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A New Measure of Income Poverty for Europe

Benoit Decerf[1], Karel Van den Bosch[2] and Tim Goedemé[3]

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Abstract

In Europe poverty is usually measured with the at-risk-of-poverty indicator which defines the poverty threshold as 60 per cent of national median income. With this indicator, poverty seems to be lower in some 'poor' EU countries than in some of the richest EU Member States. Also, when the median income changes quickly, the evolution of poverty as shown by the indicator can be counterintuitive, for instance resulting in stagnation or even a decrease in poverty when median incomes fall and living conditions of the poor deteriorate. In this article we propose a new poverty indicator, the Poverty Gap Ratio with priority to the pan-European poor (PGR-PAN) which is not subject to these limitations. The indicator is based on two lines: a hybrid poverty line which increases with national average income and a pan-European poverty line which is fixed in real terms across time and across countries. We use reference budgets to identify a set of useful poverty thresholds. On the basis of EU-SILC data we show that our indicator results in results that are in better agreement with intuitive notions about poverty within the EU and captures more adequately changes as well as cross-national differences in living standards. Furthermore, we contend that the use of our indicator can lead to a more consistent evaluation of poverty in comparison with other indicators of poverty and social exclusion.

Keywords: European Union, income poverty, inequality, pan-European poverty, PGR-PAN

JEL Codes: D63, I32

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Abbreviations:

AROP	At-risk-of-poverty rate (head count ratio)
AROP_PGR	Poverty gap ratio based on the at-risk-of-poverty line
Hyb_PGR	Poverty gap ratio based on the hybrid line
PGR-PAN	Poverty gap ratio giving priority to the pan-European poor

1. Motivation

Poverty reduction is a major political objective in Europe. In the past decade, the EU Commission has adopted a quantified poverty reduction target (Social Protection Committee - Indicators Sub-Group, 2015). In its Europe 2020 strategy, the EU Commission intends to reduce by 20 million the number of individuals that are at risk of poverty or social exclusion. This target is based on a composite indicator of poverty and social exclusion. One of its three elements is the so-called 'at-risk-of-poverty indicator', a measure of income poverty. In this paper we focus on income poverty. Any income poverty measure is composed of two elements: a poverty line and an index (Sen, 1976). A poverty line specifies the income threshold below which individuals are considered to be poor. An index aggregates the poverty of all individuals in a society and, hence (provided poverty is measured in a comparable way), allows comparing the extent of poverty in different societies or across time within the same society.

There exists a wide range of approaches to define a poverty threshold. In comparative research, the two most common approaches either define the poverty threshold as a percentage of average or median income (i.e. a floating poverty line), or make use of a threshold that is kept constant in real terms (i.e. a fixed poverty line). In Europe, the use of a floating poverty line is prevalent, as is exemplified by the at-risk-of-poverty indicator (AROP), which defines the threshold as 60 per cent of national median equivalent disposable household income (e.g. Atkinson et al., 2002). By contrast, the United States has been using a fixed poverty line since the early 1960's (e.g. Orshansky, 1965, 1969). For two reasons, the adoption of the at-risk-of-poverty line by the EU has been labelled as overly relativistic by a range of authors (e.g. Beblavy and Mizsei, 2006). First, in times of rapid economic growth poverty might increase even if living conditions of the poorest members of society improve in many respects (cf. Nolan and Maître, 2010; Whelan and Maître, 2010b on Ireland). Similarly, the opposite may be the case during economic decline: poverty might fall, even if the living conditions of the poorest members of society clearly deteriorate in many respects (e.g. Finland in the early 1990s, see Halleröd and Heikkilä, 1999, pp. 186-188; Ministry of Social Affairs and Health, 1998). Second, when cross-national differences in living standards and circumstances are large, those with an income

at the level of the at-risk-of-poverty threshold in richer countries are likely to enjoy better living conditions, in important respects, than their counterparts in poorer countries (e.g. Fahey, 2007; Goedemé et al., forthcoming). Indeed, one could reasonably doubt whether a person just below the at-risk-of-poverty line in Bulgaria can realise basic capabilities (cf. Sen, 1992) or the minimum acceptable way of life in society (cf. Council of the European Communities, 1975) to the same extent as a person just below the at-risk-of-poverty line in Belgium. Also, a purely relativistic poverty measure is not able to show an important aspect of social cohesion between all EU citizens, given that divergence or convergence in average living standards is completely cancelled out (e.g. Brandolini, 2007). This is undesirable also from an EU policy perspective, especially in the field of cohesion policy (e.g. Whelan and Maître, 2009).

For these and other reasons, the monitoring of poverty and social exclusion in the EU is not only based upon the at-risk-of-poverty indicator. More in particular, the EU makes use of a set of poverty and social exclusion indicators (Social Protection Committee - Indicators Sub-Group, 2015), which together accommodate to some extent the concerns mentioned above: the at-risk-of-poverty indicator is published along with the real value of the poverty threshold; there is an indicator of 'anchored poverty', which starts from the at-risk-of-poverty threshold of 2008, kept constant in real terms; and an indicator of 'severe material deprivation' has been added, which uses in important respects (but not fully) the same benchmark of material well-being across all EU Member States. Obviously, the joint interpretation of these indicators is not always straightforward, especially when they are telling different stories. Also, the classification of the population into those that are considered poor and those that are not, as well as their severity of poverty is not always consistent.

Therefore, in this paper we propose a new measure of income poverty as an additional EU social indicator. This measure is based on a set of two poverty lines, a fixed threshold and a hybrid one, and incorporates a recently proposed index aggregating individual poverty gaps. The fixed line is set at a lower level than the hybrid line, and aims at capturing the most severe forms of poverty. The hybrid line is hybrid in the sense of being intermediate between being completely relative, and having a fixed value across countries. The index is designed to make sure that poor persons below the fixed line

always contribute more to its overall value than persons above the fixed threshold but below the hybrid line. The theoretical properties of the indicator have been developed in Decerf (2015). In this contribution, we adapt the indicator to the social and economic situation of the EU, and illustrate how this indicator has clear advantages compared to the classical indicator of income poverty with regard to cross-national and cross-temporal comparisons. More in particular, we contend that the proposed poverty measure accommodates in a more consistent way concerns about changes in living standards across time and diverging living standards across countries, while paying specific attention to those confronted with more severe forms of poverty. While its restriction to the income space can be seen as a limitation, this has the advantage of making interpretation of trends more straightforward and consistent than what is possible with indicators that combine information on material deprivation and income poverty (e.g. Whelan and Maître, 2010a). We do not claim that this poverty indicator should replace any of the already existing indicators, but contend that it is a valuable addition to the current set of indicators, especially for researchers and policy makers who care about changes in living standards across time and place, while not ignoring the relativity of living conditions.

The paper is structured as follows. First we explain the components and rationale of the proposed indicator. In section 3, we explain how it is applied to the European Union, using the European Union Statistics on Income and Living Conditions (EU-SILC) and deriving poverty thresholds from reference budgets. Illustrative results are presented in section 4, and contrasted with those obtained on the basis of the standard at-risk-of-poverty indicator. We conclude with a summary and a brief discussion of the added value and limitations of our proposal for an additional EU social indicator.

