Oxford Poverty & Human Development Initiative (OPHI)
Oxford Department of International Development
Queen Elizabeth House (QEH), University of Oxford

OPHI RESEARCH IN PROGRESS SERIES 36b

Multidimensional poverty measurement for EU-SILC countries

Sabina Alkire*, Mauricio Apablaza** and Euijin Jung***

Revised Draft for comment

July 2014

Abstract

This paper presents a set of experimental indices of multidimensional poverty, using cross-sectional EU-SILC data. The indices use the Alkire Foster (AF) methodology – a widely used flexible methodology which can accommodate different indicators, weights and cut-offs. In constructing three sets of illustrative indices we review the joint distribution within and among potential indicators of multidimensional poverty. We draw on existing EU-2020 indicators, as well as on indicators of health, education and lived environment. The time series data enables an analysis of multidimensional poverty dynamics, including analysis of changes in overall poverty and in indicators. The paper also decomposes poverty results by gender – finding women to be poorer across countries and time – and by age categories.

Keywords: Multidimensional poverty, counting measures, material deprivation, and multidimensional poverty dynamics

* University of Oxford (UK). Corresponding author: sabina.alkire@qeh.ox.ac.uk
** Universidad del Desarrollo (Chile) and the University of Oxford (UK).
*** Korea Research Institute for Vocational Education & Training (KRIVET).

TABLE OF CONTENTS

Table of Figures

Table of Tables

2

Introduction

Methodologies of multidimensional poverty measurement that draw on the 'counting' approach have been used in policy applications since the 1970s (Townsend 1979; see Nolan and Whelan 2011, and Alkire et al. 2015 Ch 4 for a review; see also Atkinson 2003 and the references therein), and are gaining greater momentum (Erikson 1993, Callan *et al*. 1999, Atkinson 2003, Chakravarty and D'Ambrosio 2006, Alkire and Foster 2011a,). To date many studies have focused on understanding the structure among deprivations, and on identifying the normative, policy, and statistical tools that can best justify the collection of data on distinct indicators (Atkinson *et al*. 2002; Atkinson *et al*. 2005, Atkinson and Marlier 2010 and the references therein). Others have focused on statistical methods used to justify why indicators might be aggregated into a composite indicate covering one relevant dimension such as material deprivation (Guio et al 2012; OECD 2008). Drawing upon such studies, this paper will present a set of experimental indices of multidimensional poverty which use an adjusted headcount ratio M_0 that builds on a counting-based dual-cut-off methodology (Alkire and Foster 2011a, 2011b). We show how these measures can be used to provide diverse and specific descriptive analyses, hence why they may complement existing measurement approaches.

The methodology is flexible in that different indicators, cut-offs and weights can be used, including cardinal, ratio-scale, binary, ordinal and categorical variables. Unlike the headcount ratio which has been traditionally used with counting-based measures in both Europe and Latin America, the AF family of measures incorporate the joint distribution of deprivation by providing a new feature of *intensity* – which shows the percentage of dimensions in which the average poor person is deprived. Incorporating intensity into the measure itself enables the multidimensional poverty measure to be broken down by indicator (after identification), to show the levels and composition of deprivations poor people experience. This is not possible with counting-based headcount ratios. Where data permit, the measure and each of its consistent indicators can be further broken down by gender, age, social groups or regions. The global Multidimensional Poverty Index (MPI) which is released by UNDP's *Human Development Reports* and covers 108 countries in 2014 is based on this methodology (Alkire and Santos 2010; UNDP 2010). It is also used in official national measures of multidimensional poverty, such as those of Mexico, Colombia, the Philippines, and Bhutan.

Such a measure has been implemented already using the 2009 EU-SILC dataset (Whelan et al 2014). This paper extends Whelan, Nolan and Maitre's work by constructing AF poverty measures across time periods 2006-2012, using, necessarily, a more limited set of indicators. In doing so, we demonstrate the analysis of the multidimensional poverty indicator in one period and across time, by headcount, intensity, and indicator. It is important to note that limitations of data availability and coverage, as well as the inability in this draft to address all sample size degradation issues, mean that the added value of this analysis is as yet not empirical. Rather, its contribution is to show the kinds of policy analyses that could be done using this methodology, were a set of dimensions and indicators to be agreed upon by a legitimate process, and were fully consistent and comparable variable definitions to be used.

The paper proceeds as follows. Section 2 briefly situates our topic in the literature; Section 3 presents the AF methodology. Section 4 introduces a set of three experimental indices of multidimensional poverty, using cross-sectional EU-SILC data and the individual as unit of analysis. It presents the non-response and longitudinal availability of information and describes the deprivations in each indicator ('raw headcount ratios') for each country. Section 5 presents the AF results, first showing the poverty cut-off for each vigintile to illustrate the likely robustness of analyses. Choosing a poverty cut-off for each

3

measure, it then presents the overall results of the three measures, describing each and drawing attention to the advantages and disadvantages of aggregating component indicators for analyses of this class of measures. Section 5.3 then presents the findings across time, 2006-2012. As the measure uses individual level data, we decompose results by gender and age group. Section 6 concludes.

1.   Literature Review

Multidimensional approaches to poverty and deprivation have a long and distinguished history in conceptual and philosophical work (Sen 1992). In terms of policy, the late 1960s and early 1970s saw the entrance of policy applications, with the 1968 Swedish Level of Living Study (Johannsen 1973, Allardt and Uusitalo 1972); Jacques Delors' 1971 *Les indicateurs sociaux* and P.Ch. Ludz's *Materialien zum Bericht zur Lage der Nation* (1971), each providing independent impetus in different countries and across Europe for this effort.

In more recent literature, significant attention has been paid to the relationship among deprivations, to ways of communicating these, and to methodologies to validate indicators used in composite or multidimensional indices (Alkire et al 2015, Nolan and Whelan 1996, 2010, 2011, Callan et al 1993; Gordon et al 2003; Atkinson *et al*. 2002; Calandrino 2003; Saunders and Adelman 2006; Layte et al 200, Whelan 2007, OECD 2008). Drawing on the 2004 EU-SILC data, Guio and Maquet (2006) proposed a multidimensional indicator of Material Deprivation, which reflected deprivations such as poor housing, lack of durable assets, and an inability to afford to meet basic needs. The indicator was designed to be comparable across time and across the EU and most member states, and to provide meaningful trend data showing improvements in material deprivation over time. Whelan (2007) used the Irish component of the 2004 EU-SILC dataset to develop an 11-item 'consistent poverty' index; and Whelan and Maître (2008) use a range of statistical methods such as correlation and factor analysis; goodness of fit tests like root mean square error of approximation; and reliability tests like Cronbach's Alpha, to identify three dimensions of material deprivation (consumption, household facilities, and neighbourhood environment) and examine their relationship to income poverty. Coromaldi and Zoli (2012) clarify the added value of non-linear principal component analysis, NLPCA, to these techniques. Guio et al. (2012) provide a systematic exposition of an expanded range of techniques to justify a new material deprivation index using the 2009 EU-SILC dataset. A set of parallel papers explores similar questions with respect to child poverty (Bradshaw 2009, Gabos et al 2011, Guio et al 2012, and Adamson 2012). Naturally, this deep analysis of the structure of deprivations resulted in a set of empirical and policy studies on the relationship between income and other deprivations (Verbist and Lefebure 2008, Whelan and Maitre 2009, Jana et al 2012) and also gave rise to applied multidimensional measures (Whelan et al 2014).

The EU-SILC dataset has also been used by academic studies to illustrate multidimensional poverty measurement methodologies (Chakravarty and D'Ambrosio 2006; Bossert, et al 2013, among others). Brandolini (2007) explored Atkinson's (2003) counting approach using data for France, Germany and Italy and a headcount ratio associated with the minimum proportion of deprivations a person has, and comparing the various deprivation measures with income poverty measures. He drew attention to the sensitivity of cross-national comparisons to weights, and also to the deprivation cut-off.

This paper adds to this already significant recent literature by illustrating the rich variety of analyses that can be accomplished using one particular methodology, drawing on three experimental measures which differ in the number of dimensions and indicators and in their definition and weights.

2.   AF methodology

This section briefly introduces the class of M_α measures developed by Alkire and Foster (AF) that build on the Foster Greer Thorbecke (FGT) index, using the notation found in other works (Alkire and Foster 2011a). The three experimental measures use the M_0 methodology in this class.

Consider poverty in d dimensions across a population of n individuals. Let $y = [y_{ij}]$ denote the $n \times d$ matrix of achievements for i persons across j dimensions. The typical entry in the achievement $y_{ij} \geq 0$ represents individual i's achievement in dimension j. Each row vector $y_i = (y_{i1}, y_{i2}, \dots, y_{id})$ gives individual i's achievements in each dimension, whereas each column vector $y_{\cdot i} = (y_{1j}, y_{2j}, \dots, y_{nj})$ gives the distribution of achievements in dimension j across individuals. To weight the dimensions, define a weighting vector w whose j^{th} element w_j represents the weight that is applied to dimension j. We set $\sum_{j=1}^{d} w_j = 1$, that is, the dimensional weights sum to one.

The M_0 measurement methodology can be summarized as follows. Let $z_j > 0$ be the deprivation cut-off in dimension j, and z be the vector of deprivation cut-offs. Define a matrix of deprivations $g^0 = [g_{ij}^0]$, whose typical element is defined by $g_{ij}^0 = w_j$ when $y_{ij} < z_j$, and $g_{ij}^0 = 0$ when $y_{ij} \geq z_j$. From the g^0 matrix construct a column vector c of *deprivation intensity*, whose i^{th} entry $c_i = \sum_{j=1}^{d} g_{ij}^0$ represents the sum of the entries in a given row, and represents the weighted deprivations suffered by person i.

Next, we identify who is multidimensionally poor. A poverty cut-off k is selected, such that $0 < k \leq 1$, and is applied across column vector c. A person is identified as poor if their weighted deprivation score $c_i \geq k$. This can be called a *dual cut-off* identification method, because it uses the *deprivation* cut-offs z_j to determine whether a person is deprived or not in each dimension, and the *poverty* cut-off k to determine who is to be considered multidimensionally poor. This identification strategy can also be represented, following Bourguignon and Chakravarty (2003), by an *identification function* $\varrho: \mathbb{R}_+^d \times \mathbb{R}_{++}^d \to \{0,1\}$, which maps from person i's achievement vector $y_i \in \mathbb{R}_+^d$ and cut-off vector z in $\mathbb{R}_{++}^d$ to an indicator variable in such a way that $\varrho(y_i; z) = 1$ if person i is poor and $\varrho(y_i; z) = 0$ if person i is not poor.

Having identified the poor, construct a second matrix $g^0(k)$, obtained from g^0 by replacing its ith row g_i^0 with a vector of zeros whenever $c_i < k$. This *censored* matrix contains the weighted deprivations of exactly those persons who have been identified as poor and *excludes* deprivations of the non-poor. This matrix is the basis of the dimensional analysis. For example, the censored headcount ratios are simply the mean of its columns. The measure M_0 is the mean of the censored vector of deprivation scores $(c_i(k))$.[1]

M_0 can also be expressed as the product of the (multidimensional) headcount ratio (H) and the average deprivation share among the poor (A). H is simply the proportion of people that are poor, or q/n where q is the number of poor people. A is the average of fraction of deprivations poor people experience – $A = \sum_{i=1}^{n} c_i(k)/q$ – and reflects the average *intensity* of multidimensional poverty.

---

[1] M_0 is the mean of the matrix when the weights sum to d. In this notation, because weights sum to 1, M_0 is the mean of the matrix multiplied by the number of columns or dimensions d.

M_0 satisfies a number of useful axioms, specifically: replication invariance, symmetry, poverty focus, deprivation focus, weak monotonicity, non-triviality, normalisation, dimensional monotonicity, subgroup decomposability, dimensional breakdown, ordinality and weak re-arrangement (Alkire and Foster 2011a, 2014). These axioms are joint restrictions on the identification and aggregation methodologies. If data are cardinal, other measures within the M_α family can be computed. These measures can reflect the depth and severity of multidimensional poverty, and satisfy other axioms related to monotonicity and transfer. However these are beyond the scope of this paper because most of the EU-SILC variables are not cardinally meaningful.

For tracking changes across time, different approaches are possible. Naturally the number, level and significance of changes in poverty measures and their associated partial indices can be directly compared, and absolute and relative rates of change can be analysed. If the strong assumptions required can be justified, Shapley value decompositions (Roche 2013) and other decompositions (Apablaza and Yalonetzky 2011) can be used to explore the percentage of poverty reduction which can be attributed to a reduction in headcount vs intensity, and by indicator and demogratphic changes. However the required assumptions may be difficult to justify empirically (Alkire Roche Vaz 2014). Alkire *et al*. 2015 Ch 9 provides a systematic presentation of different methodologies for assessing poverty dynamics using time series data.

3.   Data and Indicators

In 2001, the Laeken European Council endorsed a set of 18 indicators of social inclusion for Europe which were subsequently refined, consolidated and extended, using normative, statistical, and policy reasoning. Atkinson et al. (2005) traces how this process led to the agreement of common social indicators related to deprivation, housing and services, which in turn gave rise to common survey instruments. The European Union Statistics on Income and Living Conditions (EU-SILC) was developed precisely to compare deprivation and social exclusion across European countries. Data are available annually from 2005. The datasets provide harmonized individual and household level information for income as well as social indicators such as labour, health, housing and the lived environment.

This paper selects an illustrative set of indicators and draws upon others' analyses of the properties of the EU-SILC variables. It is important to note that the illustrative measures are limited by variable definition (comparable variables must be present across time periods and must be accurate at the unit level rather than only on average) as well as by data availability (missing values in any variable must be low). For example we are not able to implement the improved material deprivation index (Guio *et al*. 2012), nor to replicate Whelan *et al*. (2014) multidimensional poverty measures, because both draw on variables that are present from 2009 but not in previous periods. However we do draw upon indicators related (but not identical) to the EU2020 multidimensional poverty measure component indicators.

Where reported, our aggregate figures include information only from countries with data available across all years. The aggregate figures include data of Austria, Cyprus, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom. We excluded from the EU results information of Belgium (2012), Bulgaria (2006), Croatia (2006-2010), Ireland (2012), Malta (2006-2007), Romania (2006) and Switzerland (2006-2007). Additionally, due to irregularities in the education variable PE040 (Highest ISCED level attained), Finland (2007) and Slovenia (2006) were also excluded. The 2006 and 2008 percentages of individuals with primary education in Finland were similar, but the 2007 figures differed from these and subsequent years' figures by 15%. In 2006, incidence of

deprivations in primary education was also over 15% higher than subsequent years. For national results, we include all countries[2].

Regarding the weights, a subset of countries (Croatia, Denmark, Finland, Iceland, Netherlands, Norway Slovenia and Sweden) have an important number of missing values for health variables. MPIs are calculated only for respondents having all indicators. To maintain the comparability of the aggregate and pooled results we reweighted the data to correspond to the number of individuals of each country as in the original dataset. Note that the weighted responses in a country sum to the population of that country in the given year, thus pooled data figures are similarly population-weighted – which gives equal importance to each person in Europe, regardless of the population of the country in which they live.

3.1.   *Unit of Analysis: Individual*

The measures that follow combine individual and household level information, and identify all individuals as multidimensionally poor or non-poor based on their own achievements in these indicators for which this information is available, and in household achievements otherwise.

Different units of analysis are possible using the EU-SILC dataset: individual adults; individual children; adults or children by household, and households. Here we use the individual as a unit of analysis. That is, the individual's achievements in health, education and work are used to identify their own deprivations. Household level variables are used to identify individuals as deprived or non-deprived in terms of income, material deprivations, housing, noise, crime and pollution. This way of proceeding is very useful because the resulting measures can be disaggregated by gender and age. Furthermore, one can study the clustering of deprived people by household. However given present datasets, this approach generates a larger sample drop because of missing variables, particularly in the health domain. Furthermore, normatively it overlooks (and does not foster) intra-household sharing. For example having a chronic disability in a household which can effectively care for such a person is very different than having the same health condition and living alone. Some policy aims support a household focus.

It would be possible to use the household as a unit of analysis with EU-SILC data. In this case, a household would be deprived in work, education, and health indicators depending upon the joint deprivations of those household members (which might include children) for whom data were available. This method – which was used for example in the global MPI – has an advantage in terms of missing data because if available data identify a household as deprived then all members can be included even if there are missing data for some members. However the household identification was not implemented in these experimental measures, in part because, it was not clear how household definitions and comparability vary across Europe. Also, the appropriate 'cut-off' for household level indicators built with individual education and health data would require separate analysis.[3] Finally, in the EU-context, social rights tend

---

[2] We also observed uncommon changes also in roof in Hungary (2008) and Bulgaria (2007-2008) and unmet Medical Needs in Portugal (2007) but numbers were contrasted and corroborated with official statistics. For roof see http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_mdho01&lang=en; and for unmet Medical Needs see http://epp.eurostat.ec.europa.eu/portal/page/portal/employment_social_policy_equality/social_protection_social_incl usion/indicators/health_long_term_care

[3] The options for household cut-offs are very clear, but require normative, policy, and empirical exploration to justify. They can be set based on a 'counting' approach across household members; alternatively achievements of household members can be aggregated and the average considered. Each has significant implications. For example, a household can be considered deprived in education, for example, if a) one household member has not attained a

to be individually based. For that reason, in the experimental measures the individual is taken as a unit of analysis, with the consequence of having larger sample size reductions, and not including child poverty.

3.2. *Dimensions and Indicators of Deprivation*

The dimensions and indicators of deprivation in this paper draw upon an earlier paper in which we implemented four experimental measures, each having three to six dimensions, using data 2006-10 (Alkire Apablaza and Jung 2012). Based on these results and others' comments upon them in the first Net-SILC workshop, we revised the dimensions and indicator definitions. The three experimental indices presented in this paper each have four or five dimensions. The first two have four dimensions. Three of these – living standards as measured by EU-2020 poverty indicators, health, and education – are present in nearly every treatment of poverty (Appendix 1). Drawing on the arguments provided in Whelan et al (2014) and Guio and Maquet (2006), all measures adds to these a dimension of the living environment, which includes the roof and neighbourhood considerations: noise, pollution and safety. Finally, measure 3 includes these but separates out the 'Material Deprivation' dimension of the EU-2020 poverty index into a separate dimension, leaving work intensity and income together in a separate dimension.

Terminologically, dimensions are organising concepts which may govern the weights attached to indicators, or which may be used to communicate the results in public, but which do not enter the calculation of poverty measures directly. Once again, the discussion of the appropriate dimensions to organise the measurement of deprivation has a long history, which can inform present discussions. Because these measures are experimental we do not provide an extensive normative justification of the dimensions drawing on people's own values, the theoretical literature, the policy purpose of the measure, and other considerations. Such an extensive justification is provided in the case of official multidimensional poverty measures. Appendix one provides a set of dimensions and in some cases indicators that have been used in the European context (see also Atkinson *et al* 2002).

The indicators of these measures are naturally data constrained. EU-SILC indicators tend to be defined in the space of resources, in the case of income, material deprivation or housing – or common proxies for functionings, such as levels of schooling and employment status. Some draw upon self-assessments – for example, evaluations of noise and safety – which may not reflect the objective risk of violence or noise vibrations in a neighbourhood. If a measure is intended to reflect deprivations in the functionings or capabilities that poor people experience (Sen 1992), then it would be necessary to examine in what way each indicator could be interpreted to proxy functionings and the anticipated accuracy of such proxies for diverse individuals. Rather than doing so, in this case we draw upon the rich existing literature justifying the EU-SILC indicators (Atkinson and Marlier 2010).

Table 4 provides detailed descriptions of each of the component indicators of the experimental measures and their deprivation cut-offs. Several notes may be in order. First, other measures have not necessarily included the education variable, perhaps due to country differences in the definition of levels of education. For now these measures retain it, and consider a person to be deprived if they have not

---

certain educational level; b) no one in the household has attained a certain educational level; c) at least one-third of household members have not attained a certain level, or d) if the average achievement level across household members is less than some threshold. Of course, households differ in kind as well as by cultural or geographical group: nuclear or extended families differ from student houses and migrant workers sharing accommodation, and the assumptions of intra-household sharing must be considered for each household type.

completed primary school, but the indicator is not necessarily comparable, because the same *levels* of education correspond to differing number of *years* in different countries.

The material deprivation indicator used here requires explanation. Guio et al. (2009) and the subsequent material deprivations used a cut-off of three out of nine indicators. In more recent work (Guio et al. 2012, Atkinson et al 2010), both the variables and the cut-offs have been re-assessed using the 2009 EU-SILC dataset. In this paper we follow Guio et al.'s (2012) stricter version of the indicator - severe material deprivation - with a cut-off to four out of nine.

In employment, we have modified the work intensity indicator proposed by EU-2020. Although ours follows the same structure[4] we identify as non-deprived the people not included in the original indicator: children (<18), students between 18 and 24 and elderly (>60). Thus the country rates cannot be compared with the published EU-2020 rates from EU-SILC data.

