	0.063	0.104	0.11	0.11
RCDH	All sensitivity tests	0.317	0.408	0.408	0.329	0.402	0.402	0.24	0.275	0.539	0.353	0.417	0.417
	Indicator threshold	0.317	0.408	NC	0.329	0.402	NC	NC	0.275	0.477	0.477	0.417	NC
	Exclusion indicator	0.334	0.408	0.408	0.334	0.402	0.402	0.24	0.275	0.539	0.353	0.417	0.417
	Cum. depr. threshold	NC	0.408	NC	NC	0.402	NC	NC	0.275	NC	NC	0.417	NC
	Indicator weights	0.408	0.408	0.408	0.402	0.402	0.402	0.275	0.275	0.275	0.417	0.417	0.417
CDH	Cum. depr. threshold	0.127	NC	0.66	0.151	NC	0.652	0.07	NC	0.572	0.156	NC	0.686

Note: NC means not calculated