2. The new measure

The new measure is based on two poverty lines and one particular index aggregating the income gaps from these two lines. We present in turn the two lines and then the index.

2.1 The two poverty lines

The new measure is based on a set of two poverty lines, a fixed[4] line z_a and a hybrid line z. The latter is hybrid in the sense of not having a fixed real value across all countries, nor being always set at a particular proportion of mean or median income. The hybrid line that we propose can be defined as follows. Let an income distribution $y := (y_1, \ldots, y_n)$ be a list of non-negative incomes sorted in non-decreasing order $y_1 \leq \cdots \leq y_n$. Let mean income (denoted by $\bar{y}$) be the income standard capturing the average standard of living in a distribution. Let *s* be the slope of a relative line, which specifies what fraction of mean income defines the relative poverty threshold. We take the hybrid line to be defined as $\mathbf{z(\bar{y}) = max(z_0, s\bar{y})}$.

In other words, the hybrid line is equal to a fixed threshold z_0 until fraction *s* of average income is higher than this threshold. Subsequently, we assume an elasticity of 1: with each further increase in average income, the threshold rises proportionally. As shown in Figure 1, our hybrid line *z* is constant until some value of mean income after which it becomes relative to mean income. We refer to this value of mean income as the "kink". The "kink"'s value depends directly on z_0, which is set at a higher level than z_a, and whose selection is detailed in the next section.

[4] In many studies such a fixed threshold is referred to as an "absolute" poverty line, where absolute poverty means the absence of enough resources to secure survival. Since we do not want to claim that our fixed poverty line z_a measures absolute poverty in that sense, we avoid the word "absolute".

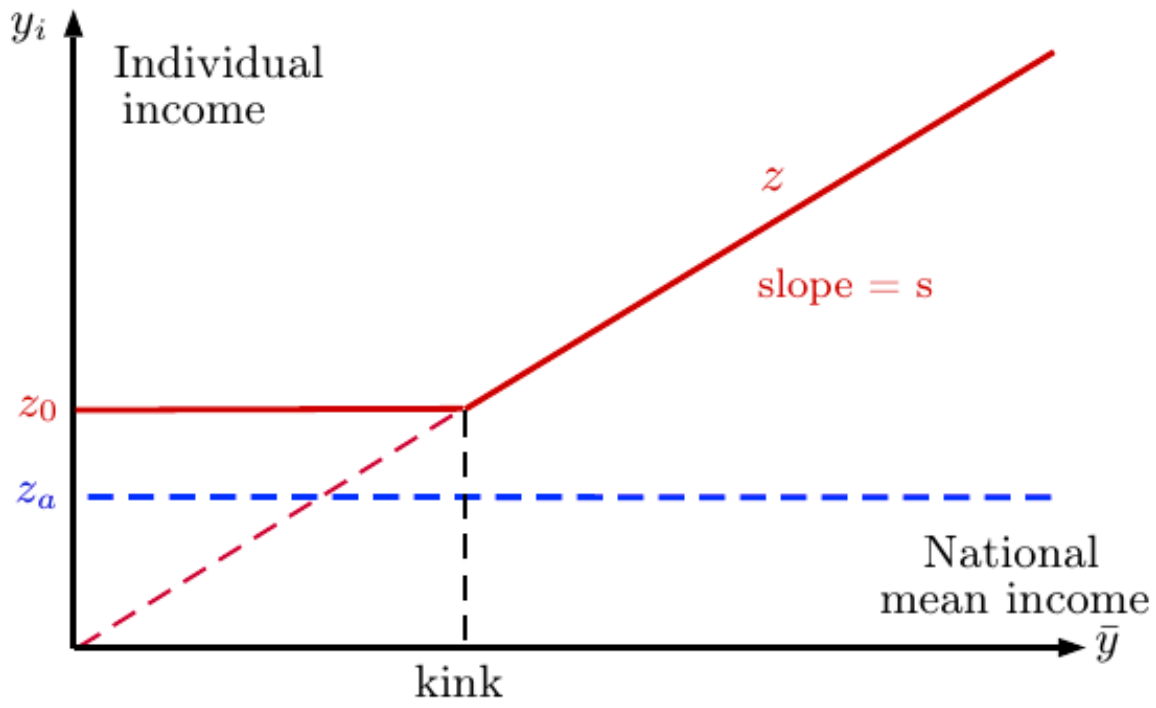

Figure 1: Hybrid line z and fixed pan-European threshold z_a.

The fixed pan-European line z_a aims to capture the most severe forms of poverty from a cross-national perspective, and is set below the hybrid line. Also, the fixed line is used for capturing changes in living standards of the poorest EU citizens, regardless of changes in the standard of living of other members of society. Therefore, the purchasing power at the level of the threshold is fixed at a similar level across countries and kept constant in real terms over time. We present in the next section the approach we used to derive a value for z_a.

The idea of a hybrid line is not new. Foster (1998) proposed hybrid lines that are a weighted geometric mean of a relative threshold and a fixed one, and which feature a constant income elasticity. This income elasticity can be interpreted as the extent to which poor individuals should share in the benefits of economic growth. Fixed lines have an income elasticity of zero and fully relative lines have an income elasticity of one, representing two extreme views on this parameter. In a similar vein, Atkinson (1998) suggested using a hybrid line for poverty measurement in Europe which is a weighted geometric average of national and pan-European poverty. This was illustrated with an application to the EU by Brandolini (2007), while Berthoud (2012) made an attempt to estimate which

weight the national and pan-European perspective each should receive. A somewhat different way to set a hybrid poverty line for the purpose of measuring global poverty was introduced by Atkinson and Bourguignon (2001). They postulate two key capabilities: physical survival and social inclusion, which correspond to fixed and relative thresholds, respectively. For poor countries, the poverty line is fixed, while it is completely relative (i.e. a fixed proportion of average income) for middle-income and rich countries. Ravallion and Chen (2011), arguing that even for people in very poor countries the costs of social inclusion are not zero, generalize this idea by adding a parameter α, which represents the lower bound to social inclusion needs. So the poverty line is $z(\square_i) = \max(z_0, \alpha + s\square_i)$ resulting in weakly relative lines, whose income elasticity is zero for low-income countries and then increases with standards of living, but, unlike in Atkinson and Bourguignon (2001), remains strictly below one when $\alpha > 0$. An application of such weakly relative lines for developing countries can be found in Chen and Ravallion (2013). We follow Atkinson and Bourguignon (2001) in setting $\alpha = 0$, but we do not assume that the fixed threshold z_0 corresponds to physical survival. To the best of our knowledge, this version of a hybrid poverty line has never been applied to the EU.