The income indicator follows the EU-2020 standards, and considers a person at risk of poverty (AROP) if their household income is less than 60% of the national median income.

3.3. *Non-Response*

The issue of missing values affects our selection of countries. In this analysis, we have adopted a rigorous approach. At the country level we excluded countries with unavailable or inconsistent data across periods from aggregated results. At the individual level, we drop respondents having a missing value in any indicator. The EU-SILC data for the retained sample are then adjusted for missing observations using sampling weights. By reweighted the retained sample, we maintain the original population of each country.[5] The proportion of the sample that has been dropped is reported in Table 1.

Table 1: Non-Response and Missing Values across deprivation indicators

	2006	2007	2008	2009	2010	2011	2012
Austria	0.25%	0.13%	0.04%	0.13%	0.13%	0.07%	0.04%
Belgium	6.79%	10.27%	5.15%	2.07%	2.53%	2.60%	-
Bulgaria	-	17.81%	1.85%	1.49%	1.33%	1.16%	1.60%
Croatia	-	-	-	-	-	44.13%	44.34%
Cyprus	1.60%	1.53%	1.63%	1.30%	1.12%	1.14%	0.81%
Czech Republic	10.00%	10.47%	14.05%	16.80%	20.93%	26.02%	24.55%
Denmark	42.00%	41.66%	40.44%	43.61%	40.18%	38.87%	38.49%
Estonia	0.35%	0.93%	11.56%	19.95%	21.59%	19.69%	21.00%
Finland	48.91%	-	43.53%	43.26%	43.61%	43.50%	44.73%

---

[4] Based on Geodeme (2010) whose do file is available at http://www.ua.ac.be/main.aspx?c=tim.goedeme&n=95420 and Anne-Catherine Guio's comments.

[5] Our bias analyses do not show significant differences between the remaining population and the individuals excluded for non-response or missing variables. To test for bias when there are large (30% or more) drops in sample size we compare the raw headcounts for the retained and dropped groups of the population, and conduct a *t* test for differences between means, retaining only countries having no significant difference between the retained and dropped sample in all indicators for which data are available. For more information regarding the use of register data in the context of the EU-SILC survey, see Jäntti, Törmälehto and Marlier (2013) available at http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-TC-13-004/EN/KS-TC-13-004-EN.PDF

France	1.38%	6.44%	1.59%	1.63%	1.60%	1.67%	1.83%
Germany	4.11%	4.69%	8.16%	6.12%	7.04%	8.88%	8.42%
Greece	2.89%	2.89%	2.77%	2.10%	2.15%	1.68%	1.65%
Hungary	0.29%	0.49%	0.43%	3.70%	1.53%	0.42%	0.61%
Iceland	48.87%	49.04%	48.61%	47.88%	47.58%	48.17%	47.35%
Ireland	2.10%	1.87%	1.96%	3.15%	12.01%	3.80%	-
Italy	0.35%	4.57%	4.83%	4.41%	3.97%	6.08%	5.27%
Latvia	0.29%	0.18%	0.25%	1.59%	1.32%	1.17%	1.22%
Lithuania	2.18%	2.01%	19.58%	15.92%	16.10%	14.49%	18.31%
Luxembourg	2.02%	1.20%	0.87%	1.89%	2.29%	3.05%	1.87%
Malta	-	-	2.29%	1.63%	1.74%	1.39%	1.01%
Netherlands	46.14%	-	45.66%	45.40%	45.27%	45.33%	45.08%
Norway	40.56%	40.70%	41.98%	42.58%	41.26%	42.84%	41.63%
Poland	0.24%	0.27%	0.24%	0.17%	0.19%	8.25%	7.36%
Portugal	13.22%	12.75%	12.31%	11.37%	11.06%	10.87%	12.16%
Romania	-	4.30%	2.21%	1.98%	1.75%	3.74%	3.59%
Slovakia	1.26%	0.74%	5.84%	4.20%	3.27%	3.64%	2.35%
Slovenia	58.33%	57.72%	57.80%	57.93%	53.86%	53.41%	52.61%
Spain	6.23%	5.78%	5.96%	5.70%	5.63%	6.13%	5.16%
Sweden	47.57%	47.42%	43.46%	41.48%	42.87%	43.00%	44.23%
Switzerland	-	-	1.02%	0.74%	0.61%	0.73%	0.89%
United Kingdom	11.19%	10.27%	15.95%	18.13%	18.20%	19.83%	12.21%

3.4.   Uncensored deprivations (raw headcounts)

The descriptive percentage range of deprivations in all indicators used across the three measures for 2006 and 2012 are reported in Table 4 below. The table includes all deprivations of all individuals for whom no data on any indicator is missing. There are several points to note. First, the income percentages roughly match those published in other sources (Nolan et al 2010, 1992).[6] Second, in the aggregate data, of the three European poverty measures deprivations in income (15.2% in the selected EU countries) are the highest although this varies by country. Labour and material deprivation tend to be lower and, in average, are roughly the same level (7.6% and 7.5%, respectively). In 2012, income (15.7%) had the highest raw headcount ratio, without significant changes across countries.

The indicators that tend to have the highest incidence are perceptual data of chronic health status, as well as the self-reported incidence of noise or even roofing problems. However this varies considerably across countries. The challenges inherent in the self-reported health indicators are biases from personality and adaptive preferences or knowledge asymmetries.

In education we merely remind the reader that educational deprivations depend in part upon the definition of primary school, and the duration thereof varies across the included countries. Finally, across the self-reported environmental indicators we see less variation overall than in other indicators which raises concerns about the extent to which they can be decisively reduced.

---

[6] We are grateful to Brian Nolan and Bernard Maitre for direction in constructing this variable

Several kinds of exploration could be useful to understand the interrelationships between indicators, as the papers surveyed demonstrate. For these illustrative measures, rather than a full justification we merely present correlations and redundancy measures across the binary deprivation indicators using the pooled data across all persons in all years.

Table 2: Correlations - Cramer's V - across key indicators

	Income	Work Intensity	Educ.	Mat. Dep.	Noise	Pollut.	Crime	Roof	Health	Chronic Illness	Morb.	Unmet M. Need
Income	1.00	0.26	0.09	0.22	0.03	0.01	0.03	0.10	0.07	0.03	0.05	0.06
Work Intensity		1.00	0.02	0.18	0.04	0.03	0.05	0.06	0.09	0.07	0.09	0.05
Material Dep.			1.00	0.07	-0.01	-0.01	-0.01	0.06	0.19	0.14	0.13	0.02
Education				1.00	0.06	0.05	0.06	0.18	0.12	0.05	0.07	0.14
Noise					1.00	0.41	0.25	0.12	0.03	0.04	0.03	0.06
Pollution						1.00	0.25	0.10	0.03	0.04	0.03	0.05
Crime							1.00	0.09	0.03	0.05	0.03	0.05
Roof								1.00	0.07	0.04	0.04	0.08
Health									1.00	0.42	0.55	0.11
Chronic Illness										1.00	0.40	0.10
Morbidity											1.00	0.08
Unmet M Need												1.00

As expected, there are higher intra-correlations among the health indicators and otherwise relatively low correlations. However pollution and crime have a negative correlation with education, indicating that these deprivations may be higher among those who are not educationally deprived. This may suggest the existence of adaptive preferences among the less educated, and/or a different frame of reference or higher aspirations among the more educated. As we shall see, the censoring process used to construct a poverty measure may effectively address this problem.

Table 3: Redundancy values - across key indicators

	Income	Work Intensity	Educ.	Mat. Dep.	Noise	Pollut.	Crime	Roof	Health	Chronic Illness	Morb.	Unmet M. Need
Income	1.00	0.49	0.23	0.45	0.24	0.16	0.18	0.25	0.23	0.36	0.22	0.24
Work Intensity		1.00	0.15	0.24	0.27	0.19	0.21	0.24	0.20	0.44	0.17	0.12
Material Dep.			1.00	0.22	0.20	0.15	0.13	0.21	0.34	0.48	0.28	0.16
Education				1.00	0.30	0.22	0.22	0.40	0.23	0.41	0.15	0.21
Noise					1.00	0.60	0.46	0.32	0.25	0.36	0.25	0.30
Pollution						1.00	0.38	0.24	0.19	0.37	0.19	0.23
Crime							1.00	0.24	0.17	0.38	0.18	0.20
Roof								1.00	0.24	0.37	0.21	0.28
Health									1.00	0.91	0.65	0.22
Chronic Illness										1.00	0.93	0.50
Morbidity											1.00	0.16
Unmet M Need												1.00

Table 4: Raw Headcounts of all deprivations, 2006 -2012 EU-SILC data

Crime	Education	Health	Income	Mat. Depr.	Morbidity	Noise	Pollution	Roof	U. M. Needs	
12%-11.8%	1.1%-0.9%	7.9%-9%	12.1%-13.7%	3.5%-3.7%	9.4%-9.5%	18.8%-19.9%	7.6%-11%	10.1%-11%	1.7%-1.3%	
17.9%-15.4%	15%-14.3%	8.4%-9.6%	14.6%-14.6%	5.7%-5.1%	7.8%-8.4%	22.5%-19.1%	15.7%-16.3%	14.1%-20.5%	0.6%-2.3%	
27.4%-26.9%	10%-6.2%	16.7%-11.8%	20.9%-20%	57.9%-43.7%	2.4%-3.9%	15.4%-11.9%	24.2%-14.4%	13.7%-13%	25%-11.5%	
3.4%-3.2%	9.2%-7.2%	26.9%-25.7%	21.2%-20.2%	14.9%-15%	7.8%-5.2%	11.1%-10.2%	7%-7.1%	15.1%-13.7%	10.7%-7.5%	1
12.7%-15.4%	24.9%-20.7%	9.4%-6.7%	16.9%-14.8%	12.8%-14.5%	8.5%-7.8%	36.5%-26.6%	24.8%-15.7%	35.3%-30.5%	5.8%-4.9%	
14%-13.1%	0.1%-0.1%	13.4%-12.8%	8.5%-8.9%	9.1%-6.4%	6.8%-6.2%	18.8%-14.2%	19.3%-15.4%	20.5%-10.2%	5.2%-3.8%	
13.4%-10.5%	0.2%-0.1%	8.8%-8.7%	12.2%-13.8%	2.9%-2.7%	0%-7.8%	18.8%-17.8%	7.6%-5.8%	8.3%-16.9%	1.1%-6%	
20.2%-15.6%	5.4%-3.1%	15%-16.3%	18%-17.8%	7.1%-9.4%	9.5%-9.8%	22.8%-12.9%	21.5%-11.8%	23.3%-19.3%	10.4%-9.9%	
15.3%-8.6%	0%-0%	11.8%-7.9%	13.4%-13.7%	3.5%-3%	13.9%-8.3%	16.6%-14.3%	12.8%-8.9%	4.3%-5.8%	3.2%-6.5%	
16.1%-14.6%	23.9%-17.2%	9.5%-8.5%	12.6%-12.9%	4.8%-4.9%	6.3%-8.7%	19.6%-16.8%	15.8%-11.1%	11.6%-12.2%	3.7%-5.5%	
12.4%-11.8%	3.4%-2.9%	9.3%-8.6%	12.3%-15.3%	4.6%-4.6%	8.2%-10.9%	27.2%-25.9%	23.7%-21.9%	14%-12.7%	11%-5.8%	
8.4%-19.8%	35.7%-26.4%	9.2%-9.3%	20.3%-22.7%	11.9%-19.6%	6%-10%	20.4%-25.1%	17.1%-26.2%	21.2%-15.2%	7.3%-9.9%	5
9.9%-10.1%	8.1%-3.5%	20.3%-15.9%	13.9%-12.5%	20.1%-24.3%	13.4%-7.8%	17.2%-10.1%	13.1%-11.8%	26.7%-23.2%	14%-8.8%	
2.4%-3.3%	3.7%-2%	5.5%-6.5%	8.8%-7.1%	1.8%-2.2%	6.7%-12.3%	12.5%-11.2%	8.2%-8.3%	11.9%-17%	3.9%-8.2%	
16%-10.4%	21.9%-17.6%	3.2%-2.9%	17.8%-14.7%	4.1%-7.2%	6.1%-4.9%	14.3%-9.2%	8.5%-4%	14.6%-10.9%	2.5%-2.7%	8
14.9%-14.8%	26.7%-20.5%	10.5%-12.4%	18.7%-18.2%	6.2%-14%	7%-9.4%	25.1%-17.7%	21.6%-17.1%	21.9%-21.2%	6.9%-6.5%	
25.7%-16.9%	3.7%-2.8%	19.4%-15.2%	22.6%-18.4%	30.8%-25.4%	10.1%-7%	20.8%-15.7%	32.1%-21.9%	31.7%-28%	26%-19.1%	
7.7%-4.9%	9.6%-9.4%	18.1%-20.4%	19.8%-18.4%	26.2%-20.4%	10.2%-8.1%	19.9%-13.2%	14.1%-14.7%	28.1%-17.7%	12.8%-3.2%	
11.5%-14.1%	29%-24.7%	7.3%-7.3%	12.8%-13.5%	0.9%-1.2%	7%-5.8%	23%-16.5%	17.8%-13.3%	14.2%-16.2%	4.2%-3.2%	
9.9%-12%	22.1%-21.5%	4.3%-3.4%	14%-13.4%	3.7%-7.6%	2.6%-2.8%	25.1%-30.6%	36.6%-40.5%	6.9%-11%	1.2%-2.4%	
16.4%-18.4%	10.7%-9.3%	6%-6.7%	8.9%-9.2%	2%-2.1%	9.4%-6.7%	31.4%-24.4%	14.2%-13.8%	16.2%-15.6%	1.9%-1.5%	
4%-5.9%	0.2%-0.4%	10.8%-7.1%	11.3%-10.7%	2.8%-1.7%	10.1%-4.9%	12.2%-11%	7.6%-9.6%	7.5%-7.7%	2.7%-2.7%	
8.9%-6.4%	20.4%-16.4%	17.3%-14.6%	17.8%-16.3%	27.8%-13.5%	6.2%-7.4%	19.8%-14.4%	12.9%-11%	41.2%-10.4%	16.4%-14.2%	1
12%-11%	54.5%-47.2%	20%-18.2%	18.1%-17.2%	8.9%-8.3%	11.5%-21.8%	25.5%-23.8%	20.4%-15.4%	19%-22%	5.5%-5.7%	
14.7%-13.6%	10.8%-8.4%	10.2%-9.5%	23.1%-21.1%	36.4%-28.5%	7.4%-8%	34.6%-26.9%	18.4%-17.5%	29.1%-14.8%	15.6%-12.8%	
8.3%-9.7%	1.4%-0.6%	18%-12.5%	10.7%-11.9%	17.8%-10.3%	11.1%-10%	19.8%-16%	19.8%-15.3%	6.3%-8.4%	6.9%-5.8%	
9.5%-8.2%	20.6%-2.9%	18%-14.5%	11.6%-13.5%	5.3%-6.8%	9.5%-12.8%	18%-14.1%	20.6%-16.2%	21.8%-31.6%	0.3%-0.3%	
19.9%-10.3%	31.4%-24.8%	12.2%-8%	19.2%-21%	3.2%-5.5%	8.6%-5.1%	27%-14.9%	17.1%-7.9%	17.1%-12%	6.2%-5.7%	
13.1%-9.5%	9.4%-8.4%	6.4%-4.8%	11.8%-14.2%	1.9%-1.3%	8.9%-6.9%	12.9%-13.1%	6.9%-7.9%	6.6%-7.2%	14.9%-11.8%	
12.6%-16.9%	18.7%-16.3%	3.2%-3.1%	15.3%-15.6%	1.9%-0.8%	5.2%-5.7%	18.4%-19.2%	13%-10.3%	7.5%-11.9%	1.8%-2%	
27.6%-19.5%	0%-0%	6.5%-8.2%	18%-15.7%	3.9%-6.9%	8.5%-10.6%	22%-17.8%	13.4%-8.2%	13.2%-16%	4.3%-2.7%	1

*2007-2012 ** 2011-2012 ˙2006-2011 ⁺2

Table 3 presents a measure of Redundancy based on the cross-tabulation of the dichotomized deprivation values (Alkire et al 2015, 7.2). The redundancy value is the percentage of the population experiencing both deprivations, divided by the lower of the two marginal headcount ratios of deprivation. Each redundancy value ranges from zero to one, and shows the percentage of possible matches between two indicators that are filled: for example: in the case of work intensity and income, 49% of the possible matches between the two indicators are realized. We see that the highest redundancy is between morbidity and chronic illness, and health and chronic illness. This redundancy in part informed the structure of Measure 2 (which omits Chronic illness).

3.5. Definition of Experimental Measures: Dimensions, Indicators, Cut-offs and Weights

Having described the deprivations, we now set out the experimental measures that are implemented as described in Table 4

Table 5: Dimensions, Indicators and Weights for Measures 1-3

Dimension	Variable	Respondent is not deprived if:	Meas. 1	Meas. 2	Meas. 3
EU 2020	Income	His/her equivalized disposable income is above 60% of median income	1/12	1/12	1/10
	Work Intensity	The ratio of the total number of months that all working-age household members have worked during the income reference year and the total number of months the same household members theoretically could have worked in the same period is higher than 0.2	1/12	1/12	1/10
	Material Deprivation	The respondent has the capacity to make ends meet; to afford one week of holidays; a meal with meat, chicken, fish or vegi equivalent; to face unexpected expenses; and, to keep home adequately warm. Or the respondent has a car, a colour TV, a washing machine, and a telephone.	1/12	1/12	1/5
Education	Education	The respondent has more than primary education	1/4	1/4	1/5
Environment	Noise	Low noise from neighbourhood or from the street	1/16	1/16	1/20
	Pollution	Low pollution, grime or other environmental problems	1/16	1/16	1/20
	Crime	Low crime, violence or vandalism in the area	1/16	1/16	1/20
	Roof	No leaking roof, damp walls, rot in window frames or floor	1/16	1/16	1/20
Health	Health	The respondent considers her own health as fair or above	1/16	1/12	1/20
	Chronic Illness	The respondent has no chronic illness or long-term condition	1/16		1/20
	Morbidity	The respondent has no limitations due to health problems	1/16	1/12	1/20
	Unmet Med. Needs	The respondent has unmet medical needs	1/16	1/12	1/20

Three measures are constructed; what varies are the weighting structures. Two use the same 12 indicators; the third drops one indicator. The measures are computed and reported for all time periods to analyse changes across time. All measures include the three dimensions of the EU2020 multidimensional poverty index: income poverty (framed as being at risk of poverty); material deprivation; and low work intensity.

All three measures also include two or three health indicators: self-reported health, the presence of a chronic illness, and activity limitations due to poor health. And all include four indicators of living environment: housing, pollution, crime and noise. Table 4 specifies the indicators and cut-offs.

In Measure 1, the 12 indicators are organized into four dimensions, each of which are equally weighted, and each indicator within a dimension is equally weighted. Measure 2 replicates Measure 1 except that

the indicator of chronic illness (which replicates information present in other health indicators and has a high incidence) is dropped and the health indicators are re-weighted accordingly. Measure 3 organises the 12 indicators into 5 dimensions by breaking up (and effectively doubling the weight on) the EU-2020 indicators. In particular, weight on income and work-intensity is 1/10, and on material deprivation is 1/5. The other three indicators have the same structure as in Measure 1, but lower weights because of this shift.

4.   Results

This section presents the results for three measures across seven periods. The comprehensive tables underlying this analysis are attached.

4.1.   Identification of multidimensional poverty

The first step to construct results is to identify who is poor. The AF dual cut-off methodology identifies a person as poor if the weighted sum of his or her deprivations is greater than or equal to the poverty cut-off. It censors the deprivations of the non-poor, in order to focus attention strictly on the poor. Information on the total deprivations (raw headcounts) is retained and can be considered later, for inter-temporal analyses in particular. Having identified the poor, the methodology then aggregates information regarding the poor into an overall poverty measure.

In our experimental indices, we first calculate the poverty measuring using all range of poverty cut-offs from 5% to 100%, for all measures in all periods. We display the results, for example, using twenty such cut-offs, from 05% to 100% for each measure in 2006-2012. Using the Measure 1 and data of three years: 2006, 2009 and 2012, we compare the level of poverty of the regions according to United Nations[7] covered in the EU-SILC data with consistent information.

Figure 1: Measure 1 Adjusted Headcount Ratio (M_0) by poverty cut-off 2006-2009-2012
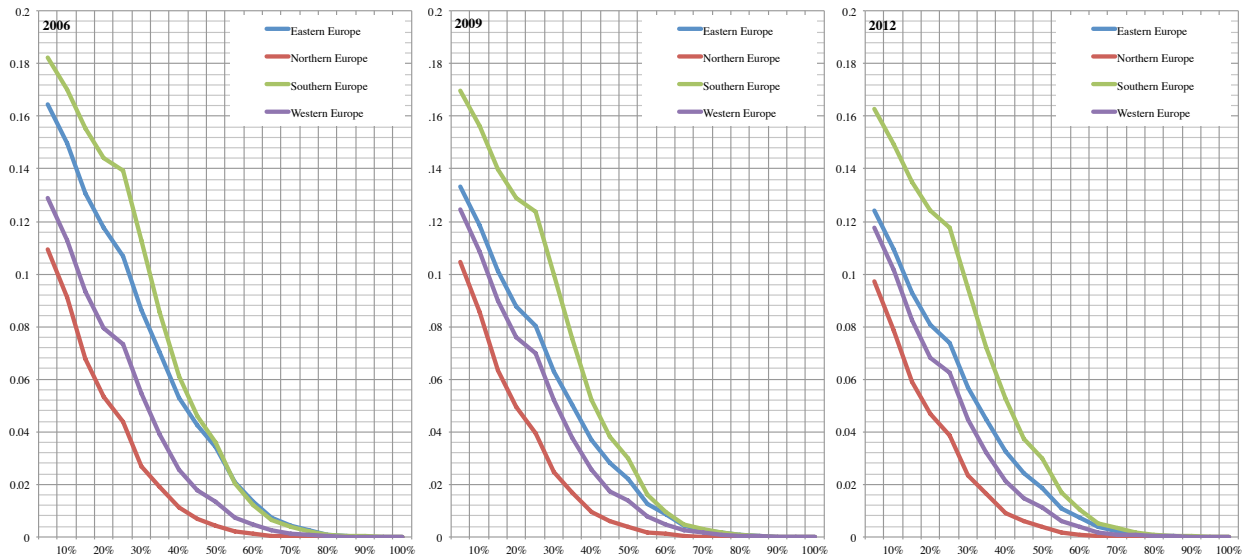
Clearly, Northern Europe is the less poor region regardless the poverty cut-off and the year, followed by Western and Eastern Union. In general, it seems that Southern Europe is the poorest region. However, in

---

[7] http://millenniumindicators.un.org/unsd/methods/m49/m49regin.htm. United Nations classify Cyprus as Western Asia; however, we included it into Southern Europe.

2006, and for higher cut offs, there is not a clear dominance of Southern Europe, over Eastern Europe. Our analysis for all other measures and year confirms the same trend being southern Europe the poorest and northern Europe the less poor.

We also use the pooled information, which includes data of Austria, Cyprus, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, Norway, Netherlands, Poland, Portugal, Slovakia, Spain, Sweden and United Kingdom. Measures 1 and 2 show a clear reduction in multidimensional poverty in Europe between 2006 and 2012; however, dominance is not clear between years. For instance, in Measure 2 results for 2008 and 2009 are not statistically different at 99%. In Measure 3, there is not clear dominance across all possible poverty cutoffs in any pair of consecutive years.

Figure 2: Measure 2 Adjusted Headcount Ratio (M0) by poverty cut-off 2006-2012
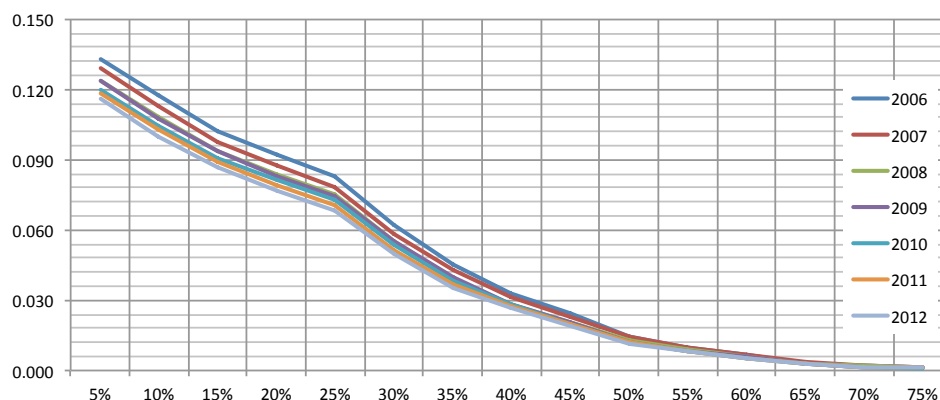
Figure 3: Measure 3 Adjusted Headcount Ratio (M0) by poverty cut-off 2006-2012
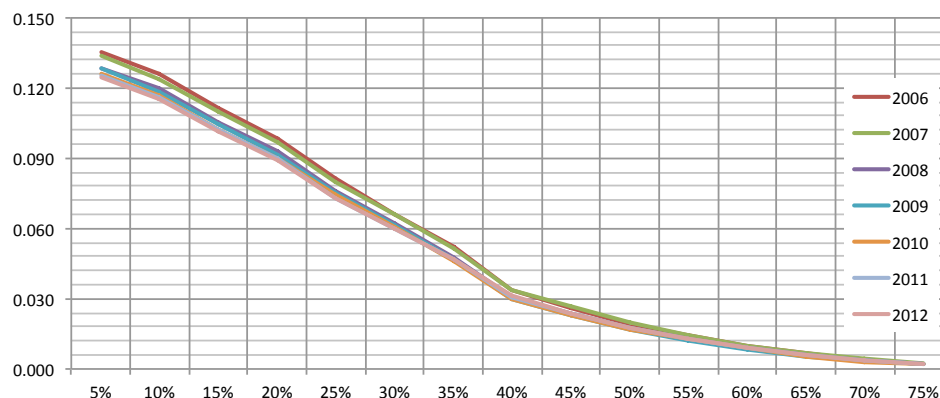
In what follows we have selected poverty cut-offs which require a person to be poor in strictly greater than one dimension or the equivalent sum of weighted deprivations drawn from several dimensions. This definition assures that each person identified as poor is indeed deprived in two or more dimensions, which coheres with the idea of 'multidimensional' poverty.[8] Table 6 presents results for the 3 Measures in 2006, 2009 and 2012 with cut offs of 26%, 26% and 21%, respectively.

Table 6: Aggregated Results by poverty cut-off 2006-2009-2012

---

[8] We are grateful to Tony Atkinson for suggesting that this conceptual issue needs to be addressed and, when the purpose of the measure permits, satisfied.

|	Measure 1 k=26%			Measure 2 k=26%			Mesaure 3 k=21%		
	2006	2009	2012	2006	2009	2012	2006	2009	2012
Adjusted Headcount Ratio	0.078	0.069	0.063	0.068	0.059	0.053	0.081	0.075	0.073
Headcount Ratio	19.4%	17.4%	16.1%	17.1%	15.0%	13.5%	22.3%	21.0%	20.1%
Intensity	39.9%	39.5%	39.4%	39.7%	39.3%	39.5%	36.3%	35.9%	36.4%
Censored Headcounts:									
Income	7.6%	7.0%	6.7%	6.8%	6.2%	5.9%	8.9%	8.7%	8.8%
Work Intensity	4.1%	3.5%	3.5%	3.5%	3.0%	3.0%	5.0%	4.3%	4.4%
Material Deprivations	4.8%	3.7%	4.6%	4.4%	3.4%	4.1%	7.1%	7.0%	8.3%
Education	12.4%	11.0%	9.5%	11.3%	9.8%	8.4%	12.7%	11.3%	9.7%
Noise	7.5%	6.7%	5.6%	7.3%	6.4%	5.3%	8.0%	7.4%	6.3%
Pollution	6.0%	5.3%	4.4%	5.9%	5.1%	4.2%	6.2%	5.8%	4.9%
Crime	5.3%	4.9%	4.2%	5.1%	4.7%	4.0%	5.6%	5.5%	4.9%
Roof	7.2%	5.5%	5.1%	6.9%	5.2%	4.8%	8.3%	6.7%	6.2%
Health	6.8%	5.9%	5.7%	6.3%	5.4%	5.1%	6.9%	6.0%	5.9%
Chronic Illness	11.7%	11.2%	10.7%				12.4%	11.9%	11.4%
Morbidity	4.6%	4.7%	4.9%	4.2%	4.3%	4.4%	4.7%	4.7%	4.9%
Unmet Med. Needs	3.2%	2.8%	2.7%	3.2%	2.8%	2.6%	3.4%	3.3%	3.3%
Percentage Contributions (weighted)									
Income	9.4%	9.7%	10.1%	9.4%	9.9%	10.4%	12.1%	12.6%	12.9%
Work Intensity	6.1%	6.0%	6.0%	6.1%	6.1%	6.1%	7.7%	7.3%	7.2%
Material Deprivations	5.6%	5.1%	6.8%	5.9%	5.5%	7.3%	17.2%	17.8%	22.1%
Education	30.7%	30.6%	28.8%	31.6%	31.6%	30.0%	26.0%	25.7%	22.7%
Noise	7.2%	7.1%	6.6%	8.1%	8.1%	7.6%	5.5%	5.4%	4.9%
Pollution	5.6%	5.7%	5.0%	6.5%	6.5%	5.8%	4.2%	4.2%	3.6%
Crime	5.4%	5.5%	5.0%	6.2%	6.3%	5.8%	4.1%	4.1%	3.7%
Roof	5.9%	5.3%	5.4%	6.6%	5.9%	6.0%	4.8%	4.4%	4.3%
Health	6.0%	5.9%	6.2%	8.4%	8.3%	8.7%	4.4%	4.1%	4.2%
Chronic Illness	10.5%	11.2%	11.4%				8.2%	8.4%	8.4%
Morbidity	4.6%	5.3%	5.7%	6.4%	7.4%	7.9%	3.3%	3.6%	3.8%
Unmet Med. Needs	2.9%	2.8%	2.8%	4.7%	4.4%	4.4%	2.2%	2.2%	2.2%

Measure 3 shows consistent the higher level of poverty regardless the year. This higher level of multidimensional poverty is explained mainly by the headcount ratio. Due to the lower cut-off, intensity is also lower. Since Measure 3 has 5 dimensions – two of them with one indicator – it is easy to be identified as a poor but with a lower intensity.

Figure 4: Intensity EU selected countries 2006-2008-2010-2012
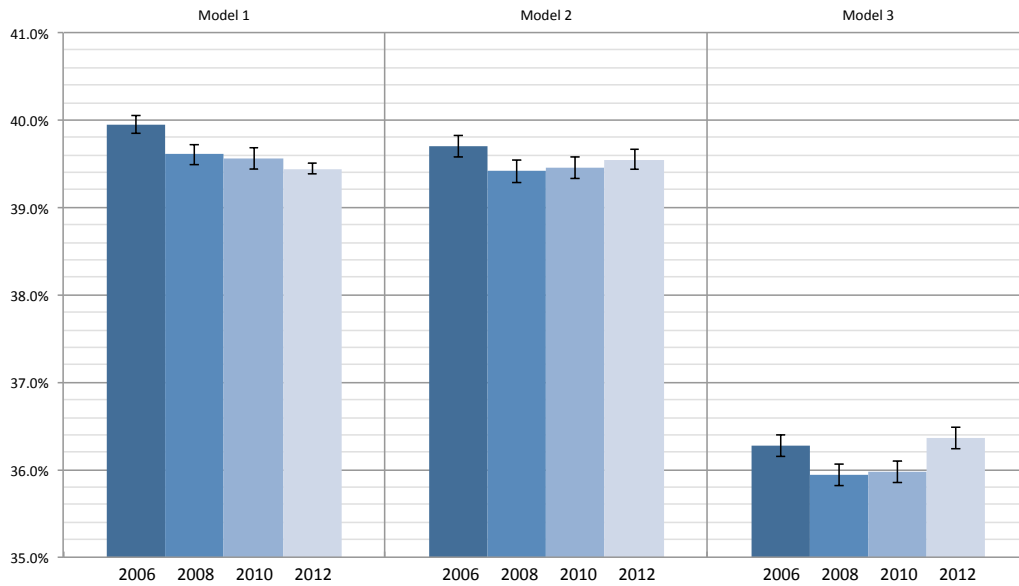
Across years and measures, the reduction in the level of multidimensional poverty is explained mainly by the reduction in the percentage of poor individuals. In Measure 1, the headcount ratio reached 19.4% in 2006 and fell to 16.1% in 2012. The intensity of poverty in the pooled sample dropped by 0.05%, but with large differences across countries. Figure 3 shows that reduction in intensity is significant between 2006 and 2010 for measure 1. Measure 2 also shows a significant reduction in the number of multidimensionally poor individuals from 17.1% to 13.5% and a non-significant reduction of the intensity between 2006 and 2012 but significant between periods (2006-2008). Measure 3 estimates poverty to be at 22.3% in 2006 and 20.1% in 2012 and a non-significant increase in intensity during the same period. Changes in intensity are significant between 2006 and 2008; and, from 2008 and 2012.

Measure 1 shows that the composition of poverty is mainly defined by education and material deprivation in all periods; however, across time there is a reduction in the former at the expense of the latter. In Measures 2 and 3 there is a clear preponderance of education distantly followed by income.

Figure 5: Dimensional Breakdown EU selected countries 2006-2009-2012
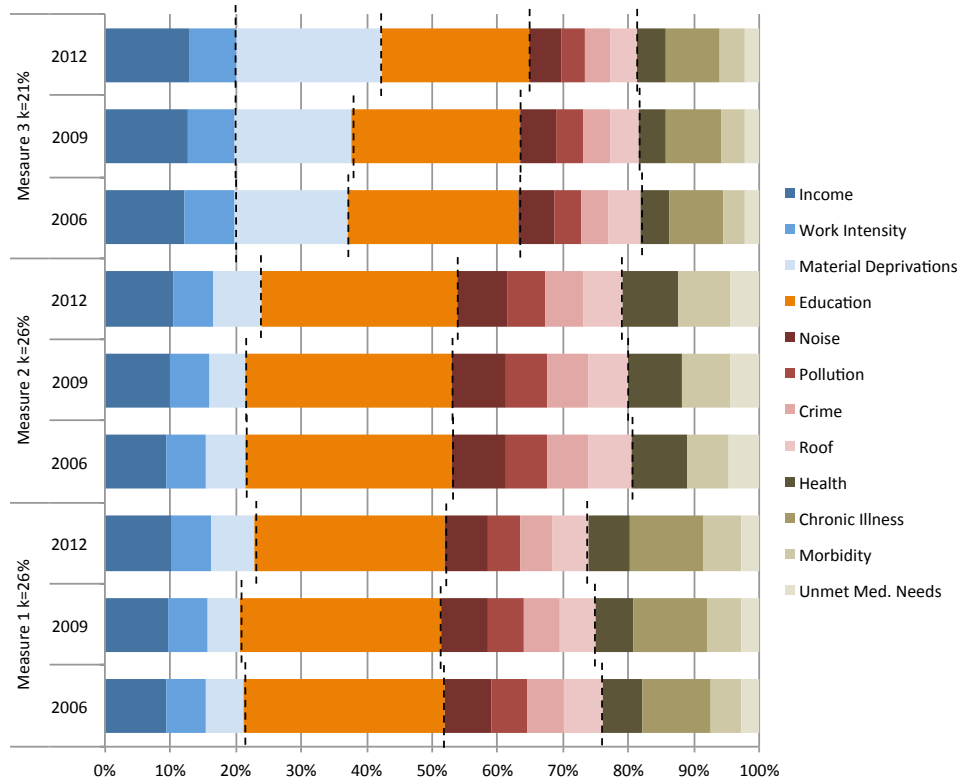
4.2. *Poverty across countries*

This section presents and discusses the three measures' results in the year 2009. To make comparisons we select a given poverty cut-off for each measure. For each measure, we present the M_0 poverty value as well as its associated indices: the headcount ratio or percentage of the population identified as multidimensionally poor for a given cut-off (H), and the intensity, or average percentage of weighted deprivations experienced by poor people (A).

From Table 7, we see first of all that each of the three measures in 2009, which differ in weights and indicators, generate relatively similar country rankings. Kendal tau b rank correlations across the countries range from 0.81 to 0.95, which suggest that more detailed robustness tests may find the measures to be relatively robust changes in indicators and weights.[9]

Table 7: Aggregated Results by poverty cut-off 2009

	Measure 1 k=26% by area			Measure 2 k=26% by area			Measure 3 k=21% by area		
	M0	*H*	*A*	*M0*	*H*	*A*	*M0*	*H*	*A*
Austria	*0.026*	*0.073*	*0.363*	*0.020*	*0.055*	*0.368*	*0.032*	*0.092*	*0.350*
Belgium	*0.069*	*0.172*	*0.403*	*0.059*	*0.147*	*0.400*	*0.069*	*0.190*	*0.365*
Bulgaria	*0.088*	*0.219*	*0.402*	*0.080*	*0.194*	*0.411*	*0.145*	*0.370*	*0.392*
Croatia	.	.	.	.	.	.	.	.	.

---

[9] For measures of robustness to weights and cut-offs see Alkire and Santos 2014, Alkire et al 20102015; Ura et al 2012.

Cyprus	0.108	0.255	0.424	0.096	0.232	0.412	0.106	0.285	0.372
Czech Republic	0.025	0.073	0.346	0.020	0.057	0.346	0.034	0.098	0.343
Denmark	0.023	0.066	0.347	0.017	0.048	0.360	0.028	0.085	0.329
Estonia	0.048	0.130	0.368	0.036	0.097	0.371	0.055	0.156	0.351
Finland	0.027	0.078	0.342	0.018	0.051	0.354	0.035	0.101	0.342
France	0.084	0.213	0.396	0.067	0.170	0.394	0.081	0.233	0.346
Germany	0.043	0.114	0.377	0.037	0.098	0.377	0.047	0.132	0.356
Greece	0.121	0.291	0.415	0.109	0.266	0.410	0.119	0.319	0.372
Hungary	0.055	0.142	0.386	0.045	0.115	0.392	0.080	0.219	0.365
Iceland	0.024	0.069	0.351	0.018	0.052	0.354	0.024	0.077	0.314
Ireland	0.074	0.187	0.396	0.060	0.154	0.390	0.076	0.213	0.355
Italy	0.096	0.234	0.411	0.089	0.218	0.407	0.093	0.257	0.362
Latvia	0.085	0.223	0.379	0.072	0.189	0.381	0.111	0.292	0.381
Lithuania	0.069	0.173	0.397	0.058	0.146	0.397	0.088	0.235	0.373
Luxembourg	0.088	0.225	0.390	0.078	0.202	0.385	0.076	0.231	0.331
Malta	0.089	0.221	0.403	0.074	0.189	0.390	0.083	0.237	0.349
Netherlands	0.054	0.144	0.374	0.041	0.110	0.371	0.051	0.155	0.329
Norway	0.017	0.051	0.339	0.012	0.033	0.350	0.021	0.062	0.341
Poland	0.094	0.223	0.421	0.083	0.198	0.418	0.104	0.268	0.390
Portugal	0.166	0.397	0.417	0.149	0.366	0.408	0.149	0.409	0.364
Romania	0.084	0.210	0.400	0.078	0.195	0.399	0.128	0.336	0.380
Slovakia	0.031	0.089	0.353	0.026	0.072	0.355	0.045	0.127	0.351
Slovenia	0.054	0.140	0.383	0.044	0.115	0.385	0.060	0.166	0.362
Spain	0.100	0.255	0.393	0.086	0.223	0.385	0.091	0.268	0.341
Sweden	0.051	0.138	0.369	0.038	0.104	0.370	0.048	0.148	0.327
Switzerland	0.057	0.151	0.378	0.047	0.124	0.375	0.052	0.158	0.329
United Kingdom	0.028	0.083	0.343	0.021	0.061	0.342	0.034	0.104	0.328

As we mentioned before, the levels of poverty provided by Measure 3 tends to be the highest, followed by Measure 1 and 2. In all three measures, Portugal has the highest poverty rates and Norway - followed by Iceland and Denmark - has the lowest poverty rates in all three measures.

While the intensity factor varies relatively less across countries, it is significantly. However, notice also that intensity tends to be highest in the countries with highest poverty – a finding that has been noted elsewhere also.

After censoring the deprivations of non-poor people, these measures can be broken down by indicator. Figures 6, 7 and 8 provide the percentage contribution of each indicator of poverty Measure 1, 2 and 3 in the year 2009, respectively. The countries are ranked from those having highest rates of poverty to those with lowest rates.

Measure 1 has four equally weighted dimensions. However, the percentage contribution of education varies greatly across countries. This reflects differences in both achievements and in definitions of lower secondary school, so unfortunately is not strictly comparable. In general, in the least poor countries the relative contribution of educational deprivations is lower and of EU-2020 (with some exceptions) is higher. This interesting finding draws attention to the need to consider non-EU-2020 indicators. The environmental indicators on the far right show relatively less variation across countries.