As the various proposals discussed above make clear, poverty researchers have debated for a long time to what extent the poverty line should be correlated with the average living standard of society in order to ensure that poverty is measured in a comparable way across time and place, i.e. to ensure that falling below the poverty line captures the same social phenomenon (e.g. Atkinson, 1998; Berthoud, 2012; Rein, 1970; Sen, 1983; Townsend, 1979; Veit-Wilson, 1986). At the conceptual level, there is quite some agreement that differences in average living standards, societal and living conditions as well as social expectations should be factored in (for a discussion, see Goedemé and Rottiers, 2011), but it is not clear how this is best taken forward to actual poverty measures.

As mentioned above, the two prevailing approaches to set the poverty threshold consist of either keeping the poverty line fixed in real terms, usually, but not necessarily, at a relatively low level, or making the poverty line proportional to average or median living standards, as measured by equivalent disposable household income or equivalent household consumption expenditures. The success of both approaches is probably primarily due to their seeming simplicity of construction and

interpretation, rather than the strength of their theoretical foundation[5]. However, it is not clear how to go beyond this, and the indicator that we propose encompasses both approaches. The use of the hybrid line set at a proportion of average income ties in with concerns of strongly increasing needs when average living standards in societies increase, especially in terms of social participation, and current practice in the system of EU social indicators. For a given level of mean income, the hybrid threshold can be interpreted as the income necessary for a citizen to satisfy both her minimal material needs and her social participation needs, whereas the lower fixed threshold reflects the income necessary to satisfy her minimal material needs.

Several additional remarks are important at this point: (1) the measure of 'average living standards' that is used; and (2) the priority we give to more severe forms of poverty from a pan-European or cross-temporary perspective. First, the choice of income standard is important because it defines the distributional changes altering the income threshold and, hence, the individual poverty status. Poverty judgments depend on the income standard used. Median-sensitive lines are often used in practice for studies of the EU. The median is known to be more robust than the mean in random samples (Cowell and Victoria-Feser, 1994). Hence, median-sensitive lines entail less volatile income thresholds. Therefore, they are considered superior to mean-sensitive lines when inequality is constant over time. However, given total aggregate income, the median, unlike the mean, is affected by the inequality in the distribution. de Mesnard (2007) has shown that median-sensitive indices behave very counter-intuitively when income distributions experience an increase in inequality. For instance, policies whose unique impacts are regressive transfers from the middle class to the rich would be deemed poverty-reducing. This issue is particularly problematic in a world in which intra-country inequalities are on the rise (e.g. Atkinson, 2015; Bourguignon, 2015). The evolution of the official poverty measure in New-Zealand over the period 1981 – 1992 constitutes an illustration of the problem (cf.

[5] The simplicity of interpretation may be illusory, given that creating an adequate cost of living index for keeping the threshold constant across time and place is confronted with many – partially unresolved – challenges (Deaton, 2006, 2010). In other words, it is very difficult, if not impossible, to make sure the threshold represents exactly the same purchasing power across time and place. Both approaches face challenges of measuring (equivalent disposable) income in a comparable way.

Easton, 2002). The problem of the robustness of the mean can at least be partially resolved by top- and bottom coding the incomes observed in the sample.

Second, we are convinced that, for a given relative income distribution[6], it is reasonable to assume that poverty should increase when average real income falls, at least below a certain level of average income. In addition, we consider it reasonable to assume that for some part of the 'minimum acceptable way of life', or for some 'basic capabilities' the economic resources one requires (in real terms) cannot fall below a certain level, independently of one's relative income in society. We think this is especially true for the highly monetised economies of the European Union. The first assumption resonates with the view that the at-risk-of-poverty indicator misses important forms of poverty by being overly relativistic. The second assumption ties in with Sen's (1983) view that there is an irreducible absolute core to poverty. The new measure embeds both assumptions through two mechanisms. First, when real average incomes falls, there is a point at which the hybrid line reaches the "kink", below which it is equal to z_0. If average real income falls further, the hybrid poverty line remains constant, and so – for a given relative income distribution – poverty will increase. Second, the index that we use implies that below the pan-European threshold z_a, which defines the 'minimum acceptable way of life' from a pan-European perspective, only the individual's income matters for individual poverty.

2.2 The index

Any poverty measure is obtained by combining a poverty line with an index. Our new measure is obtained by combining the two lines defined above with an index PGR-PAN proposed by Decerf (2015). The particularity of index PGR-PAN is to account for both pan-European and relative poverty while always considering that an individual who is below the fixed pan-European poverty line is poorer than another individual who is only relatively poor. This contrasts with classical indices, which may implicitly consider – when combined with a hybrid line – that a 'pan-European poor' individual in a low-income country to be better-off than a relatively poor individual in a high-income country,

[6] The relative income distribution associated to an income distribution is obtained by dividing all incomes by the income standard (e.g. the average) of the distribution.

who has an income above the lower pan-European poverty line. This is for instance the case for the popular Foster-Greer-Thorbecke (FGT) indices (Foster et al., 1984) defined as

$$P^{FGT}(y) = \frac{1}{n}\sum_{i=1}^{q}\left(1 - \frac{y_i}{z(\overline{y})}\right)^{\alpha} \qquad (1)$$

where q denotes the number of poor individuals in distribution y. The most well-known members of this family are the Head-Count Ratio (HC) and the Poverty Gap Ratio (PGR) for $\alpha = 0$ and $\alpha = 1$ respectively.

Figure 2a illustrates the individual well-being comparisons implicit in the FGT measures. Any poor individual is attributed by FGT indices a value of well-being that only depends on her normalized income, i.e. her income divided by the income threshold in her society. The black curves below *z* are iso-poverty curves. They reveal the levels of individual income that, according to the FGT indices, represent the same level of well-being in countries with various mean incomes. Individual A living in a low-income country is below the pan-European poverty threshold, while individual B in a high-income country is above that threshold and only relatively poor. Yet, as they are on the same iso-poverty curve, they are attributed the same level of well-being by the FGT index.

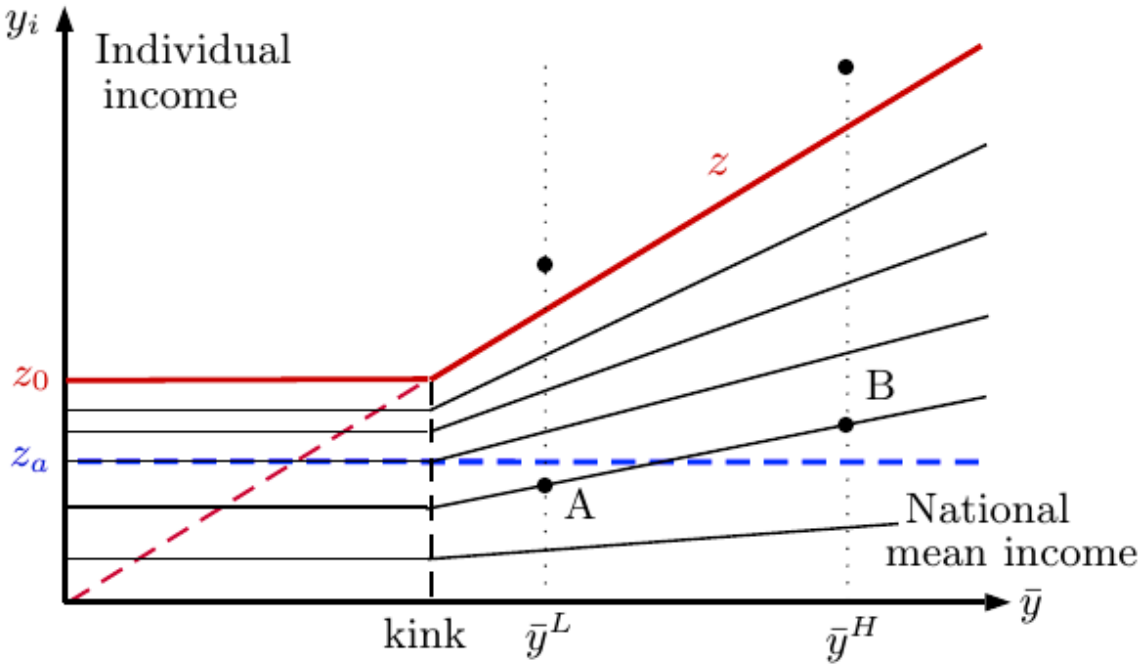

Figure 2.a: Individual well-being comparisons implicit in the Foster-Greer-Thorbecke measures.

The index PGR-PAN (Poverty Gap Ratio - Priority to pan-European poverty) improves on classical indices by changing the implicit comparisons of individual well-being across societies with different standards of living. Its mathematical expression is

$$PGR{-}PAN(y) = \frac{1}{n}\sum_{i=1}^{q}\left(1 - d(y_i, \overline{y})\right) \qquad (2)$$

where *d* is the poor individuals' well-being function. Function *d* is defined as

$$d(y_i, \overline{y}) = \begin{cases} \frac{y_i}{z_0} & \text{if } \; y_i \leq z_a, \\ \frac{z_a}{z_0} + \frac{z_0 - z_a}{z_0}\frac{y_i - z_a}{z(\overline{y}) - z_a} & \text{if } \; z_a < y_i < z(\overline{y}) \end{cases} \qquad (3)$$

and z_0 is the minimal threshold value of the hybrid line.

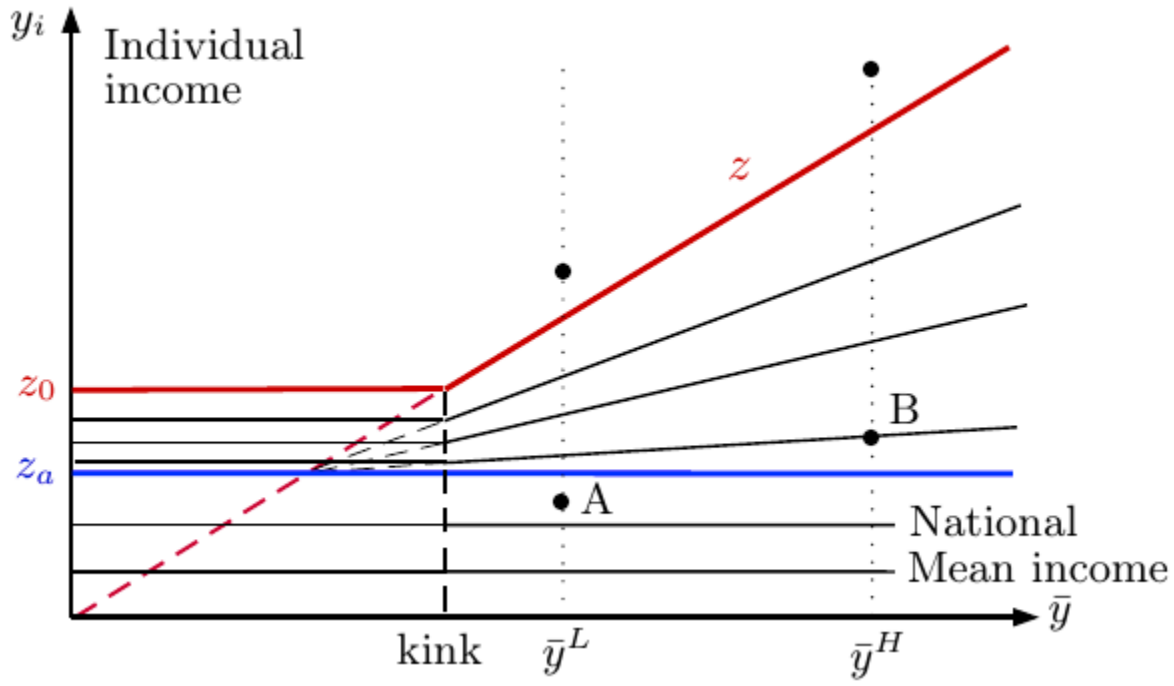

Figure 2.b: Individual well-being comparisons implicit in index PGR-PAN.

Its implicit comparisons are illustrated in Figure 2b. The iso-poverty curves representing equal well-being are flat below the pan-European fixed threshold, indicating that the well-being of pan-European poor individuals only depends on their own income. Above the fixed threshold z_a but below the hybrid line z, well-being depends on the position relative to the fixed line and the hybrid line, and so it depends on both own income and the mean income in the country. PGR-PAN attributes lower well-being to individual A in a low-income country than to individual B in a high-income country.

Decerf (2015) shows that PGR-PAN is the only index inside a modification of the FGT family that satisfies two very basic properties. These two properties are called Monotonicity in Income and Transfer. Monotonicity in Income requires that decreasing the income of some poor individual never leads to an unambiguous poverty reduction. Transfer requires that a progressive transfer taking place between two poor individuals never unambiguously increases poverty. Furthermore, the definition of well-being implies for PGR-PAN that

- An extra euro has the same impact on European poverty when it is given to a pan-European poor individual in a low-income country as when it is given to a pan-European poor individual in a high-income country.

- A transfer of one euro from a rich individual to a relatively poor individual has more impact on European poverty when it occurs in a low-income country than when it occurs in a high-income country. Even if lifting an individual from the pan-European threshold to the relative threshold has the same impact on well-being in both countries, it is more costly to do so in the high-income country.