Figure 6: Dimensional Decomposition Measure 1 k=26% by country (2009)
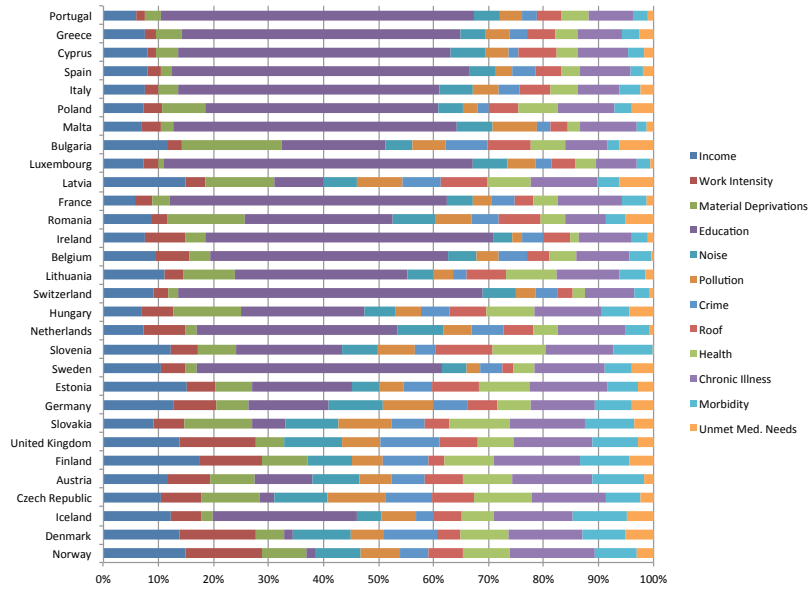
Figure 7: Dimensional Decomposition Measure 2 k=26% by country (2009)
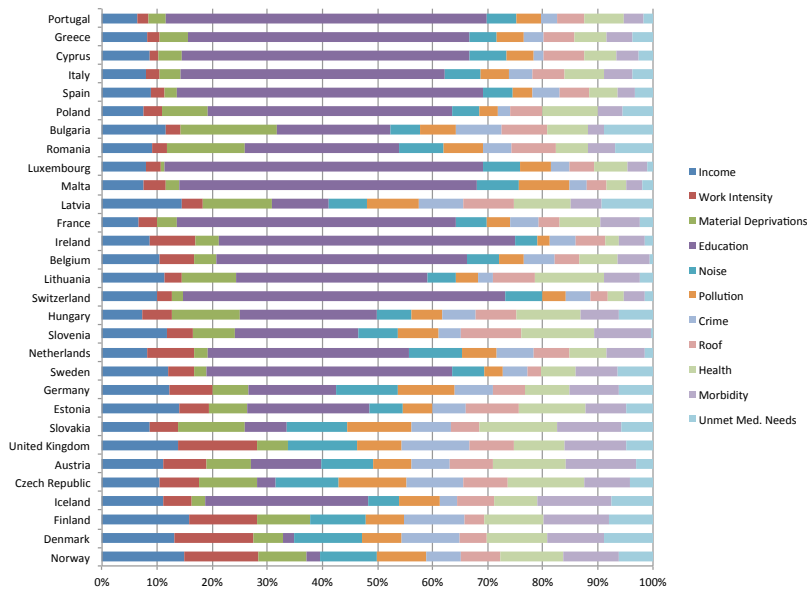
Figure 8: Dimensional Decomposition Measure 3 k=21% by country (2009)
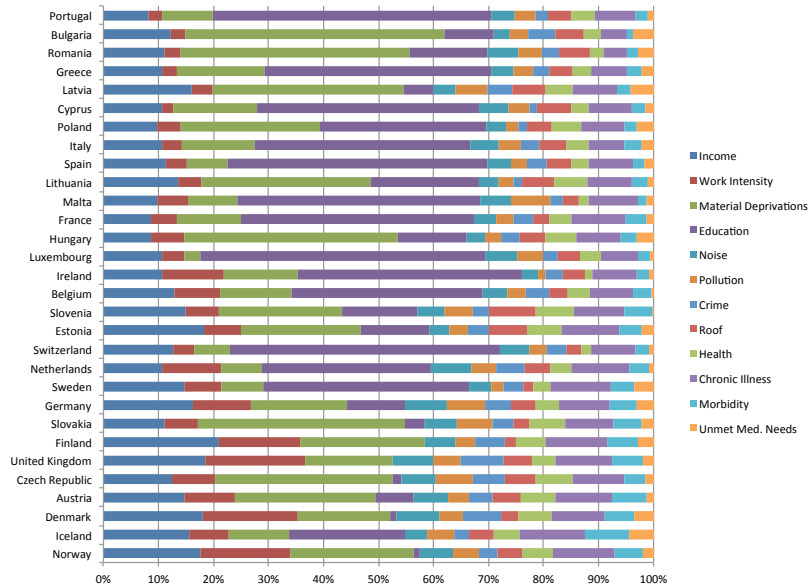
In Figure 6 and 8, we can compare two similar measures using 2009 data. Measure 1 and 3 have the same indicators, cut-offs and but different weights. In the case of measure 3, the income and labour deprivations are one dimension with weight 20%, material deprivation and education are two different dimensions valued at 20% each one.

In both graphics, the countries are ranked from low to high poverty (bottom to top). As we can see, in measure 1 the relative contribution of labour, material deprivation decline as overall poverty in a country increases, as do the relative contributions of the health variables. The educational deprivations' contribution to multidimensional poverty increases strikingly in the poorer countries. In measure 3, there is a similar although less marked trend. Material deprivation is a crucial component across all countries.

Naturally the composition of poverty is affected both by the rates of deprivations in each indicator and also by the weights applied to it. It can also therefore be useful to view the levels of deprivation in each indicator individually, separately from the weights. To do this we construct censored headcount ratios, which show the percentage of people who are identified as poor and are deprived in each particular indicator. Note that the poverty measure M_0 is merely the simple average of the weighted censored headcounts – that is, the sum of the censored headcounts of each indicator, where censored headcount is multiplied by its respective weight.

Figure 9 below provides the raw and censored headcounts of three countries: Norway, Hungary and Portugal, using Measure 3 (k=21%) in 2009. Necessarily, the censored headcounts are equal to or lower than the raw headcounts. The difference between these shows whether some persons who are deprived in that indicator are not simultaneously deprived in enough other indicators to be identified as multi-dimensionally poor.

Figure 9: Dimensional Decomposition Measure 3 k=21% by country (2009)
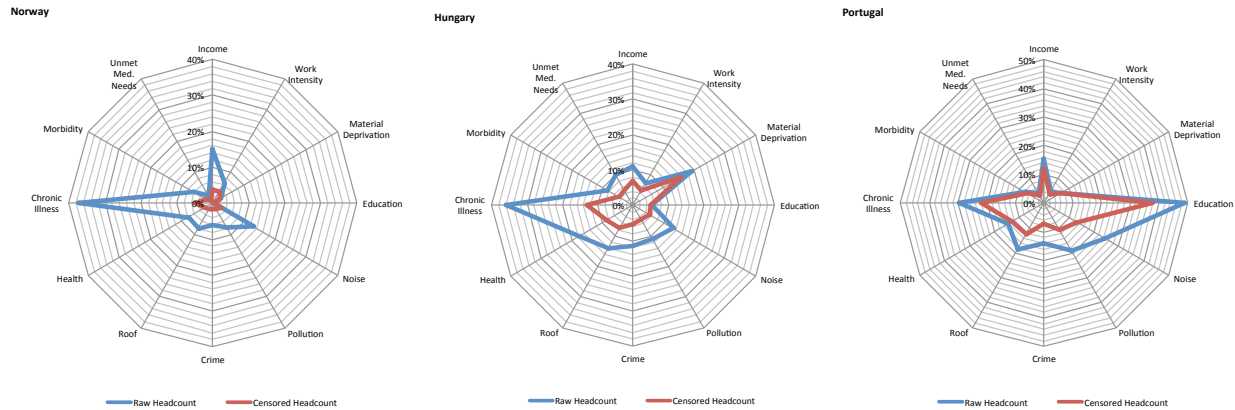
For example, in all indicators, the difference between raw and censored headcounts is particularly noticeable in relation to chronic health, and health limitations as well as noise, crime and pollution. In this way the poverty cut-off may be used to 'clean' the observations of deprivations that do not signify poverty – in some cases because they may reflect varying frames of reference (noise), or standards (housing). Note also that the deprivations with the highest weight (income, labour, education) have relatively less differences between raw and censored headcounts than the others because one requires fewer additional indicators to be identified as poor. Of these three, the differences between raw and censored headcounts in income tend to be larger, but this is not a fixed rule.

In the case of Norway, almost 40% of the population is deprived in chronic illness. However, the dual cut-off approach shows that this does not imply poverty. The percentage of the population who are poor and deprived in chronic illness is barely 7.9%. A similar situation can be perceived in the income and noise indicators.

In the case of Hungary – the central radar in figure 9 – the chronic illness has the same pattern as in Norway. However, due to the structure of the measure, it is clear that an individual materially deprived or deprived in education will tend to be considered poor as well. For instance, the raw headcount of material and education deprivation is 19.6% and 5.2%, respectively; and the censored headcount shows that 15.6% of the population is materially deprived and poor; meanwhile 4.9% is deprived in education and poor. This shows that 4% is only materially deprived and 0.3% is only deprived in education.

Finally, in the case of Portugal, the structure of the censored headcount replicates the raw headcount. The income measure seems to play a more important role. 15.4% of the population is income poor and only 12.1% is both income deprived and poor. It is clearly shown, therefore, that by using income only as a poverty measure a 3.2% of the population would be misidentified as poor since none of them is deprived in any other dimension.

This section has illustrated the basic analyses of multidimensional poverty measures and their partial indices; the appended tables provide comprehensive results for all measures across all years, with varying poverty cut-offs. The next section analyses the changes in poverty across time.

Table 8: Aggregated Results by country 2006 and 2012

	Measure 1 k=26%						Measure 2 k=26%						Measure 3 k=21%					
	2006			*2012*			*2006*			*2012*			*2006*			*2012*		
	M0	*H*	*A*	*M0*	*H*	*A*	*M0*	*H*	*A*	*M0*	*H*	*A*	*M0*	*H*	*A*	*M0*	*H*	*A*
Austria	0.018	5.2%	35.3%	0.023	6.4%	35.3%	0.014	4.0%	36.5%	0.017	4.8%	35.6%	0.024	7.3%	33.4%	0.028	8.2%	34.2%
Belgium	0.064	16.0%	39.8%	.	.	.	0.055	14.0%	39.3%	.	.	.	0.065	18.0%	36.2%	.	.	.
Bulgaria	.	.	.	0.072	18.1%	40.0%	.	.	.	0.065	15.9%	41.1%	.	.	.	0.135	35.3%	38.2%
Croatia	.	.	.	0.072	17.8%	40.2%	.	.	.	0.060	14.6%	40.8%	.	.	.	0.091	23.3%	38.9%
Cyprus	0.120	27.2%	44.2%	0.103	24.8%	41.5%	0.109	25.6%	42.6%	0.087	21.5%	40.3%	0.122	31.3%	39.0%	0.112	30.5%	36.8%
Czech Republic	0.033	9.2%	35.8%	0.022	6.5%	34.4%	0.027	7.7%	35.4%	0.017	4.8%	34.6%	0.046	12.8%	35.9%	0.032	9.1%	34.7%
Denmark	0.019	5.7%	33.7%	0.029	8.3%	34.5%	0.014	4.0%	33.5%	0.021	5.9%	35.3%	0.027	7.9%	34.2%	0.035	10.5%	33.3%
Estonia	0.066	16.6%	39.4%	0.051	13.8%	37.0%	0.056	14.2%	39.2%	0.039	10.4%	37.4%	0.070	18.9%	37.0%	0.065	18.0%	36.0%
Finland	0.033	9.6%	34.0%	0.023	6.8%	33.7%	0.022	6.2%	35.0%	0.015	4.3%	34.6%	0.041	12.0%	34.1%	0.032	9.7%	33.1%
France	0.093	23.3%	39.8%	0.070	17.6%	39.5%	0.074	18.8%	39.6%	0.056	14.2%	39.3%	0.087	25.0%	34.7%	0.068	19.5%	34.8%
Germany	0.042	11.2%	37.1%	0.039	10.6%	37.2%	0.035	9.5%	37.2%	0.033	8.7%	37.5%	0.046	13.2%	35.1%	0.043	12.0%	35.6%
Greece	0.126	30.4%	41.3%	0.127	30.1%	42.3%	0.115	28.3%	40.6%	0.115	27.4%	41.9%	0.125	33.3%	37.5%	0.144	36.9%	39.2%
Hungary	0.081	19.9%	40.4%	0.058	15.2%	38.5%	0.070	17.2%	40.7%	0.048	12.3%	39.2%	0.103	27.0%	38.4%	0.093	24.6%	37.8%
Iceland	0.021	6.0%	34.9%	0.027	7.4%	36.1%	0.016	4.5%	35.1%	0.021	5.9%	36.6%	0.023	7.2%	31.6%	0.029	8.7%	33.7%
Ireland	0.081	20.1%	40.2%	.	.	.	0.066	16.4%	39.9%	.	.	.	0.078	21.7%	35.8%	.	.	.
Italy	0.110	26.5%	41.4%	0.097	23.4%	41.4%	0.101	24.7%	40.9%	0.087	21.2%	41.1%	0.104	28.3%	36.7%	0.105	28.0%	37.7%
Latvia	0.103	26.8%	38.5%	0.071	18.9%	37.5%	0.093	24.1%	38.4%	0.061	16.1%	37.5%	0.140	35.8%	39.0%	0.108	28.8%	37.6%
Lithuania	0.084	21.2%	39.8%	0.073	18.8%	39.0%	0.073	18.3%	40.1%	0.060	15.4%	39.2%	0.119	31.3%	38.1%	0.100	26.5%	37.8%
Luxembourg	0.090	22.3%	40.1%	0.077	19.5%	39.4%	0.079	19.9%	39.7%	0.068	17.4%	39.2%	0.077	22.8%	33.8%	0.067	19.9%	33.6%
Malta	.	.	.	0.093	23.4%	39.7%	.	.	.	0.075	19.7%	38.2%	.	.	.	0.091	26.2%	34.9%
Netherlands	0.060	15.6%	38.2%	0.052	14.0%	37.4%	0.047	12.6%	37.6%	0.038	10.3%	37.3%	0.057	17.1%	33.6%	0.052	15.9%	32.9%
Norway	0.023	6.8%	34.3%	0.016	4.7%	34.4%	0.015	4.1%	36.9%	0.011	3.1%	35.7%	0.028	8.5%	33.4%	0.020	6.0%	33.7%
Poland	0.126	29.9%	42.3%	0.082	19.7%	41.4%	0.114	27.3%	41.8%	0.070	16.8%	41.5%	0.155	38.6%	40.1%	0.092	24.2%	38.0%
Portugal	0.174	42.0%	41.5%	0.171	40.1%	42.6%	0.160	39.2%	40.7%	0.155	37.1%	41.7%	0.154	42.6%	36.2%	0.154	41.4%	37.1%
Romania	.	.	.	0.071	17.5%	40.7%	.	.	.	0.066	16.2%	40.9%	.	.	.	0.111	29.5%	37.7%
Slovakia	0.036	10.3%	35.1%	0.028	7.9%	35.8%	0.030	8.3%	35.9%	0.023	6.3%	36.3%	0.060	17.3%	34.7%	0.043	12.0%	35.8%
Slovenia				0.050	13.1%	37.7%				0.038	10.0%	38.1%				0.060	16.7%	36.1%
Spain	0.112	27.6%	40.7%	0.085	21.7%	39.0%	0.103	25.9%	39.8%	0.069	17.9%	38.6%	0.100	28.6%	35.0%	0.084	24.2%	34.5%
Sweden	0.044	12.0%	36.3%	0.042	11.5%	37.0%	0.032	8.9%	36.5%	0.032	8.7%	36.9%	0.043	13.3%	32.0%	0.042	12.6%	32.9%

Switzerland	.	.	.	0.056	14.7%	38.1%	.	.	.	0.046	12.3%	37.6%	.	.	.	0.050	15.2%	32.6%
United Kingdom	0.031	9.0%	34.6%	0.028	8.3%	34.4%	0.024	6.8%	34.6%	0.021	6.1%	34.8%	0.037	11.1%	33.7%	0.039	11.2%	35.1%

4.3. Poverty across time: 2006-2012

This section presents the annual time comparisons. According to all measures, poverty decreased between 2006 and 2012 in aggregated terms as seen shown in table 4. This reduction goes from 9.9% in measure 3 to 22% in measure 2 (with 19.2% in measure 1). This change has two clear patterns. In measure 2, 77% of the change is explained by the poverty reduction of the first triennium. In Measure 1 and 3 the first triennium explain accounts for more than the 55% of the change. Moreover, the average yearly reduction of multidimensional poverty between 2006 and 2008 is more than 5% and it is around 2% between 2009 and 2012 for all measures.

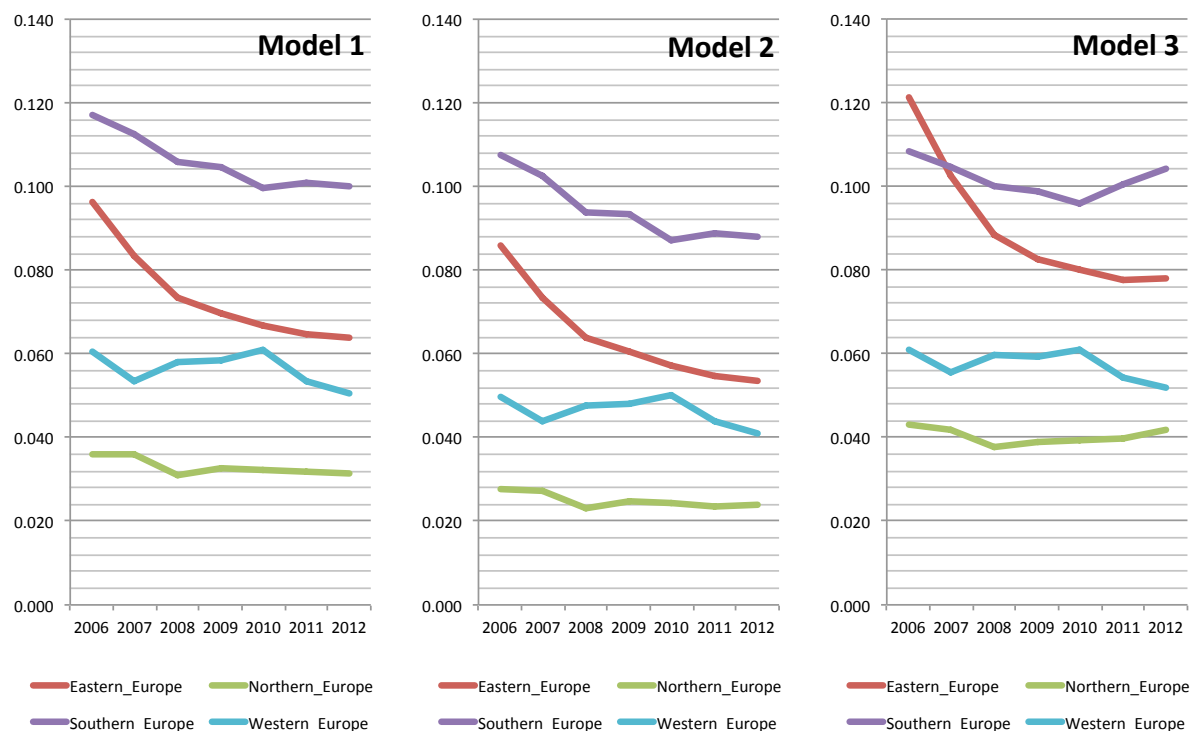**Figure 10: Changes in the adjusted headcount ration by region over time**

Figure 10 shows the evolution of the adjusted headcount ratio between 2006 and 2012 for the European sub regions. All measures show a reduction in the poverty level of Eastern Europe; however, this reduction is faster during the first years. Southern Europe shows the higher poverty with a parsimonious reduction till 2010. From 2010-2012, Measure 1 and 2 show no change and Measure 3 an increase in poverty. Western Europe reduces poverty in the first period then small increments and finally a decline from 2010. Finally, Northern Europe presents slight reduction in Measure 1 and 2; and, insignificant changes in Measure 3 (increasing marginally from 2008).

Figure 11 below shows the evolution of M_0 across time for measure 1 across all countries. The empty gaps for some countries and years are due to the lack of comparable data.

In all graphics, the countries are ranked from low to high poverty using 2006 poverty data for the measure shown. According to all countries experienced poverty drops but Iceland, Austria and Denmark. Highest reductions were exhibited by Poland, Spain, Latvia, Hungary, Finland and Czech Republic. Measure 3 also shows the same pattern. Only Greece, Italy, United Kingdom, Iceland, Austria and Denmark do not reduce poverty between 2006 and 2012. The faster poverty reduction corresponds to Poland (40,6%)

Most countries show low or no decrease from 2009 to 2012. In all measures except 3, there is a relatively stronger decrease in poverty from 2008-9. Some of this apparent decrease may be due to drops in the (relative) income poverty rates due to the financial crisis, illustrating the need for care in interpreting mixed relative and absolute indicators. Patterns also vary by country.