A reformulation of (2) and (3) makes the interpretation of PGR-PAN easier. We can write PGR-PAN as the sum of the contributions of individuals to the overall poverty measure. These contributions p_i vary between 0 and 1 and are equal to 1-d, so they are inversely related to the well-being function; for all individuals above z, the contribution is 0; for individuals with zero income it is 1. Equation (3) can then be rewritten as:

$$p_i(y_i, \overline{y}) = \frac{z_0 - y_i}{z_0} \qquad \text{if} \quad y_i \leq z_a \tag{4a}$$

$$\begin{aligned} p_i(y_i, \overline{y}) &= \frac{z_0 - z_a}{z_0} - \frac{z_0 - z_a}{z_0}\frac{y_i - z_a}{z(\overline{y}) - z_a} \\ &= \frac{z_0 - z_a}{z_0}\left(1 - \frac{y_i - z_a}{z(\overline{y}) - z_a}\right) \\ &= \frac{z_0 - z_a}{z_0}\frac{z(\overline{y}) - y_i}{z(\overline{y}) - z_a} \qquad \text{if} \quad z_a < y_i < z(\overline{y}) \end{aligned} \tag{4b}$$

Equation 4a says that for persons below the fixed threshold, the contribution varies between a maximum of 1 and a minimum that approaches $(z_0 - z_a)/z_0$. For relatively poor individuals (below the hybrid threshold but on or above the fixed threshold), equation 4b indicates that the contribution varies between a maximum of $(z_0 - z_a)/z_0$ and a minimum that approaches 0. The maximum is reached when the income is equal to the fixed threshold z_a. The second fraction in 4b is the ratio of the

distance between the hybrid threshold $z(\overline{y})$ and the individual's income in the numerator and in the denominator the distance between the hybrid threshold and the fixed threshold.

Importantly, the index PGR-PAN can be decomposed between the contributions of pan-European and relatively poor individuals. This decomposability follows from the additivity of FGT indices and the distinction made by d between the two forms of poverty.

$$PGR-PAN(y) = \underbrace{\frac{1}{n}\sum_{i=1}^{\mathbf{q_a}}(1-d(y_i,\overline{y}))}_{\mathbf{PAN-Europ.\ poors}} + \underbrace{\frac{1}{n}\sum_{i=\mathbf{q_a+1}}^{\mathbf{q}}(1-d(y_i,\overline{y}))}_{\mathbf{Relatively\ poors}} \qquad (5)$$

where q_a denotes the number of pan-European poor individuals in y and $q-q_a$ is the number of relatively poor individuals in y. This decomposability simplifies the analysis of the evolution of poverty and its communication towards a broad audience.

3. Application to the EU

3.1 Data

We use the EU□SILC data. EU□SILC consists of a random sample of private households in all EU Member States and is the EU reference source for information on income and living conditions in the EU. In the large majority of participating countries, EU□SILC has a 4□year rotational panel design and households are selected using a sample design. In most countries, except for Ireland and the United Kingdom, income data refer to the year before the survey year. In this paper, we use data from the 2005 wave (with incomes of 2004) up to SILC 2014 (incomes of 2013).[7] We do not consider Croatia, because it joined the EU only very recently.

[7] For more information on EU-SILC, we refer to Marlier et al. (2007); Iacovou et al. (2012); and Decancq et al. (2014).

We use equivalent disposable household income as our income measure. This equals the sum of all after-transfer incomes of all household members, net of taxes and social contributions, divided by the modified-OECD equivalence scale of the household. In this paper, we use 'income' and 'equivalent disposable household income' interchangeably. These incomes are top-coded at the (country and year specific) 99th percentile, and bottom coded at the 1st percentile, or at zero where the 1st percentile was negative.

In order to apply the pan-European and hybrid poverty line, it is necessary to make incomes comparable across countries in terms of purchasing power. Therefore, all incomes have to be converted to the same currency, taking account of relative price differences across countries. We do so in two steps. First, incomes are updated within each country to the year 2013, using the HICP (harmonized index of consumer prices), provided by Eurostat. Second, we apply purchasing power parities (PPPs) for final household consumption as calculated by Eurostat. We are aware that the use of PPPs is not a perfect solution for making incomes cross-nationally comparable[8]. Nonetheless, PPPs are the best tool available for making incomes cross-nationally comparable (for a more extensive discussion of the use of PPPs in poverty research, see for instance Milanovic (2005) and Deaton (2006)).

3.2 The poverty thresholds

The most crucial decision concerns the thresholds for the poverty lines z_a and z_0. Chen and Ravallion (2013) use the $1.25 a day threshold, considered by the World Bank as the threshold for extreme poverty. Even though z_a should be very low in order to identify situations of severe poverty, this level seemed to be of little relevance for EU countries. More generally, in order to produce useful results, the z_a threshold should not be so high that in the poorest countries a majority of households are below this subsistence line, nor so low that only a marginal proportion of the population is found to be in that situation. The thresholds z_a and z_0, whose values are derived independently (see below), together

[8] The procedure to first update incomes using national price indices, and then convert to a common base using PPPs for the most recent year (instead of first converting and then updating) is recommended by Schreyer and Koechlin (2002).

define the key ratio z_a / z_0. As shown in equation 3, this ratio defines the well-being of an individual with an income exactly equal to the pan-European threshold. Its normative interpretation is then the relative weight attributed to having an income at this threshold in the determination of individual well-being. Also, as shown in equation 4b, a high ratio z_a / z_0 implies that the contribution of relative poverty to the overall value of the index would be quite small, while a low ratio z_a / z_0 would have the opposite effect.

We derive the set of thresholds z_a and z_0 from the reference budgets developed in the context of the 'ImPRovE' project[9] by Goedemé et al. (2015). Reference budgets are priced baskets of goods and services that are needed by households in given countries, regions or cities to achieve a given standard of living. The 'ImPRovE' project aimed at reference budgets enabling full social participation that are comparable across countries, while also being acceptable within each country. Reference budgets were developed in 2014 for six European cities: Antwerp, Athens, Barcelona, Budapest, Helsinki and Milan, for four family types, and for tenants and mortgage-free owners. The budgets were divided into nine components: food, clothing, rest and leisure, personal care, health care, maintaining social relations, safe childhood, mobility without car, and housing including taxes and energy. From the budgets for a single person, the thresholds z_a and z_0, to be applied to all EU countries, were derived in the following steps:

– The housing budgets in the ImPRovE project were calculated for the regions where the reference cities were located, using EU-SILC data (see Van den Bosch et al. (2016) for details on the estimation method used). These housing costs are often higher than in other regions within the same country. For this reason, we recalculated the housing budget, separately for tenants and outright owners, for each country as a whole. Since the OECD modified equivalence scale does not distinguish between tenants and outright owners, we use the weighted average of the housing budgets for these two housing tenure situations, where the weights are proportional to the relative

[9] See http://improve-research.eu/.

proportions of tenants and outright owners among the lowest income quartile in the EU as a whole. These are 16.5 and 58.8 percent respectively, so the weights are 0.218 and 0.782.