Figure 11: Adjusted Headcount Ratio for all Measures by country (2006-2012)
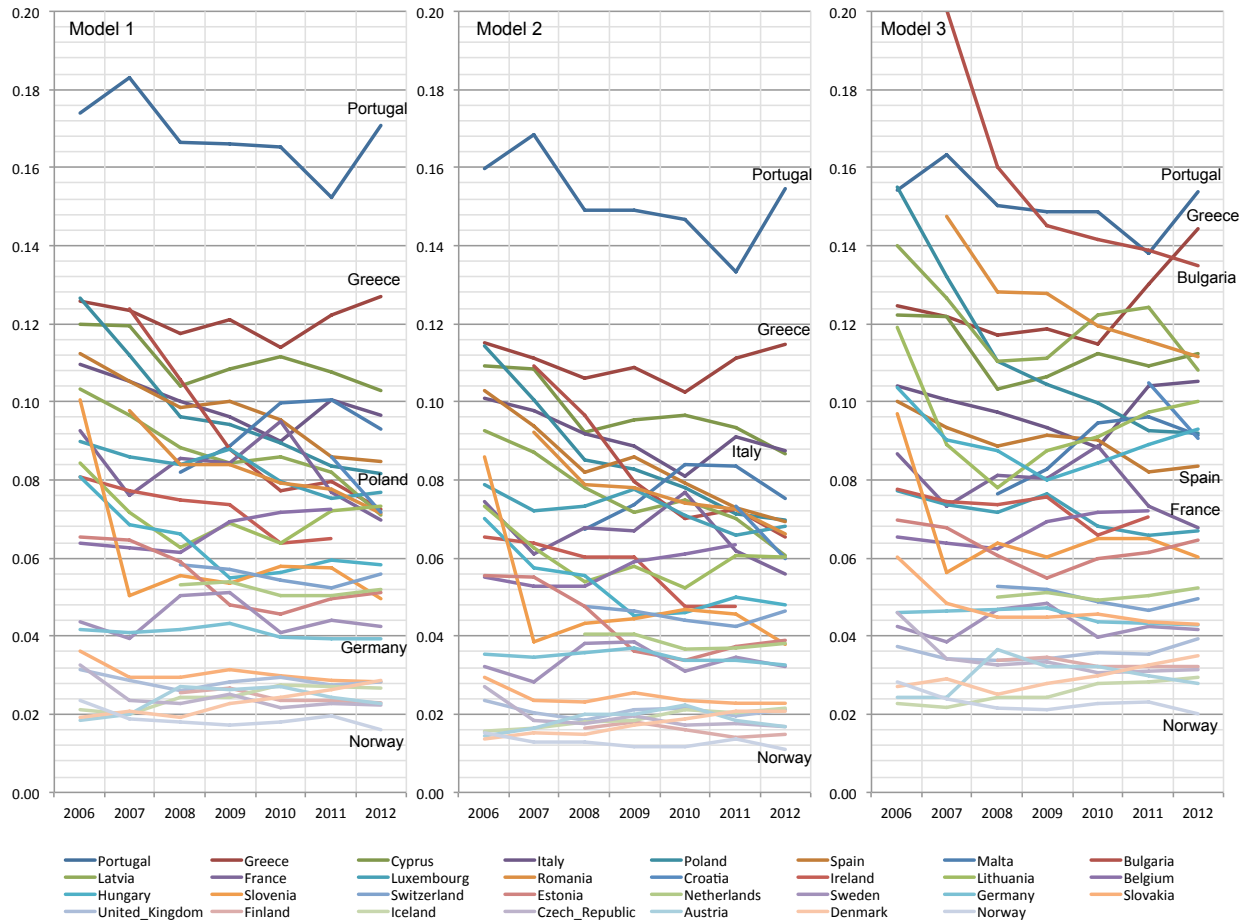
Portugal clearly has the highest level of poverty across time and Measures except in Measure 3 between 2006 and 2008 where Bulgaria was the poorest. In Portugal, poverty increased in 2006, then it decreased until 2010 – not significantly between 2008 and 2010 - to increase again in the last period. In Measure 1 and 2, Greece is consistently the second poorest country.

Denmark was the least poor country in 2006 in all Measures. However, from 2007, this position was taken by Norway who reduces poverty in all periods but 2010 and 2011.

Across countries, Poland is the only country that consistently decreases poverty in all Measures and periods; however, this change not significant in 2008 and 2012. Bulgaria presented sharp poverty reductions from 2007 (data is not available for 2006) except in 2011 (Measures 1 and 2).

Germany, on the other hand, remains stable without significant changes in any period except 2009 and Spain displays a constant reduction in poverty across all years and Measures except in 2009.

Italy presented a persistent poverty reduction till 2010 when the level sharply increases. Between, 2011 and 2012, situation was more ambiguous. Measures 1 and 2 suggest a reduction in poverty meanwhile

Measure 2 contritely reports a new increment. France shows a singular trend. Positive and negatives changes are intercalated in all periods and year before 2011.

Normally the poverty analyses are undertaken at the country level to facilitate national policy design. However it can be quite interesting from a human-centric perspective to look across countries, and see where the people who are identified as poor by each measure live, and what proportion of poverty each country contributes to the whole. Among the 22 countries used in this analysis, we have aggregated their M_0 measures using annual population figures for each of the years 2006 to 2012. Following figure, below, provides this information. The height of the stripe associated with each country depicts that countries' relative contribution to the overall M_0 of the 22 countries together.

The graphic also depicts what was already seen earlier, namely the sharp drop between 2006-2007 and the relative stability of poverty 2007-2012. Due to their size, Italy, France, Spain, Poland and Germany dominate poverty trends in Europe. Italy reduces its relative contribution during the whole period but 2011. France's and Spain's contribution consistently falls only from 2010. Poland is the only country that reduces its relative contribution in all periods.

Such depictures are useful complements to detailed national analyses. Furthermore, with changes in population share it is possible decompose changes in multidimensional poverty that might eventuate from demographic shifts across countries.

Figure 12: Poverty contributions by country, population-weighted Measure 1

27
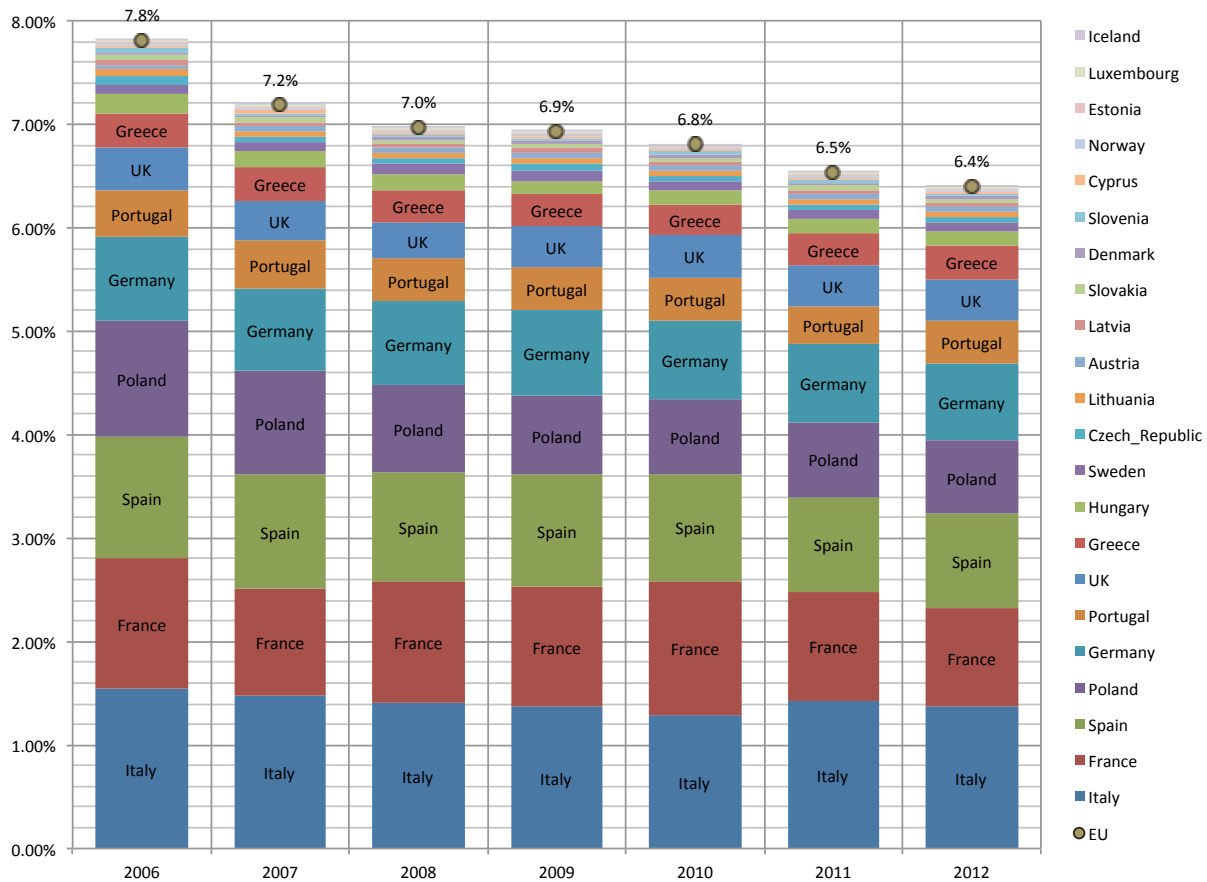
The value of including the intensity in the poverty measure is evident in Figure 13 below. The bubble graphic plus the headcount and intensity of every country. The different periods are shown in contrasting colours. The size of the bubble corresponds to the population of the country. We see, first of all, that across all countries and all periods, the intensity of poverty is highest in the countries which simultaneously have high headcount ratios of poverty – located in the upper right hand corner. However we also see that at the same headcount – for example 10%, the headcounts vary, with some countries having 47% and others 42%. We also see that in some countries such as in the circled pair the reduction of poverty does occur by reducing intensity relatively more than headcount. A measure focused solely on the reduction of the prevalence of poverty would overlook these important changes. Further, as was mentioned above, such a measure could not be broken down by indicator into consistent sub-indices (Alkire Foster and Santos 2011).

Figure 13: Bubble graph of changes by H and A 2006-2009-2012
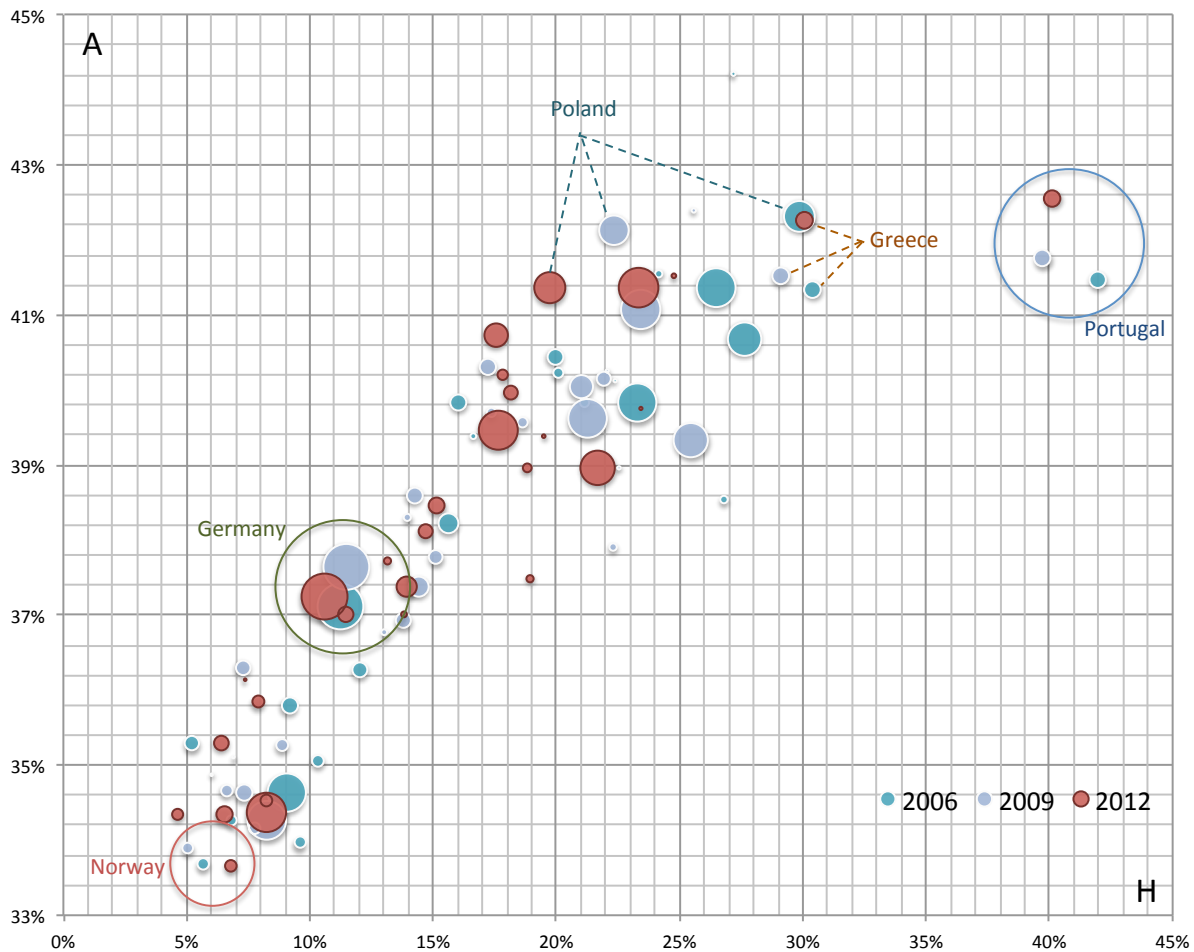
Poverty in Portugal - on the left hand side - increased between 2006 and 2012. Between 2006 and 2009, there was a reduction in the percentage on poor individuals and a slightly increase in the intensity. From 2009 to 2012, the change is mostly explained by the higher intensity.

Greece's poverty increased due to an intensity upswing. In the first triennium, there was a marginal reduction in the percentage of poor people, which was partially reverted, in the second period. On the

other hand, Poland reduced poverty based mainly on the lower headcount ratio and marginally by the intensity reduction.

During the first triennium, Germany increased poverty because of the raise in intensity. The second triennium is characterized by the reduction of intensity and partially by the decline in the percentage of poor individuals. Finally, Norway decreases and increases poverty in the first and second period, respectively, mainly due to changes in the headcount.

An alternative method to present the same material is to show changes by each country over time: that is presented in the panels below.

Table 9: Relative change Multidimensional Poverty 2006-2012, Measure 1, k=26%

	2006-2007			*2007-2008*			*2008-2009*			*2009-2010*			*2010-2011*			*2011-2012*		
	Δ%M0	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*
Austria	14.5%	11.8%	2.5%	19.9%	20.9%	-0.8%	1.1%	1.9%	-0.8%	11.3%	8.9%	2.2%	-18.4%	-16.1%	-2.7%	-7.3%	-4.8%	-2.6%
Belgium	-4.1%	-3.0%	-1.1%	-0.1%	-0.2%	0.1%	11.6%	8.5%	2.8%	3.8%	2.1%	1.6%	3.9%	4.2%	-0.3%			
Bulgaria				-11.5%	-9.1%	-2.6%	-17.6%	-15.2%	-2.8%	-12.0%	-13.0%	1.1%	3.6%	2.1%	1.4%	-10.2%	-7.9%	-2.4%
Croatia																-18.4%	-15.4%	-3.6%
Cyprus	-0.6%	-1.2%	0.7%	-14.8%	-12.1%	-3.1%	3.4%	4.4%	-0.9%	1.2%	1.2%	0.0%	-3.6%	-3.9%	0.3%	-7.1%	-4.8%	-2.4%
Czech Republic	-32.6%	-30.4%	-3.2%	-4.2%	-3.8%	-0.4%	12.2%	10.8%	1.3%	-12.8%	-11.4%	-1.6%	2.0%	3.0%	-0.9%	-4.5%	-7.0%	2.8%
Denmark	12.4%	8.4%	3.6%	-1.1%	-4.8%	3.9%	15.7%	15.7%	0.0%	8.0%	7.1%	0.8%	9.9%	20.6%	-8.9%	0.8%	-5.4%	6.6%
Estonia	-0.4%	3.3%	-3.5%	-14.1%	-15.8%	2.0%	-23.9%	-20.9%	-3.7%	-7.0%	-8.6%	1.7%	11.1%	12.0%	-0.8%	4.5%	4.5%	0.0%
Finland							9.0%	6.3%	2.5%	-10.4%	-10.7%	0.4%	-13.2%	-12.2%	-1.1%	5.9%	7.4%	-1.4%
France	-17.9%	-15.7%	-2.6%	11.1%	8.8%	2.1%	-1.0%	-1.2%	0.3%	14.2%	12.7%	1.3%	-19.2%	-18.1%	-1.3%	-9.9%	-9.7%	-0.2%
Germany	-2.2%	-0.9%	-1.4%	3.2%	1.8%	1.4%	3.3%	1.9%	1.3%	-8.8%	-8.6%	-0.2%	-0.3%	-0.1%	-0.2%	-3.2%	-3.2%	0.0%
Greece	-3.3%	-2.8%	-0.6%	-4.6%	-5.3%	0.7%	2.5%	1.8%	0.6%	-5.9%	-5.2%	-0.7%	8.8%	7.6%	1.1%	3.1%	1.1%	1.9%
Hungary	-17.8%	-15.7%	-2.5%	-3.5%	-3.8%	0.3%	-18.6%	-17.2%	-1.7%	2.3%	3.5%	-1.2%	7.9%	6.1%	1.7%	-3.6%	-3.2%	-0.5%
Iceland	4.8%	1.0%	3.8%	9.9%	14.8%	-4.2%	1.1%	-0.5%	1.7%	16.6%	15.3%	1.2%	-3.7%	-7.1%	3.6%	4.7%	6.1%	-1.4%
Ireland	-2.4%	-1.0%	-1.4%	-5.6%	-5.6%	0.0%	-0.5%	0.3%	-0.8%	-20.9%	-18.4%	-3.1%	-0.2%	-3.6%	3.6%			
Italy	-3.4%	-3.3%	-0.1%	-5.8%	-5.9%	0.2%	-3.7%	-3.1%	-0.7%	-8.6%	-7.2%	-1.5%	12.3%	8.5%	3.4%	-3.9%	-3.1%	-0.8%
Latvia	-5.9%	-5.9%	0.0%	-10.2%	-12.3%	2.3%	-8.2%	-5.2%	-3.1%	4.5%	4.3%	0.2%	-6.2%	-5.2%	-1.1%	-13.9%	-13.4%	-0.5%
Lithuania	-14.5%	-14.5%	0.0%	-14.2%	-13.9%	-0.4%	7.4%	8.1%	-0.6%	-9.6%	-7.5%	-2.3%	16.4%	14.6%	1.5%	-0.7%	-0.2%	-0.5%
Luxembourg	-8.5%	-6.3%	-2.3%	1.6%	2.3%	-0.7%	5.9%	6.0%	-0.1%	-8.9%	-8.3%	-0.6%	-7.0%	-8.0%	1.1%	3.6%	2.5%	1.2%
Malta							9.6%	8.1%	1.5%	13.7%	12.8%	0.8%	-0.2%	1.3%	-1.5%	-10.0%	-8.8%	-1.3%
Netherlands							0.2%	3.0%	-2.7%	-9.8%	-10.0%	0.2%	0.8%	-0.6%	1.4%	3.4%	4.6%	-1.1%
Norway	-15.8%	-13.1%	-3.1%	-1.0%	-1.5%	0.6%	-9.5%	-6.8%	-2.8%	2.2%	1.7%	0.5%	14.6%	10.0%	4.2%	-18.3%	-16.2%	-2.5%
Poland	-12.2%	-11.6%	-0.7%	-15.3%	-15.1%	-0.2%	-2.6%	-3.3%	0.8%	-5.8%	-5.7%	-0.1%	-8.9%	-7.6%	-1.5%	-2.2%	-2.9%	0.7%
Portugal	5.5%	2.4%	3.1%	-11.6%	-8.4%	-3.5%	0.2%	-0.5%	0.7%	-1.6%	-2.3%	0.7%	-9.3%	-7.9%	-1.6%	16.3%	12.7%	3.2%
Romania				-14.9%	-12.7%	-2.5%	-0.8%	0.2%	-1.0%	-5.0%	-6.8%	1.9%	-2.3%	-2.2%	0.0%	-8.6%	-9.1%	0.5%
Slovakia	-21.0%	-21.2%	0.3%	-0.6%	1.4%	-2.0%	9.9%	9.3%	0.5%	-7.6%	-7.7%	0.1%	-3.2%	-2.2%	-1.0%	-0.1%	-3.1%	3.2%
Slovenia				11.6%	13.2%	-1.4%	2.5%	0.9%	1.6%	5.4%	6.0%	-0.6%	-2.1%	-1.7%	-0.4%	-17.0%	-17.0%	-0.1%
Spain	-8.9%	-8.1%	-0.9%	-12.5%	-10.0%	-2.8%	4.6%	4.2%	0.4%	-7.5%	-7.6%	0.1%	-8.3%	-9.2%	1.0%	-4.8%	-4.0%	-0.9%
Sweden	-12.8%	-14.6%	2.2%	34.8%	35.1%	-0.2%	1.0%	1.7%	-0.7%	-19.2%	-18.3%	-1.1%	11.8%	10.9%	0.8%	-7.1%	-7.2%	0.2%
Switzerland							-2.1%	-3.2%	1.1%	-5.6%	-5.8%	0.2%	-3.6%	-3.8%	0.2%	9.3%	9.4%	-0.1%
United Kingdom	-13.1%	-14.5%	1.6%	-10.1%	-6.9%	-3.4%	13.6%	12.9%	0.7%	3.1%	-0.6%	3.8%	-9.7%	-6.8%	-3.1%	8.2%	6.9%	1.2%

Table 10: Relative change Multidimensional Poverty 2006-2012, Measure 2, k=26%

	2006-2007			2007-2008			2008-2009			2009-2010			2010-2011			2011-2012		
	$\Delta\%M0$	$\Delta\%H$	$\Delta\%A$	$\Delta\%M0$	$\Delta\%H$	$\Delta\%A$	$\Delta\%M0$	$\Delta\%H$	$\Delta\%A$	$\Delta\%M0$	$\Delta\%H$	$\Delta\%A$	$\Delta\%M0$	$\Delta\%H$	$\Delta\%A$	$\Delta\%M0$	$\Delta\%H$	$\Delta\%A$
Austria	9.1%	4.6%	4.3%	34.0%	37.9%	-2.8%	-2.0%	-3.5%	1.5%	2.9%	-0.6%	3.5%	-10.2%	-5.9%	-4.6%	-7.3%	-5.8%	-1.6%
Belgium	-2.3%	-0.6%	-1.7%	-1.7%	-2.6%	0.9%	13.0%	10.8%	2.0%	3.4%	2.1%	1.3%	1.2%	1.0%	0.3%			
Bulgaria				-14.6%	-13.4%	-1.4%	-16.7%	-14.2%	-3.0%	-12.1%	-12.7%	0.7%	3.1%	1.9%	1.2%	-9.1%	-7.0%	-2.3%
Croatia																-16.3%	-13.2%	-3.6%
Cyprus	-0.6%	-0.7%	0.1%	-12.7%	-9.6%	-3.4%	4.0%	4.8%	-0.8%	3.0%	2.4%	0.5%	-3.6%	-3.4%	-0.3%	-4.4%	-2.1%	-2.4%
Czech Republic	-28.0%	-25.0%	-4.0%	-3.7%	-3.5%	-0.2%	11.3%	10.2%	1.0%	-14.3%	-13.7%	-0.7%	5.2%	6.3%	-1.1%	-2.0%	-2.9%	0.9%
Denmark	9.3%	5.6%	3.5%	-7.7%	-8.6%	0.9%	18.9%	20.7%	-1.5%	6.3%	4.2%	2.0%	7.7%	15.5%	-6.7%	8.5%	3.6%	4.7%
Estonia	-1.2%	1.1%	-2.3%	-8.9%	-8.4%	-0.5%	-18.7%	-15.3%	-4.0%	-4.8%	-5.4%	0.6%	8.6%	8.9%	-0.2%	2.9%	2.7%	0.2%
Finland							5.1%	3.4%	1.7%	-11.1%	-11.6%	0.5%	-1.2%	2.4%	-3.5%	-2.0%	-3.5%	1.6%
France	-17.9%	-16.1%	-2.1%	12.2%	10.5%	1.5%	-1.5%	-1.5%	0.0%	12.9%	11.4%	1.3%	-19.2%	-18.2%	-1.3%	-9.4%	-9.0%	-0.4%
Germany	-1.6%	-0.6%	-1.0%	2.2%	0.4%	1.8%	3.0%	2.2%	0.7%	-7.8%	-7.2%	-0.6%	-1.4%	-1.0%	-0.4%	0.4%	0.5%	-0.1%
Greece	-1.8%	-1.4%	-0.5%	-4.7%	-5.1%	0.4%	2.8%	2.3%	0.5%	-5.8%	-6.0%	0.2%	7.4%	7.2%	0.2%	4.0%	2.6%	1.4%
Hungary	-14.8%	-11.6%	-3.5%	-3.6%	-4.5%	1.0%	-17.1%	-15.4%	-2.0%	2.4%	3.6%	-1.1%	5.6%	3.8%	1.7%	-1.8%	-0.8%	-1.0%
Iceland	-5.2%	-8.1%	3.1%	22.3%	27.7%	-4.3%	-0.5%	-2.4%	2.0%	13.7%	12.1%	1.4%	-1.3%	-2.3%	1.0%	-2.7%	-3.2%	0.5%
Ireland	-4.3%	-4.4%	0.0%	-3.2%	-2.5%	-0.8%	-1.2%	-0.3%	-0.9%	-13.7%	-10.0%	-4.0%	2.0%	-0.1%	2.1%			
Italy	-4.0%	-4.4%	0.4%	-4.7%	-4.6%	-0.1%	-4.0%	-3.0%	-1.0%	-6.5%	-5.3%	-1.3%	11.9%	8.6%	3.1%	-3.9%	-3.0%	-1.0%
Latvia	-6.6%	-7.0%	0.4%	-8.4%	-10.1%	1.9%	-4.3%	-0.5%	-3.8%	1.5%	1.1%	0.4%	-4.3%	-3.0%	-1.3%	-13.5%	-13.3%	-0.2%
Lithuania	-14.9%	-15.6%	0.8%	-12.7%	-12.9%	0.2%	9.8%	11.3%	-1.4%	-7.3%	-5.0%	-2.3%	13.0%	11.5%	1.3%	1.5%	2.3%	-0.8%
Luxembourg	-4.2%	-1.1%	-3.1%	-2.3%	-2.8%	0.5%	4.6%	4.9%	-0.3%	-9.4%	-8.7%	-0.7%	-5.4%	-6.0%	0.6%	2.1%	1.0%	1.2%
Malta							8.3%	6.9%	1.4%	12.5%	11.4%	0.9%	0.7%	1.7%	-0.9%	-7.5%	-6.3%	-1.3%
Netherlands							1.1%	3.1%	-2.0%	-6.6%	-6.0%	-0.7%	0.4%	-0.2%	0.6%	3.3%	3.2%	0.1%
Norway	-19.1%	-18.8%	-0.4%	-4.6%	-6.6%	2.1%	-4.8%	-2.1%	-2.8%	5.8%	5.6%	0.3%	7.3%	4.0%	3.1%	-17.8%	-16.2%	-2.0%
Poland	-11.6%	-11.2%	-0.4%	-14.2%	-13.5%	-0.8%	-2.0%	-2.7%	0.7%	-4.7%	-4.2%	-0.5%	-6.9%	-5.1%	-1.8%	-2.2%	-2.7%	0.5%
Portugal	5.0%	2.2%	2.8%	-8.9%	-6.1%	-3.0%	-0.4%	-1.4%	1.0%	-0.5%	-1.1%	0.7%	-7.8%	-6.5%	-1.4%	12.1%	9.2%	2.7%
Romania				-14.3%	-12.3%	-2.3%	0.2%	1.1%	-0.9%	-5.7%	-7.3%	1.8%	-2.3%	-2.2%	-0.1%	-7.7%	-7.7%	0.0%
Slovakia	-19.1%	-19.5%	0.5%	0.8%	2.0%	-1.2%	5.9%	4.5%	1.3%	-4.2%	-3.6%	-0.6%	-4.2%	-4.1%	0.0%	-1.4%	-3.7%	2.3%
Slovenia				9.9%	10.9%	-0.9%	-3.6%	-5.1%	1.6%	8.0%	7.5%	0.5%	-0.8%	0.0%	-0.8%	-13.7%	-12.6%	-1.2%
Spain	-6.2%	-5.1%	-1.2%	-6.4%	-3.8%	-2.7%	1.6%	1.1%	0.5%	-4.8%	-4.1%	-0.8%	-10.1%	-10.6%	0.5%	-1.4%	-0.8%	-0.7%
Sweden	-9.8%	-10.8%	1.2%	27.8%	26.3%	1.2%	1.2%	1.8%	-0.5%	-19.7%	-18.7%	-1.3%	7.5%	5.8%	1.7%	-3.5%	-3.3%	-0.1%
Switzerland							-2.3%	-3.5%	1.2%	-4.9%	-4.8%	-0.1%	-3.6%	-3.8%	0.2%	6.9%	6.1%	0.7%
United Kingdom	-8.1%	-8.1%	0.1%	-9.3%	-6.3%	-3.2%	8.9%	6.7%	2.1%	3.8%	2.1%	1.7%	-6.1%	-4.1%	-2.1%	2.5%	1.7%	0.8%

Table 11: Relative change Multidimensional Poverty 2006-2012, Measure 3, k=21%

	2006-2007			2007-2008			2008-2009			2009-2010			2010-2011			2011-2012		
	Δ%M0	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*	*Δ%M0*	*Δ%H*	*Δ%A*
Austria	1.0%	-4.0%	5.3%	49.5%	51.2%	-1.1%	-12.2%	-12.7%	0.6%	0.4%	-1.8%	2.3%	-7.8%	-4.5%	-3.5%	-5.7%	-4.7%	-1.0%
Belgium	-2.4%	-1.6%	-0.9%	-2.0%	-2.6%	0.7%	11.1%	9.9%	1.1%	3.4%	2.0%	1.4%	0.5%	-0.2%	0.7%			
Bulgaria				-20.1%	-19.8%	-0.4%	-9.4%	-6.4%	-3.2%	-2.5%	0.2%	-2.7%	-2.0%	-4.6%	2.7%	-2.8%	-0.3%	-2.5%
Croatia																-13.5%	-12.3%	-1.4%
Cyprus	-0.3%	-2.5%	2.2%	-15.2%	-10.6%	-5.2%	3.0%	4.7%	-1.6%	5.9%	5.4%	0.5%	-2.9%	-3.1%	0.2%	2.9%	4.7%	-1.7%
Czech Republic	-25.3%	-23.0%	-3.1%	-5.3%	-3.9%	-1.5%	3.2%	3.2%	0.1%	-8.9%	-8.3%	-0.7%	2.0%	2.9%	-0.9%	1.2%	-1.4%	2.6%
Denmark	7.7%	7.2%	0.4%	-14.3%	-10.1%	-4.6%	11.3%	10.8%	0.4%	7.7%	3.0%	4.6%	8.4%	14.5%	-5.4%	7.4%	5.0%	2.3%
Estonia	-2.7%	0.4%	-3.1%	-10.6%	-10.2%	-0.5%	-9.6%	-8.1%	-1.7%	8.8%	7.6%	1.1%	3.0%	0.9%	2.0%	5.1%	5.9%	-0.7%
Finland							1.9%	1.1%	0.8%	-7.1%	-6.7%	-0.5%	1.0%	3.0%	-1.9%	-0.9%	0.0%	-0.9%
France	-15.5%	-14.3%	-1.4%	11.1%	10.4%	0.7%	-1.0%	-1.4%	0.5%	10.3%	7.9%	2.2%	-17.4%	-16.8%	-0.8%	-7.6%	-6.9%	-0.7%
Germany	0.3%	-0.1%	0.5%	1.2%	0.9%	0.2%	0.5%	-0.3%	0.7%	-7.6%	-7.3%	-0.3%	-0.3%	-1.9%	1.6%	-1.5%	-0.3%	-1.2%
Greece	-2.2%	-2.1%	-0.1%	-4.1%	-3.6%	-0.5%	1.5%	1.5%	0.0%	-3.3%	-4.1%	0.8%	13.2%	10.8%	2.1%	11.0%	8.7%	2.1%
Hungary	-12.9%	-9.5%	-3.8%	-3.0%	-3.5%	0.6%	-8.6%	-7.0%	-1.7%	5.7%	5.6%	0.1%	5.5%	2.0%	3.5%	4.4%	4.5%	0.0%
Iceland	-4.0%	-7.0%	3.3%	11.8%	17.6%	-5.0%	-0.6%	-2.1%	1.5%	16.2%	12.9%	2.9%	1.4%	-0.5%	1.9%	3.3%	0.9%	2.3%
Ireland	-4.1%	-3.8%	-0.3%	-1.0%	-1.3%	0.3%	2.7%	3.6%	-0.9%	-13.2%	-10.1%	-3.3%	6.9%	4.4%	2.4%			
Italy	-3.3%	-3.3%	0.0%	-3.2%	-2.9%	-0.2%	-4.2%	-3.2%	-1.1%	-5.4%	-4.5%	-0.9%	17.8%	13.3%	4.0%	1.4%	0.4%	1.0%
Latvia	-9.4%	-8.7%	-0.7%	-13.0%	-14.9%	2.3%	0.9%	4.9%	-3.8%	9.7%	8.8%	0.8%	1.9%	3.3%	-1.3%	-13.1%	-12.2%	-1.0%
Lithuania	-25.1%	-25.7%	0.8%	-12.5%	-9.9%	-2.9%	12.4%	12.0%	0.3%	4.1%	6.8%	-2.5%	6.7%	3.2%	3.4%	2.7%	2.4%	0.3%
Luxembourg	-4.4%	-1.2%	-3.2%	-2.9%	-3.6%	0.7%	6.9%	6.2%	0.7%	-10.9%	-9.8%	-1.3%	-3.3%	-4.7%	1.4%	1.7%	0.4%	1.4%
Malta							8.5%	6.1%	2.3%	14.3%	13.0%	1.2%	1.5%	2.6%	-1.1%	-4.8%	-4.4%	-0.3%
Netherlands							2.6%	4.9%	-2.2%	-3.7%	-4.7%	1.0%	2.0%	2.5%	-0.5%	4.2%	4.9%	-0.7%
Norway	-15.8%	-14.9%	-1.1%	-8.8%	-10.7%	2.1%	-1.8%	-2.9%	1.2%	6.9%	9.6%	-2.4%	2.6%	-1.7%	4.4%	-13.8%	-11.2%	-2.9%
Poland	-14.6%	-12.9%	-2.0%	-16.5%	-15.5%	-1.1%	-5.5%	-5.7%	0.2%	-4.7%	-4.3%	-0.4%	-6.9%	-4.8%	-2.2%	-0.8%	-0.9%	0.1%
Portugal	5.9%	3.1%	2.7%	-7.9%	-5.3%	-2.8%	-0.9%	-1.7%	0.8%	-0.1%	-1.3%	1.2%	-7.3%	-5.6%	-1.8%	11.4%	8.8%	2.5%
Romania				-13.2%	-10.1%	-3.5%	-0.3%	0.7%	-1.0%	-6.5%	-7.5%	1.1%	-3.3%	-2.8%	-0.6%	-3.4%	-2.4%	-1.1%
Slovakia	-19.4%	-19.5%	0.2%	-7.5%	-6.4%	-1.1%	-0.3%	-2.3%	2.1%	2.2%	1.7%	0.5%	-4.1%	-3.3%	-0.8%	-1.7%	-4.0%	2.4%
Slovenia				13.5%	14.1%	-0.5%	-5.7%	-6.1%	0.4%	7.7%	7.4%	0.3%	0.1%	0.4%	-0.3%	-6.9%	-6.5%	-0.4%
Spain	-6.5%	-5.3%	-1.2%	-5.0%	-2.7%	-2.4%	2.8%	1.9%	0.9%	-1.3%	-1.1%	-0.1%	-9.0%	-10.0%	1.1%	1.8%	1.5%	0.3%
Sweden	-9.5%	-10.2%	0.8%	22.0%	22.4%	-0.3%	3.2%	1.6%	1.6%	-18.5%	-17.4%	-1.3%	7.9%	6.6%	1.2%	-2.6%	-3.4%	0.9%
Switzerland							-1.6%	-2.5%	0.9%	-5.8%	-5.4%	-0.4%	-4.6%	-4.2%	-0.4%	6.6%	6.6%	-0.1%
United Kingdom	-8.2%	-8.8%	0.6%	-1.5%	2.4%	-3.8%	1.7%	1.1%	0.6%	4.7%	0.3%	4.4%	-1.4%	0.2%	-1.6%	11.1%	6.4%	4.4%

4.4. Decompositions

Because the AF methodology satisfies the property of subgroup-consistency and subgroup decomposability, it is possible to break down the measure by any sub-groups for which the data are representative and the measure is appropriate. Decompositions are also useful to check the adequacy of indicators for different subgroups. To illustrate this, we decompose all three measures by gender and by age category for all periods.

4.4.1. By gender

We cannot assess the statistical significance of gender inequalities. However across all measures, women are poorer than men in all countries in 2006. Women remain poorer than men in measures 1, 2, and 3 although their relative disparity evolves. In 2012, women's poverty is higher than men's poverty in all countries except Denmark for some measures. Figure 14 below shows the pooled M_0 levels for all measures for each year. We see that overall women are poorer than men in all periods according to all measures.

Figure 14 Multidimensional Poverty (M_0) by Measure, Gender and year
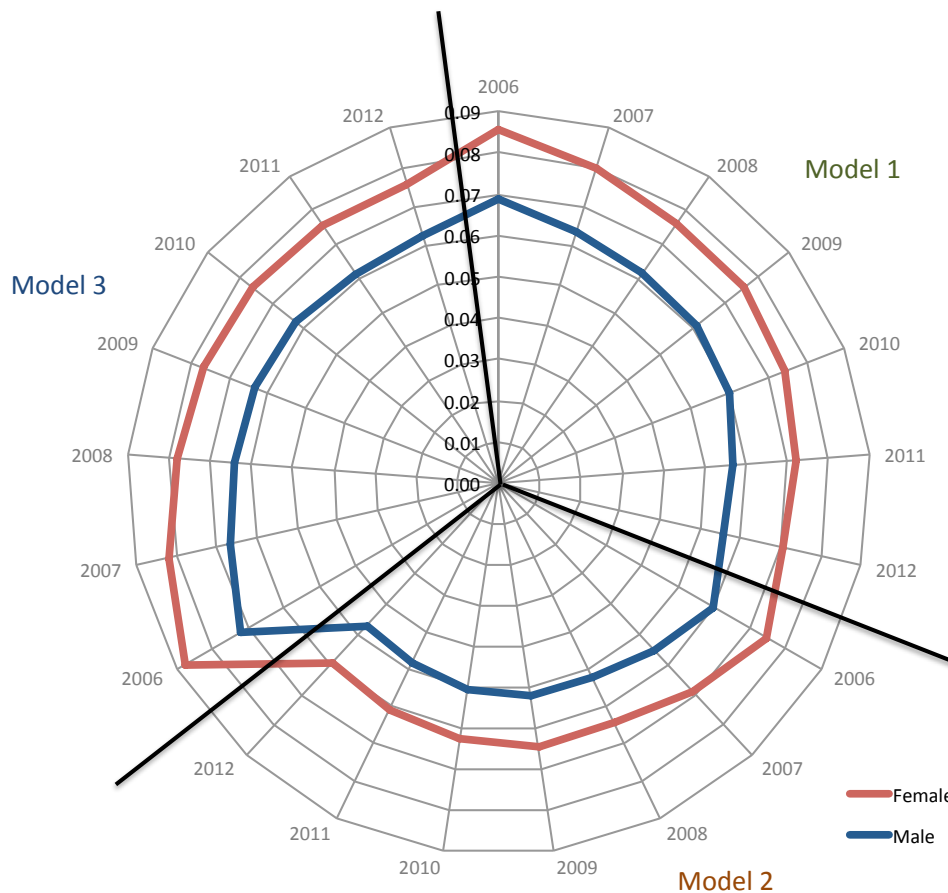
Figure 15 provides the headcount ratios of men and women in the ten poorest countries, and we see that a greater number of women than men are multidimensionally poor in all countries, all periods, except

34

Portugal 2012. However the headcount ratio does not depict how the intensities of poverty for men and women differ.

**Figure 25 Headcount Ratio of Multidimensional Poverty (M_0) by Gender for 10 Countries**
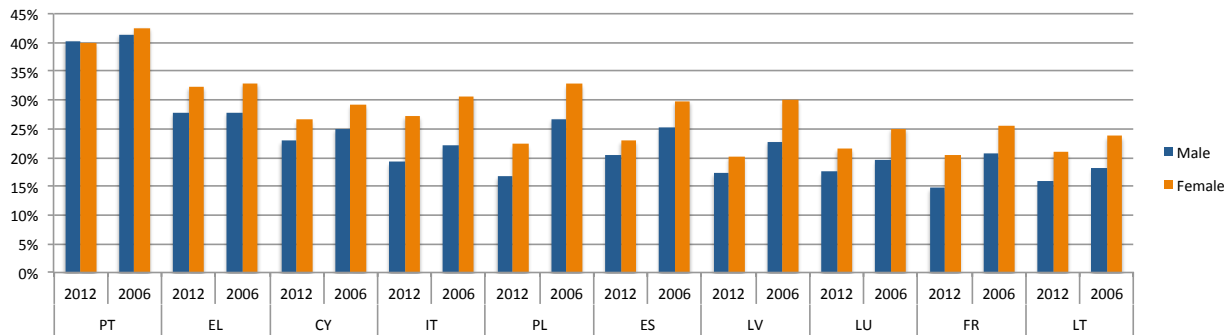
Figure 16 below, provides the country-specific contributions of each gender to overall M_0 (incidence and intensity) for each country for Measure 1 in the year 2006. The height of the bar is the level of M_0. You can see that the gender differentials vary by country. Hungary and Ireland have nearly the same M_0 but in Hungary the gender disparity in poverty is higher.