- We assume that there is little or no regional variation in the other components (or that these variations cancel each other out in the aggregate), so the total budgets with the recalculated housing costs are supposed to refer to the whole country.
- We convert the amounts by component to the year 2013 using goods-specific price indices and purchasing power parities for food, clothing and housing, and the price indices and PPPs for total consumption for the other components, as those do not correspond closely to the grouping of consumption by Eurostat. We use 2013 as a base-year, given that the most recent EU-SILC data available at the time of writing (EU-SILC 2014) have 2013 as the income reference year.[10]
- We exclude the budget for Greece, as this was an outlier among the other countries (the total budget for Greece is 8,854 Euro, while it varies among the other five countries between 6,387 Euro-PPPs in Italy to 7,354 Euro-PPPs in Finland).[11]
- We use the average budget among the remaining countries as the threshold for z_0 for all EU countries.
- We use the average (excluding Greece) of the sum of the budget components food, clothing and housing as the threshold for z_a for all EU countries. Food, clothing and housing are necessary for survival, so these components seem an appropriate selection for a pan-European line below which any person living in the EU can be regarded as being in severe poverty (cf. Citro and Michael (1995), who also make the assumption that spending on food, clothing and shelter represent necessary expenditure).[12]

The values of the thresholds z_a and z_0 are 3,766 Euro-PPPs and 6,874 Euro-PPPs respectively. The ratio of z_a to z_0 is 0.548, which seems reasonable given that a value too close to either of the extremes,

[10] In principle, the reference budgets could be used to estimate purchasing power parities at the level of the threshold. However, as we have reference budgets for only six countries, we make use of Eurostat purchasing power parities to be consistent with the empirical application to all EU-SILC countries.

[11] The main reason for this seems to be very high property taxes for outright owners in Athens in 2013.

[12] Of course, the exact items to include could be a matter of discussion, given that also other expenses (e.g. on health care) could be considered essential.

0 or to 1, would imply that the measure is dominated by the contributions of one type of poor (relatively poor if the ratio is close to 0, pan-European poor if the ratio is close to 100 percent). As the choice of thresholds is to some extent a matter of judgment, we performed a sensitivity test using a much lower set of thresholds with z_a and z_0 set at 2,805 Euro-PPPs and 4,608 Euro-PPPs respectively. The rationale for these thresholds and the results are reported in Annex 2; they confirm the main findings obtained from the chosen set of thresholds. For the slope *s* of the hybrid poverty line beyond the kink, we chose the fraction 0.5 because the resulting threshold amounts are fairly close to 60% of median equivalent income, which is the poverty line used in the AROP.

Since the values of the thresholds are in Euro at the average price level across 28 EU countries, it may be difficult to understand what they mean in national terms. Therefore, in Figure 2 we chart the set of thresholds together with income distribution percentiles. Countries are arranged by mean equivalent income in 2013 from low to high. The pan-European threshold z_a is slightly below the median in Romania, and just below the 25th percentile in Bulgaria. For a range of Eastern European countries, and also Greece and Portugal, it is near the 10th percentile; in the countries of Northwestern Europe, it is near or below the bottom 1st percentile. The hybrid line z remains at the fixed value z_0 until the average level of income of Slovenia, above which it becomes relative at 50 percent of mean income. From that point on it is located generally near the 10th percentile, except in Spain and Italy. Below the "kink" it is above the 25th percentile in a number of countries, and in Romania even above mean income.

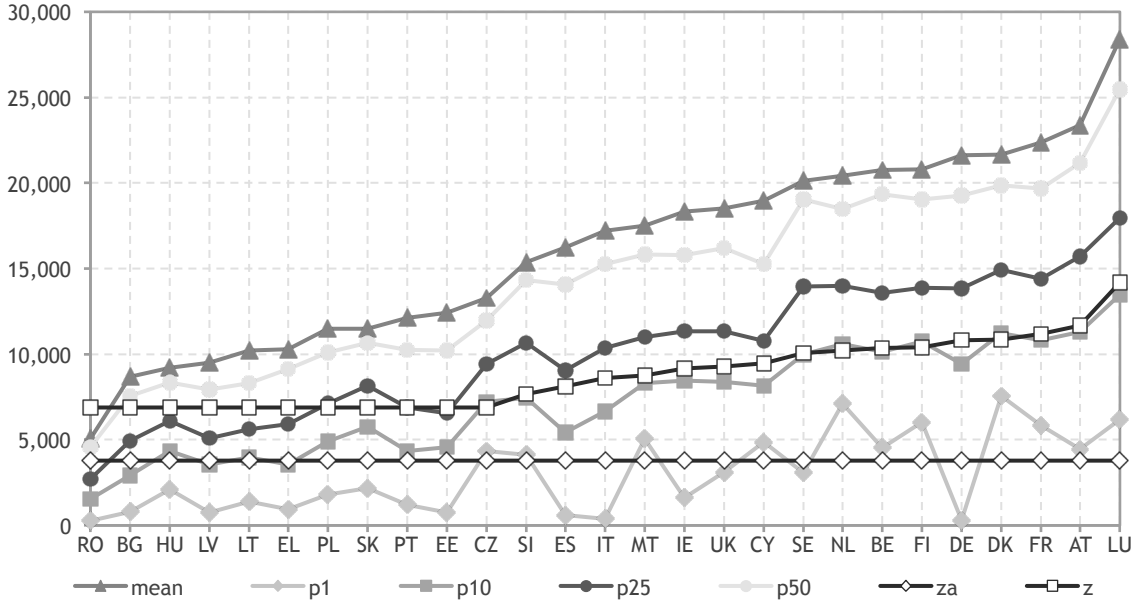

Figure 2: Poverty thresholds and percentiles of the income distribution in EU countries, 2013, Euro-PPPs

4. Results

The results presented in this section are not intended as an overview of the distribution and evolution of poverty in the EU, but rather as an illustration of how the results obtained with the poverty measure we propose (PGR-PAN) differ from those of the AROP and other existing poverty measures. In particular, we show to what extent our measure, unlike the AROP, is sensitive to differences and changes in standards of living. In the first subsection below we look at the correlations across EU countries in 2013 of the AROP and the PGR-PAN with the average standard of living. In the second subsection we compare the level and evolution of the AROP, and the PGR-PAN for three broad groups of EU countries. In the third subsection, we focus on comparisons of the level of poverty between sets of particular countries. In the fourth subsection we look at the contrasting cases of Greece and Poland, and argue that the AROP masks the very different poverty evolutions within those countries, while the PGR-PAN brings these out much more adequately. Results obtained with the low

set of income thresholds are shown in Appendix 2. They generally follow the same pattern, though sometimes less pronounced.

4.1 Poverty in 2013: overview

Figure 3 shows the large differences in standards of living existing between the EU countries in 2013[13] (the last year for which we have data), gathered in three groups: the rich countries of Northwestern Europe (AT, BE, DE, DK, FI, FR, IE, LU, NL, SE and UK), the Southern European countries (CY, EL, ES, IT, MT, PT, SI) and the Eastern European countries (BG, CZ, EE, HU, LV, LT, PL, RO, SK). Recall that we use mean PPP-corrected equivalent household income as our measure of the national standard of living. In general the countries of Northwestern Europe are characterized by the highest standard of living, and low or moderate inequality. South-European countries have a lower standard of living, and rather unequal income distributions (with the exceptions of Malta and Slovenia). In Eastern Europe, the average standard of living is less than half of that in Northwestern Europe, although there is some overlap with Southern Europe, especially due to the precipitate drop of income in Greece. Most countries in this region of Europe have high income inequality, but the Czech Republic, Slovakia and Hungary belong to the countries with the lowest Gini coefficients.

[13] Using EU-SILC 2014 data, in which incomes refer to the year 2013 (except for the UK and Ireland).