Figure 16 Contributions to National Multidimensional Poverty (M_0) by Gender 2006 (Measure 1)
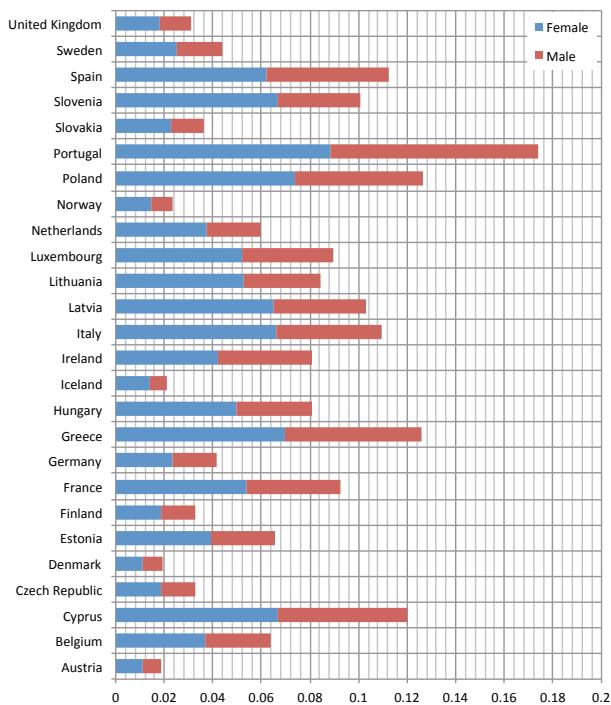
To see the comparisons more transparently, we map the percentage contributions of men and women to overall poverty (Figure 17). If their contributions were equal, we would see each bar meeting at the 50% line. Instead we see that for all countries, the women's bar (right) exceeds 50%, with Portugal having nearest to parity – but still lacking parity once we take into account the intensity of women's poverty.

35

Figure 3 Gender Decomposition of M_0 by Country 2006 and 2012 (Measure 1)
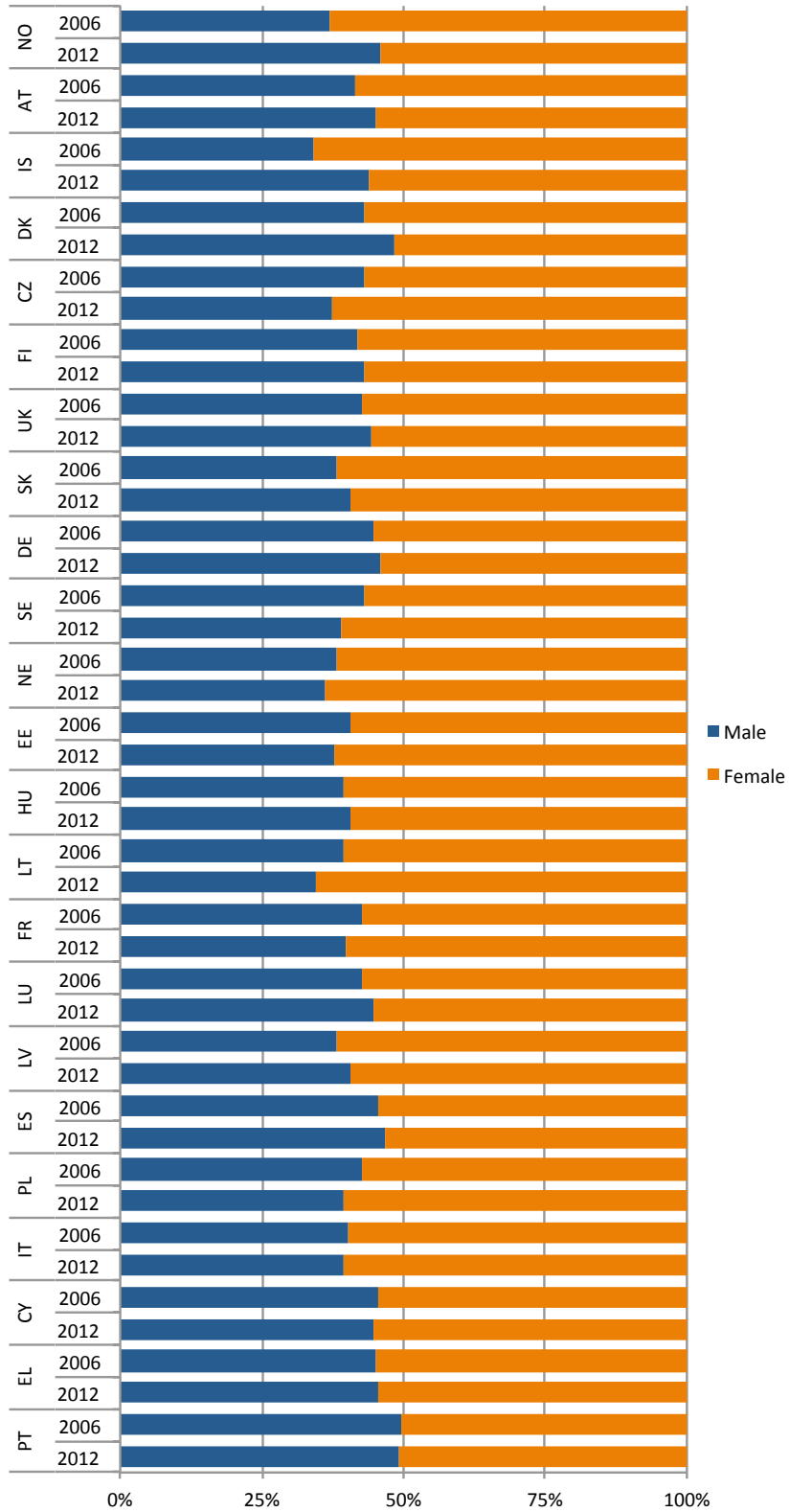
Naturally, the question arises how the composition of poverty for women and men varied. Figure 18 below shows that gendered differences in poverty composition for the pooled data are relatively less than inter-country differences – even for education (the orange stripe) which is a wholly individual dimension. Obviously part of the coincidence is due to the shared household level indicators that are used in the measure.

Figure 4 Aggregate Multidimensional Poverty (M$_0$) by Gender and year Measure 1
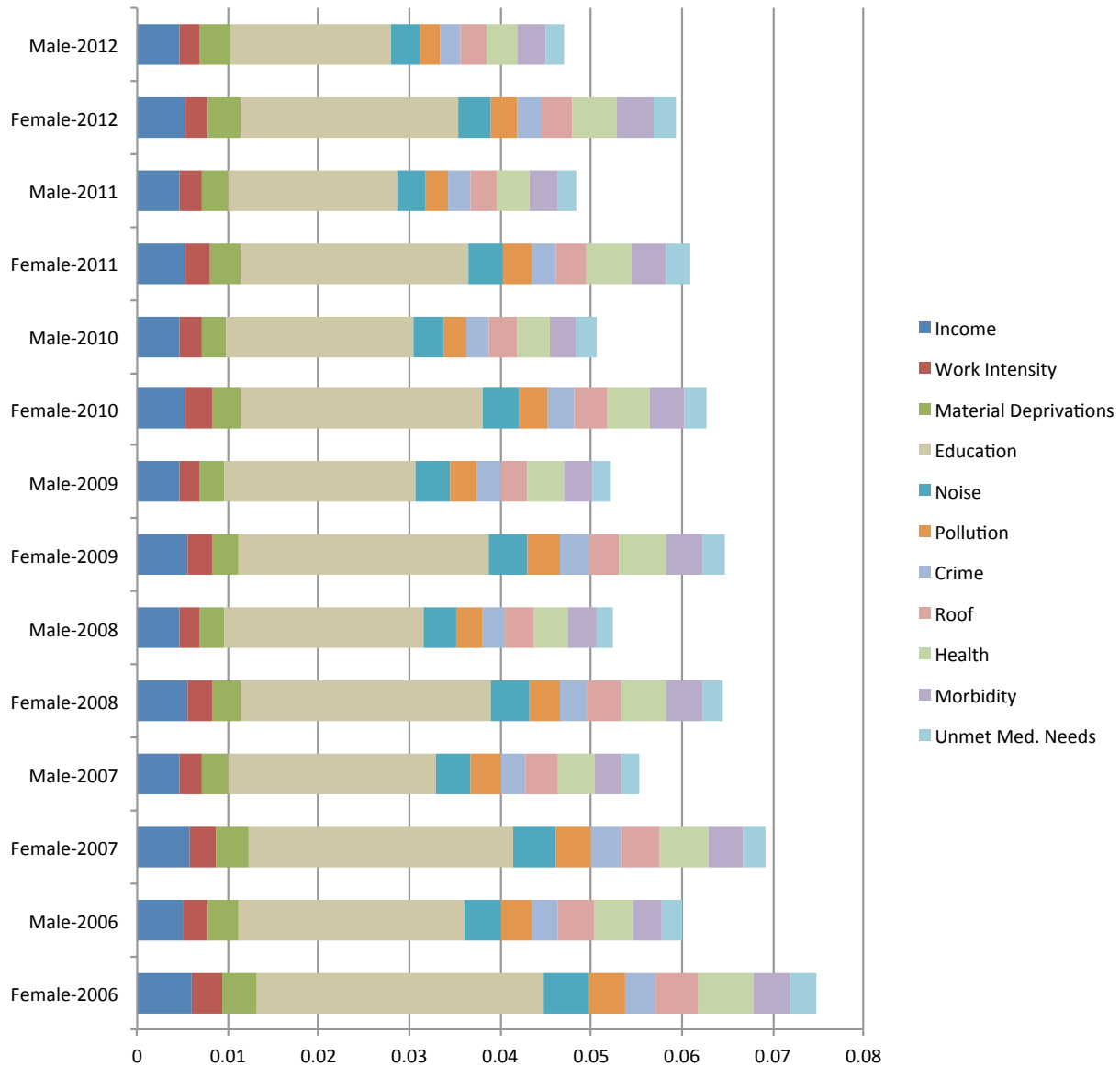
As a final step, we might consider gendered poverty profiles by country, to see how these vary. A fascinating picture emerges, actually, because while the poverty profiles vary considerably by country, the male and female profiles for a given country are similar.

4.4.2. By age

Finally, we also decompose the measures by four age categories: 16-30, 31-45, 46-60 and above 60 years of age. We find a clear pattern between age and poverty levels, particularly in the 60+ category. In all countries elder poverty was higher than youth poverty in 2006. The age differential raises further questions as to whether to use the same variables and cutoffs in health and education across all age groups – making this an absolute comparison – or whether to use different definitions of some deprivations for older cohorts.

Figure 5 Percentage contributions to Multidimensional Poverty (M_0) by age and year Measure 1
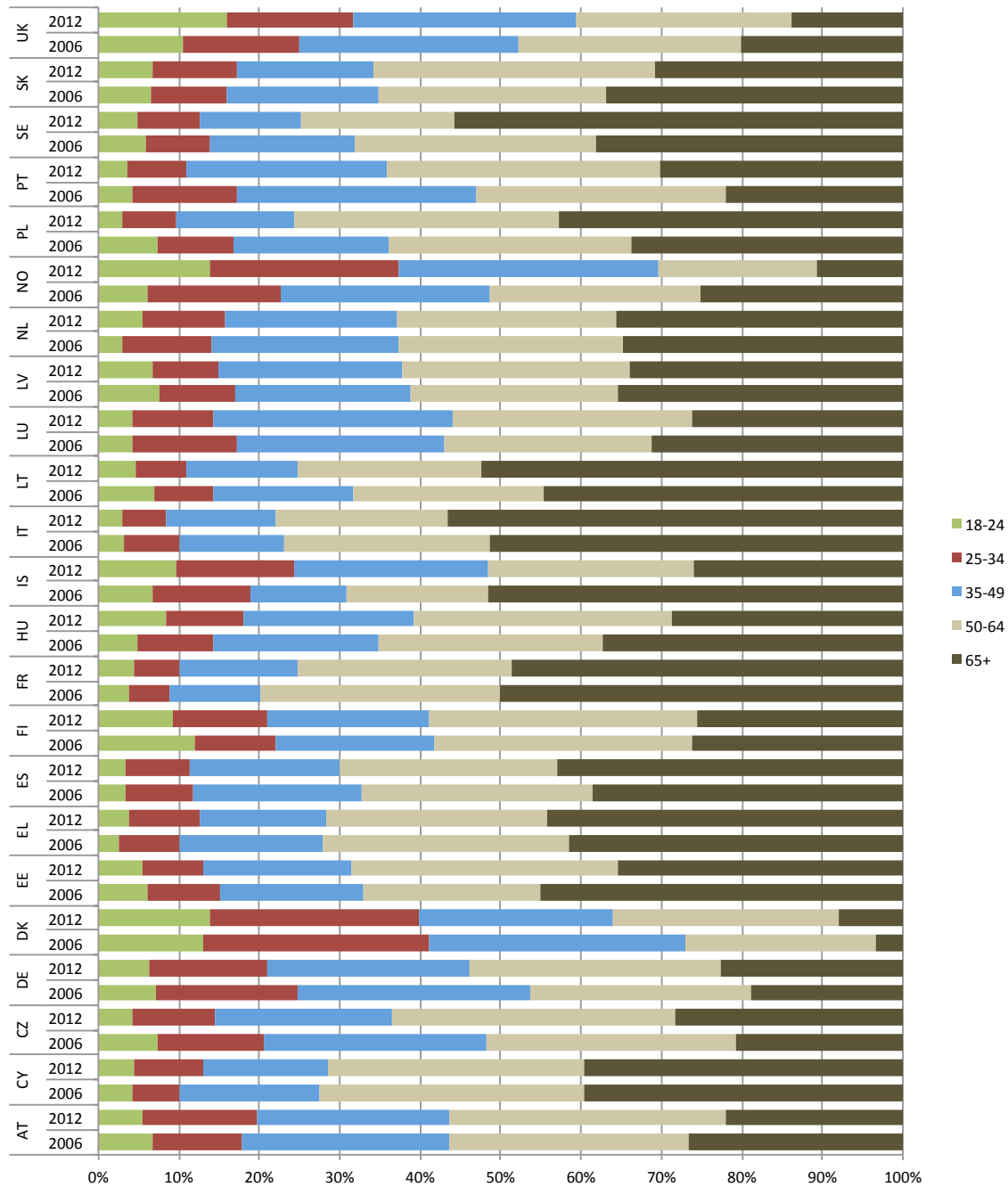
5.   Concluding Remarks

This paper has presented three experimental multidimensional poverty indices, which have been implementing with the EU-SILC datasets for seven waves from 2006-2012 using the Alkire Foster Methodology. The experimental measures differ mainly in the weights and Measure 2 drops one indicator; otherwise indicators and their definitions are similar.

In Section one we survey the extensive counting-based literature in Europe on multiple deprivations (and the Appendix provides different indicators and dimensions relevant for European poverty discussions). It then introduces the AF methodology, which builds on the counting tradition but adds new features of intensity, which permit the construction of a set of consistent partial indices including the headcount ratio, intensity, and censored headcount ratios for each of the included indicators. The AF methodology can also be used to analyse changes over time by country, by subgroup, and by changes in each indicator.

Section 3 introduces the data, the indicator definition, treatment of missing values, and the description of indicators in terms of the level of deprivations and the structure of their joint distribution, using correlation and redundancy matrices. It then sets out the structure of the three experimental measures.

Section 4 first presents the results pooled across all countries for which there is consistent data, and then shows individual country trajectories over time for each measure. Honing into the composition of poverty, we study again both the aggregate composition and its evolution from 2006-2012, and look at snapshots of country comparisons. We then track the changes in poverty over time, for our main poverty measure, the adjusted headcount ratio M_0, as well as for the headcount ratio and intensity. To explore further the poverty of different population subgroups, we decompose results by gender nad by age category. We find that women are poorer than men in nearly all countries and all time periods, and also that elder poverty contributes disproportionately to overall poverty.

For space limitations, we cannot include further descriptive results – for example analyses of the dimensional changes in poverty over time, nor analyses of statistically significant changes by partial index and dimension.[10] These additional components of a full analysis of changes in multidimensional poverty over time are available in other papers (Alkire Roche and Vaz 2014). We are also unable in this paper to present the full complement of robustness results that would be required for a policy-relevant measure. However we note that unfortunately the level of education variable is not comparable across countries, and also find some evidence of adaptive preference in some self-reported indicators. Any policy-relevant measure would also require attention to these issues, which are beyond the scope of this paper.

Naturally the next step beyond a fuller description of changes in poverty over time is to undertake analysis of those changes in relation to macroeconomic variables, to policies, and to demographic characteristics. Such studies are a necessary complement to the analysis contained in this paper, and greatly enrich the scope of action that can be informed by multidimensional poverty measurement.

---

[10] Standard errors are available for all years upon request and will be included in the final draft of this paper.

6.   Bibliography

Adamson, Peter, (2012), 'Measuring Child Poverty: New league tables of child poverty in the world's rich countries', UNICEF Innocenti Research Center, Report Card 10

Allardt, Erik (1993), 'Having, loving, being: An alternative to the Swedish model of welfare research', in Martha Craven Nussbaum and Amartya Kumar Sen (eds.), The Quality of life (Oxford, New York: Oxford University Press), 88-94.

Allardt, Erik and Uusitalo, Hannu, (1972), 'Dimensions of welfare in a comparative study of the Scandinavian societies', *Scandinavian Political Studies, Vol*. 7. Oslo, Univenitetsforlaget,

Alkire, Sabina (2002), 'Dimensions of human development', World Development, 30 (2), 181-205.

Alkire, Sabina and Foster, James (2011a), 'Counting and multidimensional poverty measurement', Journal of Public Economics, 95 (7-8), 476–87.

Alkire, Sabina and Foster, James (2011b), 'Understandings and misunderstandings of multidimensional poverty measurement', Journal of Economic Inequality, 9 (2), 289-314.

Alkire, Sabina, Foster, James; Seth, Suman; Santos, Maria Emma; Roche, Jose Manuel; and Ballon, Paola. *Multidimensional Poverty: Measurement and Analysis*. Oxford: Oxford University Press. *Forthcoming* 2015.

Alkire, Sabina and Santos, Maria Emma (2010), 'Acute Multidimensional Poverty: A New Index for Developing Countries', OPHI working paper series, 38.

Alkire, S. and Santos, M. E. (2014). 'Measuring Acute Poverty in the Developing World: Robustness and Scope of the Multidimensional Poverty Index'. World Development, 59: 251–274.

Apablaza, Mauricio and Yalonetzky, Gaston (2011) Measuring the dynamics of multiple deprivations among children: the cases of Andhra Pradesh, Ethiopia, Peru and Vietnam, Young Life research in progress, Oxford, University of Oxford

Atkinson, Anthony Barnes, et al. (2005), *Taking Forward the EU Social Inclusion Process*, Luxembourg Presidency of the Council of the European Union)

Atkinson, Anthony Barnes (2003), 'Multidimensional deprivation: Contrasting social welfare and counting approaches', Journal of Economic Inequality, 1 (1), 51-65.

Atkinson, Anthony Barnes, Cantillon, Bea, Marlier, Eric, and Nolan, Brian (2002), *Social indicators: The EU and social inclusion*, (Oxford: Oxford University Press).

Atkinson, Anthony Barnes, Cantillon, Bea, Marlier, Eric, and Nolan, Brian, (2005), *Taking Forward the EU Social Inclusion Process*, Luxembourg Presidency of the Council of the European Union.

Atkinson, Anthony Barnes and Marlier, Eric, (2010), Analysing and Measuring Social Inclusion in a Global Context, Department of Economic and Social Affairs, United Nations, New York

Atkinson, Anthony Barnes and Marlier, Eric (2010), Income and Living conditions in Europe, Eurostat European Commission, Belgium

Bossert, W., Chakravarty, S., and D'Ambrosio, C. (2013) 'Multidimensional Poverty and Material Deprivation With Discrete Data'. *Review of Income and Wealth*, 59(1): 29–43.

Bourguignon, François & Chakravarty, Satya (2003), "The Measurement of Multidimensional Poverty," Journal of Economic Inequality, Springer, vol. 1(1), pages 25-49, April.

Bradshaw, Jonathan, (2009), 'Social inclusion and child poverty', in P. Perrig-Chiello (ed.) *Changing Childhood in a Changing Europe*: Interdisciplinary workshop report, European Science Foundation, Strasbourg, pp. 29-35.

Brandolini,Andrea, (2007),"Measurement of income distribution in supranational   entities: the case of the European Union", in Jenkins, S and J. Mickewright (Eds), *Inequality and poverty re-examined*. p 62-83. Oxford: Oxford University Press.

Callan, Tim, Layte, Richard, Nolan, Brian, Watson, Dorothy, Whelan, Christopher. T., Williams, James and Maître, Bertrand (1999), Monitoring Poverty Trends, Policy Research Series Paper No. 51, ESRI, Dublin.

Callan, Tim, Nolan, Brian, and Whelan, Christopher T. (1993): "Resources, Deprivation and the Measurement of Poverty". *Journal of Social Policy*, 22, pp 141-172.

Chakravarty, Satya R. and D'Ambrosio, Conchita (2006), 'The measurement of social exclusion', *Review of Income and Wealth*, 53 (3), 377-98.

Coromaldi, Manuela and Zoli, Mariangela (2012), 'Deriving Multidimensional Poverty Indicators: Methodological Issues and an Empirical Analysis for Italy', *Social Indicators Research*, Volume 107, Issue 1, pp 37-54, May 2012

D'Ambrosio, Conchita, Deutsch, Joseph and Silber, Jacques, (2009), "Multidimensional approaches to poverty measurement: an empirical analysis of poverty in Belgium, France, Germany, Italy and Spain, based on the European panel", *Applied Economics*, Vol 43, Issue 8, pp. 951-961

Delors, Jacques (1971), *Les indacateurs sociaux* Futuribles Paris

Doyal, Len and Gough, Ian (1992), 'Need Satisfaction as a Measure of Human Welfare', in Wolfgang Blaas and John Foster (eds.), Mixed economies in Europe : an evolutionary perspective on their emergence, transition and regulation (Brookfield, Vt.: E. Elgar).

Erikson, Robert, (1993) Descriptions of inequality: the Swedish approach to welfare research, In M.C. Nussbaum and A. Sen (eds), The Quality of Life, Clarendon Press, Oxford, 1993

Jäntti, Markus, Törmälehto, Veli-Matti and Marlier, Eric (2013), "The use of registers in the context of EU–SILC: challenges and opportunities". EUROSTAT Statistical working papers. Retrieved from http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-TC-13-004/EN/KS-TC-13-004-EN.PDF

Laeken European Council Meeting (2001) *Presidency Conclusions*. Dec 14-15 2001

Eurostat (2007) Comparative EU statistics on Income and Living Conditions: Issues and Challenges, Proceedings of the EU-SILC conference (Helsinki, 6-8 November 2006), Eurostat Methodologies and Working Papers, European Commission

Eurostat (2010) Description of Target Variables: Cross-Sectional and Longitudinal 2010 operation (Version February 2010), EU-SILC 065, European Commission

Eurostat (2012) Measuring material deprivation in the EU: Indicators for the whole population and child-specific indicators, Eurostat Methodologies and Working Papers, European Commission

Fusco, Alessio, Guio, Anne-Catherine and Marlier, Eric (2011) Income poverty and material deprivation in European countries, CEPS/INSTEAD Working Paper Series No 2011-04

Gabos, András, Ozdemir, Erhan, Ward, Terry (2011), "Material Deprivation among Children", Research Note, European Commission, Social Situation Observatory – Income Distribution and Living Conditions 2011

Galtung, John (, 1994),, *Human Rights in Another Key*, Cambridge, Mass: Polity Press

Goedemé, Tim. (2013). How much confidence can we have in EU-SILC? Complex sample designs and the standard error of the Europe 2020 poverty indicators. *Social Indicators Research*, *110*(1), 89-110.

Goedemé, Tim (2010). "The standard error of estimates based on EU-SILC. An exploration through the Europe 2020 poverty indicators," Working Papers 1009, Herman Deleeck Centre for Social Policy, University of Antwerp.

Gordon, David, Nandy, Shailen, Pantazis, Christina, Pemberton, Simon, Townsend, Peter (2003), 'The distribution of child poverty in the developing world', (Bristol: Centre for International Poverty Research).

Guio, Anne-Catherine, David Gordon and Eric Marlier (2012). "Measuring material deprivation in the EU: Indicators for the whole population and child-specific indicators" *mimeo*

Guio, Anne-Catherine and Maquet, Isabelle Engsted (2006) "Material deprivation and poor housing" What can be learned from the EU-SILC 2004 data? How can EU-SILC be improved in this matter?, in Comparative EU statistics on Income and Living Conditions: Issues and Challenges Proceedings of the EU-SILC conference,(Helsinki, 6-8 November 2006), 2007, Eurostat Methodologies and Working Papers, European Commission

Guio, Anne-Catherine, Fusco, Alessio, and Marlier, Eric (2009) A European Union Approach to Material Deprivation using EU-SILC and Eurobarometer data, CEPS/INSTEAD, IRISS Working Paper Series, No.2009-19

Jana, Stávková , Nad'a, Birciakova, Jana, Turčínková. (2012) Material Deprivation in Selected EU Countries According to EU-SILC Income Statistics, MENDELU Working Papers in Business and Economics, No 2012-19, Mendel University in Brno, Faculty of Business and Economics.

Johansson, Sten (1973) 'The level of living survey: A presentation', Acta Sociologica, Vol. 16, No. 3, pp. 211-219

Ludz, P.Ch. *Materialien zum Bericht zur Lage der Nation* (1971)

Nolan, Brian and Marx, Ive (2009), 'Economic Inequality, Poverty and Social Exclusion', in Wiemer Salverda, Brian Nolan, and Timothy M. Smeeding (eds.), *Oxford Handbook of Economic Inequality* , (Oxford: Oxford University Press), 315-41.

Nolan, Brian and Whelan, Christopher T (1996), Resources, deprivation and poverty, Oxford: Oxford University Press.

Nolan, Brian and Whelan, Christopher T. (2010) "Using Non-Monetary Deprivation Indicators to Analyse Poverty and Social Exclusion in Rich Countries: Lessons from Europe?" *Journal of Policy Analysis and Management*, Special Issue on Poverty Measurement, Volume 29, Issue 2, pp 305–325.

Nolan, Brian and Whelan, Christopher T. (2011) *Poverty and Deprivation in Europe*. Oxford: Oxford University Press.

Nolan, Peter, Sender, John, and Sen, Amartya (1992), 'Death rates, life expectancy and China's economic reforms: a critique of A. K. Sen', *World Development*, 20 (9), 1279-303.

OECD, (Organisation for Economic Co-operation and Development) (2008), *Handbook on Constructing Composite Indicators*: *Methodology and User Guide*, ed. Joint Research Centre European Commission (Paris: OECD).

Sen, Amartya K. (1992), *Inequality re-examined* (Oxford: Clarendon Press).

Townsend, P. (1979). *Poverty in the United Kingdom*, Allen Lane, Harmondsworth.

UNDP (2010), Human Development Report: The Real Wealth of Nations: Pathways to Human Development, UNDP

Ura, Karma, Alkire, Sabina, Zangmo, Tshoki, and Wangdi, Karma (2012), A Short Guide to Gross National Happiness Index, The Centre for Bhutan Studies, Bhutan: Thimpu

Verbist, Gerlinde and Lefebure, Stijn (2008) The Inclusion of Non-cash Housing Advantages in the Income Concept. Estimates and Distribution Effects for Belgium, Herman Deleeck Centre for Social Policy, University of Antwerp, Working Paper Series, No 0801

Whelan, Christopher T and Nolan, Brian (2001), 'Income, Deprivation and Economic Strain: An Analysis of the European Community Household Panel.', European Sociological review, 17 (4), 357-72.

Whelan, Christopher T, and Maître, Bertrand. (2009) "The Europeanisation of Reference Groups?," Papers RB2009/3/2, Economic and Social Research Institute (ESRI).

Whelan, Christopher T, Layte, Richard, and Maître, Bertrand (2004), 'Understanding the mismatch between income poverty and deprivation: a dynamic comparative analysis', European Sociological Review, 20 (4), 287-302.

Whelan, Christopher T. (2007) Understanding the Implications of Choice of Deprivation Index for Measuring Consistent Poverty in Ireland, The Economic and Social Review, Vol. 38, Issue 2, pp 211-234

Whelan, Christopher T. and Maître, Bertrand (2008) "Measuring Material Deprivation in the Enlarged European Union", Economic and Social Research Institute (ESRI), Papers WP249

Whelan, Christopher T., Nolan, Brian. and Maitre, Bertrand, (2014), Multidimensional Poverty Measurement in Europe: An Application of the Adjusted Headcount Approach, *Journal of European Social Policy* Vol. 24 no. 2 183-197

Appendix 1: Dimensions or Indicators of Poverty, Social Exclusion, Quality of Life or Welfare

Allardt (1993) Comparative Scandinavian Welfare Study	Laeken European Council Meeting (2001) Presidency Conclusion	Sten Johansson, Allmanna Forlaget, (1970) Om leviiarlsnivdrinderstikningen, Stockholm: Johansson, Sten

1.*Having:*
  econ resources,
  housing, employment,
  working conditions,
  health,
  education
2.*Loving:*
attachments/ contacts with local community,
family and kin,
friends, associations,
work-mates
 	
3. Being
self-determination, political activities, leisure-time activities, meaningful work, opportunities to enjoy nature.
	1. At-risk-of-poverty rate;
	2. At-risk-of-poverty threshold (illustrative values);
	3. Income quintile ratio;
	4. Persistent at-risk-of-poverty rate;
	5. Relative median poverty risk gap;
	6. Regional cohesion;
	7. Long-term unemployment rate;
	8. Population living in jobless households: children;
	9. Population living in jobless households: prime-age adults;
	10. Early school leavers not in education or training;
	11. Low reading literacy performance of pupils;
	12. Life expectancy;
	13. Self-defined health status by income level;
	14. Dispersion around the at-risk-of-poverty threshold;
	15. At-risk-of-poverty rate anchored at a moment in time;
	16. At-risk-of-poverty rate before social cash transfers;
	17. Gini coefficient;
	18. Persistent at-risk-of-poverty rate (50% of median income);
	19. Working poor (in-work poverty risk);
	20. Long-term unemployment share;
	21. Very long-term unemployment rate
	22. Persons with low educational attainment;
		1. health,
		2. nutritional habits,
		3. residence,
		4. living conditions during childhood and family relations,
		5. education,
		6. degree of employment and work conditions,
		7. economic resources,
		8. political resources,
		9. leisure

Galtung 1994: HR in Another Key (1994)	Whelan, C.T., Nolan, B. and Maitre, B. (2012) Multidimensional Poverty Measurement in Europe: An Application of the Adjusted Headcount Approach	Whelan, C.T. (2007) Understanding the Implications of Choice of Deprivation Index for Measuring Consistent Poverty in Ireland	Whelan, C.T. and Maître, B. (2008) The 'Europeanisation' of Reference Groups: A Reconsideration Using EU-SILC
1. Survival needs: *to avoid violence* individual & collective 2. Well-being needs: *to avoid misery:* nutrition, water, air, movement, excretion, sleep, sex, protection against climate, against diseases, against heavy degrading boring work, self-expression, dialogue, education 3. Identity needs: *to avoid alienation*: creativity, praxis, work, self-actuation, realising potentials, well-being, happiness, joy, being active subject, not passive client/object, challenge and new experiences, affection, love, sex; friends, offspring, spouse, roots, belongingness, networks, support, esteem, understanding social forces, social transparency, partnership with nature, a sense of purpose, of meaning , closeness to the transcendental, transpersonal education 4. Freedom needs: *choice :* in receiving/ expressing information & opinion, of people/places to visit and be visited, in consciousness formation, in mobilization, confrontation, occupation, job, spouse, goods/services, way of life	Basic Deprivation: comprising items relating to enforced absence of a *1.* meal, *2.* clothes, *3.* a leisure activity, *4.* a holiday, *5.* a meal with meat or a vegetarian alternative, *6.* adequate home heating, *7.* shoes; Consumption Deprivation: Comprising three items relating a *1.* PC, *2.* car *3.* internet connection; Health: comprising three items relating to *1.* The health of the HRP, namely current reported self-assessed health status, *2.* Restrictions on current activity *3.* The presence of a chronic illness; Neighbourhood Environment: comprising five items comprising *1.* reported levels of litter, *2.* damaged public amenities, *3.* pollution, *4.* crime/violence/vandalism *5.* noise in the neighbourhood	Basic Deprivation: *1.* Two pairs of strong shoes *2.* A warm waterproof overcoat *3.* Buy new rather than second hand clothes *4.* Eat meals with meat, chicken or fish (or vegetarian equivalent) every second day *5.* Have a roast joint (or its equivalent) one a week *6.* Go without heating during the past twelve months *7.* Keeping the home adequately warm *8.* Replace any worn out furniture *9.* Buy presents for family or friends once a year *10.* Have family or friends for a drink or meal once a month *11.* Have a morning, afternoon or evening out in the past fortnight for entertainment	Household Income: the total annual disposable household income; Material Deprivation: *1.* Cannot afford meal with meat, chicken, fish (or vegetarian) every second day; *2.* Inability to keep home adequately warm; *3.* Cannot afford to have a car; *4.* Cannot afford a telephone; *5.* Cannot afford a PC; *6.* Cannot afford a colour TV; *7.* Cannot afford a washing machine; *8.* Cannot afford a week of holiday away from home; *9.* Cannot afford to pay unexpected required expenses; *10.* Experiencing arrears on rent, mortgage, utility bills or hire purchase payments; Economic stress: Qualitative answers to the question "Thinking now of your household's total income, from all sources and from all household members, would you say that your household is able to make ends meet""

Bossert, W., Chakravarty, S.R. and D'Ambrosio, C. (2009) Multidimensional Poverty and Material Deprivation, CIREQ (Material deprivation)	Coromaldi, M. and Zoli, M. (2012) Deriving Multidimensional Poverty Indicators: Methodological Issues and an Empirical Analysis for Italy
1. The dwelling has a leaking roof, damp	Maintenance capacity:

walls/doors/foundations, or rot in doors, window frames or door. 2. The household lacks the ability to keep the home adequately warm 3. The dwelling does not have a proper room with a bath or shower 4. The dwelling does not have an indoor using toilet for the sole use of household 5. The household has been in arrears at any time in the last 12 months on mortgage or rent payments 6. The household has been in arrears at any time in the last 12 months on utility bills 7. The household has been in arrears at any time in the last 12 months on hire purchase instalments or other loan payments 8. The household cannot afford to pay for a one-week annual holiday away from home 9. The household cannot afford a meal with meat, chicken, (or vegetarian equivalent) every second day 10. The household lacks the capacity to face unexpected required expenses 11. The household cannot afford a telephone (including mobile phone) 12. The household cannot afford a colour TV 13. The household cannot afford a computer 14. The household cannot afford a washing machine 15. The household cannot afford to have a car 16. The dwelling has noise from neighbours or noise from the street 17. The household lives in an area with pollution, grime or other environmental problems caused by traffic or industry The household lives in an area with crime, violence or vandalism.	1. Arrears on utility bills 2. Holiday 3. Capacity to afford a meal (with meat…) 4. Capacity to face unexpected expenses 5. Ability to make ends meet 6. Ability to keep home adequately warm 7. Financial burden of the total housing cost 8. Ability to purchase food 9. Ability to purchase clothes 10. Capacity to spend money for health 11. Capacity to spend money for education 12. Capacity to spend money for transport 13. Capacity to spend money for paying taxes 14. Capacity to spend money for medical treatment 15. Capacity to spend money for dental examination; Consumption deprivation: 16. Possession of Mobile 17. Possession of Telephone 18. Possession of Computer 19. Possession of Car 20. Possession of Dishwasher 21. Possession of VHS 22. Possession of Camera 23. Possession of Aerial 24. Access to Internet; Health Status: 1. General health 2. Suffer from chronic illness 3. Limitation in activities because of health problems 4. Incapacity to look for a job because of personal illness; Housing facilities: 1. Possession of TV 2. Possession of washing machine 3. Possession of fridge 4. Problems with dwelling (darkness) 5. Bath or shower in dwelling 6. Indoor toilet 7. Hot water in dwelling; Other housing related problems: 1. Problems of noise 2. Problems of pollution 3. Problems of crime 4. Problems of leaking roof 5. Problems with dwelling (dampness) 6. House density 7. Financial burden of mortgage 8. Arrear on mortgage Financial burden of rent

Fusco, A., Guio, A. and Marlier, E. (2011) Income poverty and material deprivation in European countries, CEPS	Guio, A., Fusco, A. and Marlier, E. (2009) A EU Approach to Material Deprivation using EU-SILC and Eurobarometer data, IRISS Working Paper Series	Guio, A. and Maquet, I.S. (2006) "Material deprivation and poor housing" What can be learned from the EU-SILC 2004 data? How can EU-SILC be improved in this matter?	Adamson, Peter, (2012), 'Measuring Child Poverty: New league tables of child poverty in the world's rich countries', UNICEF Innocenti Research Center, Report Card 10
Income poverty: *1.* at-risk-of-poverty; *2.* the median at-risk-of-poverty gap; Material deprivation: *1.* to face unexpected expenses; *2.* one week annual holiday away from home; *3.* to pay for arrears (mortgage or rent, utility bills or hire purchase instalments); *4.* a meal with meat, chicken or fish every second day; *5.* to keep home adequately warm; *6.* to have a washing machine; *7.* to have a colour TV; *8.* to have a telephone *9.* to have a personal car.	Material deprivation: *1.* to face unexpected expenses; *2.* one week annual holiday away from home; *3.* to pay for arrears (mortgage or rent, utility bills or hire purchase instalments) *4.* a meal with meat, chicken or fish every second day; *5.* to keep home adequately warm; *6.* to have a washing machine; *7.* to have a colour TV; *8.* to have a telephone; *9.* to have a personal car.	Economic strain: Could not afford – *1.* One week annual holiday away from home *2.* Arrears (mortgage or rent, utility bills or hire purchase instalments) *3.* A meal with meat, chicken or fish every second day *4.* To keep home adequately warm *5.* Capacity to face unexpected expenses; Durables: Enforced lack of *1.* Colour TV *2.* Telephone *3.* Personal car *4.* Washing machine; Housing: *1.* Leaking roof, damp walls/floors/foundations, or rot in window *2.* Frames or floor *3.* Accommodation too dark *4.* Bath or shower in dwelling *5.* Indoor flushing toilet for sole use of the household	*1.* Three meals a day *2.* At least one meal a day with meat, chicken or fish (or a vegie equivalent) *3.* Fresh fruit and vegetables every day, *4.* Books suitable for the child's age and knowledge level (not including schoolbooks) *5.* Outdoor leisure equipment (bicycle, roller-skates, etc.) *6.* Regular leisure activities (swimming, playing an instrument, participating in youth organizations etc.) *7.* Indoor games (at least one per child, including educational baby toys, building blocks, board games, computer games etc.) *8.* Money to participate in school trips and events *9.* A quiet place with enough room and light to do homework *10.* An Internet connection *11.* Some new clothes (i.e. not all second-hand) *12.* Two pairs of properly fitting shoes(including at least one pair of all-weather shoes) *13.* The opportunity, from time to time, to invite friends home to play and eat *14.* The opportunity to celebrate special occasions such as birthdays, name days, religious events, etc.

Whelan, C.T. and Maître, B. (2008) Measuring Material Deprivation in the Enlarged European Union	Gabos, A., Ozdemir, E., Ward, T. (2011) Material Deprivation among Children	Jana, S., Nad'a, B., Jana, T. (2012) Material Deprivation in Selected EU Countries According to EU-SILC Income Statistics
Consumption deprivation: *1.* Afford to pay unexpected required expenses; *2.* Weeks holiday away from home; *3.* Meals with meat, chicken, fish (or vegetarian); *4.* Can afford a PC?; *5.* Arrears relating to mortgage payments, rent, utility bills, hire purchase; *6.* Inability to keep home adequately warm; *7.* Respondent for household can afford to have a car; Household facilities: *8.* Bath or shower in dwelling; *9.* Indoor toilet; *10.* Can afford a telephone?; *11.* Can afford a colour TV? *12.* Can afford a washing machine?; Neighbourhood environment: *13.* Pollution, grime or other environmental problems in the area caused by traffic or industry; *14.* Noise from neighbours or noise from the street; *15.* Crime, violence or vandalism in the area; Others: *16.* Rooms too dark, light problems; *17.* Leaking roof, damp walls/ceilings/floors/foundations, rot in doors, window frames	Basic Needs: *1.* Some new clothes; *2.* Two pairs of shoes; *3.* Fresh fruit daily; *4.* Three meals a day; *5.* One meal with meat; Education and leisure needs: *1.* Books; *2.* Outdoor leisure equipment *3.* Indoor games; *4.* Celebration on Special occasions; *5.* Invite friends; *6.* Participate in school trips; *7.* Place to study; *8.* Outdoor space to play;	*1.* Household ability to pay rent, mortgage, loans and utility bills, *2.* ability to keep the home adequately warm, *3.* the ability to face unexpected expenses, *4.* to eat meat or proteins regularly, *5.* to go on holiday once a year, *6.* whether the household has a TV, a refrigerator, a car and a telephone