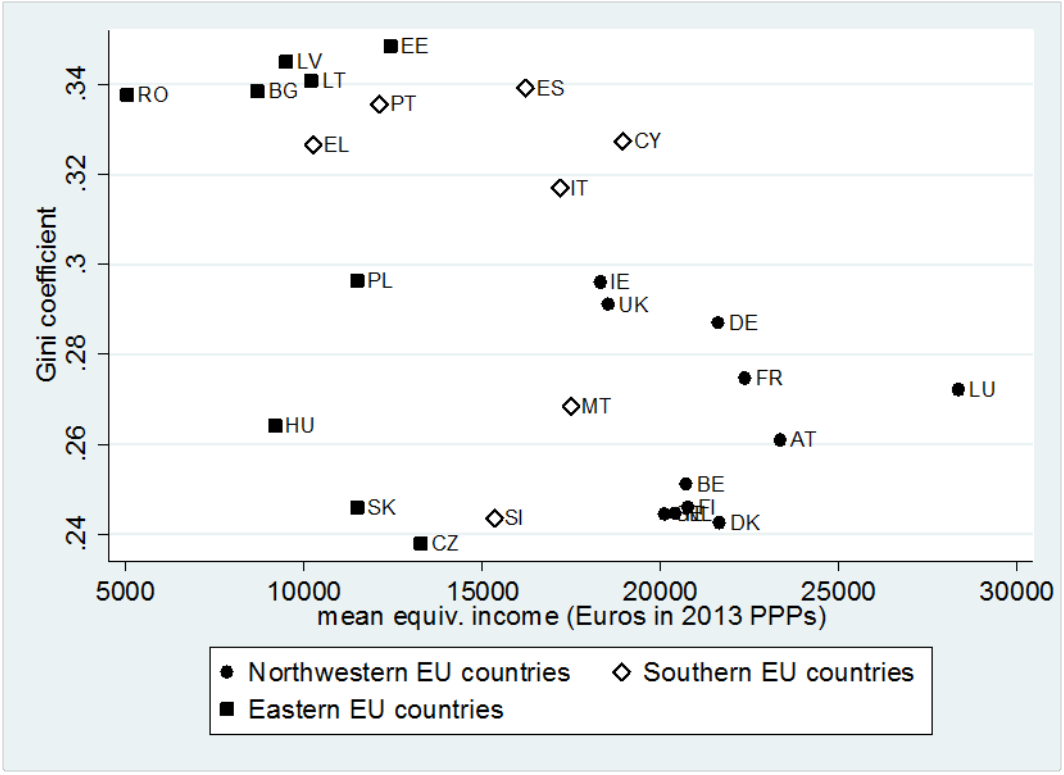

Figure 3: Cross-country comparisons of mean incomes and Gini coefficients. in 2013

Source: EU-SILC 2014 UDB, own calculations.

The left panel of Figure 4 shows that the EU at-risk-poverty-rate (AROP) is across countries only moderately related to the average standard of living. The AROP headcount ranges between 10% in the Czech Republic and 25% in Romania. The AROP of the rich EU countries is higher than that of several "poor" but equal EU countries. In fact, the AROP is very strongly related to the degree of income inequality, and much of the apparent correlation between the AROP and mean equivalent income is due to the negative relation existing in the EU context between the Gini and mean income, as shown in Figure 3. By contrast, PGR-PAN decreases very strongly with the standard of living among the EU countries with relatively low to moderate mean income and ranges between 0.11 in The Netherlands and 0.36 in Romania. Note for instance that the AROP of Hungary and Slovakia is lower than that of Germany and the UK, while the opposite is true for our new measure. At the same time, the indicator that we propose is not just a measure of absolute differences in average living

standards: mean income is a good, but certainly not a perfect predictor of the PGR-PAN. Among the high-income countries, where there are few people below the fixed pan-European line, PGR-PAN is more strongly correlated with income inequality than with mean income. For instance, due to its low income inequality, the Czech Republic has about the same score on our measure as Luxembourg, despite the enormous difference in average income.

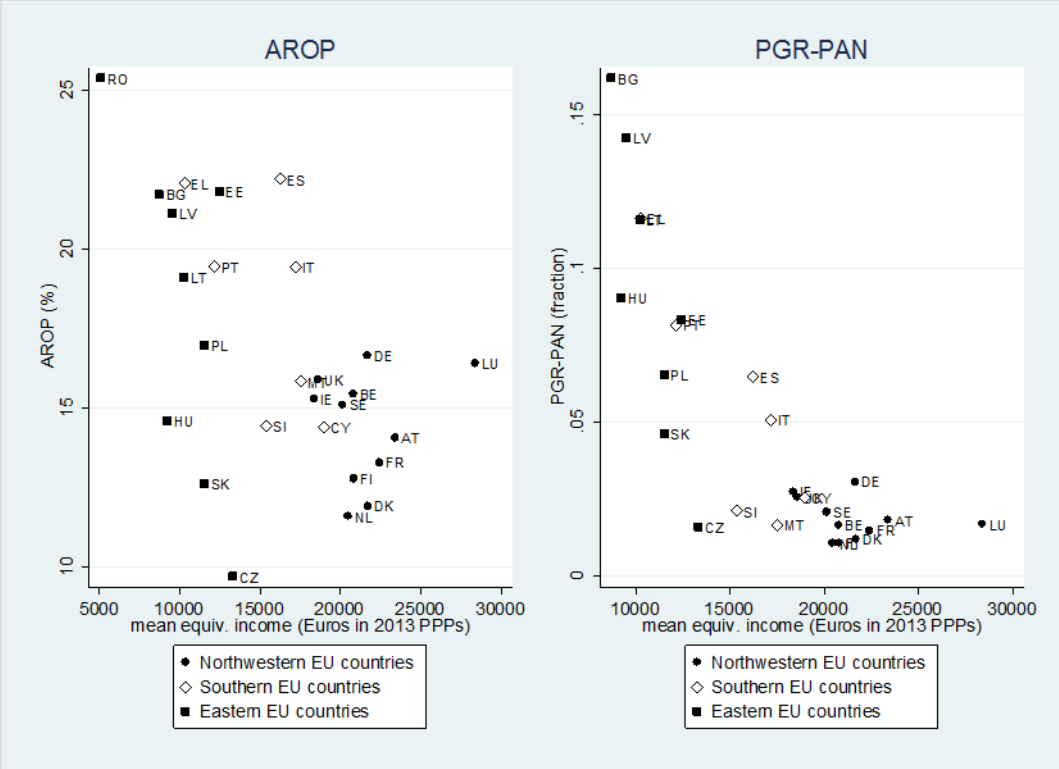

Figure 4: Cross-country comparisons of mean incomes vs AROP and PGR-PAN in 2013.

Note: In the right graph, RO is off the chart (its value for PGR-PAN is 0.36)

Source: EU-SILC 2014 UDB, own calculations.

3.2 Differences at the aggregated level

For a general overview of the results we aggregate all results across the three country groups distinguished above for the last year for which we have data, 2013. For both lines, we pay attention to the poverty gap ratio (PGR). We do this in order to provide more insight into the difference between AROP and the PGR-PAN, given that the former is a headcount measure, whereas our proposed indicator is a version of the poverty gap ratio.

The incidence of poverty is lower in Eastern Europe than in Southern Europe according to AROP (and also according to AROP_PGR) but the reverse is true for all other measures. However, the magnitudes of the reverses differ considerably. For example, the AROP of the Northwestern countries amounts to 73% of that of the Southern countries, while the poverty gap ratio below the hybrid line (Hyb_PGR) of the first group is equal to 43% of that of the latter. For our new measure PGR-PAN, the ratio is even lower: 36%. Most importantly, while the AROP of the Eastern countries is lower than that of the Southern countries, and not much higher than that of Northwestern Europe, using Hyb_PGR suggests that poverty is much more prevalent in Eastern Europe than in other European regions. The contrast is even stronger when adopting our new measure PGR-PAN. These differences imply a substantially different distribution of the European population hit by poverty.

Table 1: Poverty comparisons by country group in 2013.

Country Group	Population (millions)	Mean income[1]	AROP	AROP_PGR	Hyb_PGR	PGR-PAN
Europe	496	1.00	1.00	1.00	1.00	1.00
Northwestern	267	1.20	0.88	0.74	0.50	0.41
Southern	131	0.91	1.20	1.44	1.16	1.13
Eastern	98	0.56	1.06	1.11	2.15	2.44

Note: Mean income and poverty indicators are given as proportion of the European value. Countries weighted by population. [1]Income is equivalent income in 2013 Euro-PPPs

Source: EU-SILC 2014 UDB, own calculations.

In Table 2 we show what happened over time within these country groups between 2007 and 2013. While overall in Europe average income declined in real terms, this decline was much stronger in Southern Europe than elsewhere, while Eastern Europe still enjoyed a substantial rise in the average standard of living. Despite this income increase, AROP rose in this country group, as was the case, unsurprisingly, in Southern Europe. By contrast, Hyb_PGR and PGR-PAN suggest that the extent of poverty has substantially declined in Eastern Europe. For the Southern European countries, the

increase in poverty indicated by Hyb_PGR is much larger than that in the AROP, while the rise in our new measure PGR-PAN is even bigger. The reason for the latter difference is that the rise in pan-European poverty (income below the fixed threshold z_a) in some Southern European countries gets more weight in our new measure than in the Hyb_PGR.

Table 2: Evolution of poverty over time across groups (2007-2013)

Country Group	Mean income[1]	Gini	AROP	AROP_PGR	Hyb_PGR	PGR-PAN
Europe	0.96	1.01	1.03	1.15	1.03	1.04
Northwestern	0.97	0.99	1.01	1.07	1.04	1.06
Southern	0.89	1.06	1.06	1.27	1.42	1.54
Eastern	1.09	0.99	1.04	1.14	0.88	0.88

Note: all figures are value in 2013 divided by their value in 2007. Countries weighted by population.

[1]Income is equivalent income in 2013 Euro-PPPs

Source: EU-SILC 2014 UDB, own calculations.

3.3 Reversals in poverty rankings between countries

On the country level, the differences between the various poverty measures are often more glaring. In Table 3 we single out three interesting comparisons, each of which features high-income high-inequality countries and and low-income low-inequality countries. The first part compares Spain and Portugal with Poland, the second part compares the UK, Ireland, Germany and Slovakia and the last part compares France, the Netherlands and Luxembourg with the Czech Republic. The figures are mean values over the period 2008-2013, to make sure that these comparisons do not rely on a particular year, and to remove small variations which render the comparisons more confusing.

Panel 1 of Table 3 shows that Poland has a lower mean income than Spain and Portugal, but also less income inequality (Gini). The AROP is higher in Spain and Portugal than in Poland, corresponding to the higher Gini. Yet, their higher standards of living imply that both Spain and Portugal have lower values on PGR-PAN than Poland. While the AROP of Spain is 24% larger than that of Poland, the score of Spain on PGR-PAN is 13% lower than that of Poland. Note that the Hyb_PGR is higher in Spain than in Poland. This is because Hyb_PGR implicitly considers that an individual living at the threshold for pan-European poverty (3,766 Euro-PPPs, the minimal amount to cover food, clothing and housing) contributes more to the poverty index (i.e. is deeper in poverty) if he lives in Spain than if he lives in Poland. To put it differently, Hyb_PGR implicitly considers that an individual with an income of 3,766 Euro-PPPs in Poland contributes as much to poverty as an individual with an income of 4,931 Euro-PPPs in Spain. By contrast, our new measure PGR-PAN considers that an individual with an income of 3,766 Euro-PPPs in Poland contributes equally to the overall extent of poverty as an individual with the same income in Spain. Panel 2 of Table 3 shows that Slovakia has a lower mean income than the UK, Ireland and Italy, and at the same time less income inequality (Gini). In a similar way as is the case for the comparison between Poland, Spain and Portugal, the PGR-PAN leads to different conclusions as compared to AROP.[14]

As can be expected from the definition of PGR-PAN, the difference between PGR-PAN and Hyb_PGR increases as the average income of a country is higher. Below the "kink", where the hybrid line z is fixed at z_0, there is no difference between PGR-PAN and Hyb_PGR. The same general conclusions can be drawn when comparing the Czech Republic on the one hand and France, the Netherlands and Luxembourg on the other (third panel of Table 3). Note that all measures used are in agreement that the extent of poverty is higher in Luxembourg than in the Netherlands, despite the much higher average income of the former country. For comparisons between countries with high average incomes (far above the "kink"), relative poverty is much more important than absolute pan-

[14] For this particular comparison, Hyb_PGR leads to the same ranking of countries as PGR-PAN (though the difference between Slovakia and the UK on Hyb_PGR) is marginal.

European poverty, and so the results of PGR-PAN (as well as Hyb_PGR) are more closely correlated with income inequality.

Table 3: Poverty comparisons across countries (average over the period 2008 - 2013)

Country	Mean income[1]	Gini	AROP	AROP_PGR	Hyb_PGR	PGR-PAN
ES	16,203	0.333	21.42	8.12	7.59	6.44
PT	13,084	0.332	18.32	5.22	6.13	6.11
PL	11,145	0.297	17.29	4.52	7.11	7.11
UK	19,350	0.307	16.88	4.42	4.18	3.09
IE	18,796	0.289	15.09	3.74	3.35	2.54
DE	21,940	0.276	15.98	3.95	3.26	2.24
SK	11,586	0.243	12.44	3.44	4.20	4.20
FR	22,703	0.281	13.55	2.78	2.45	1.66
NL	21,297	0.243	10.74	2.02	1.48	1.03
CZ	13,421	0.236	9.21	1.90	1.60	1.60
LU	28,957	0.271	15.06	3.07	2.41	1.48

Note: [1]Income is equivalent income in 2013 Euro-PPPs

Source: EU-SILC 2014 UDB, own calculations.

3.4 Evolution over time in countries with considerable changes in living standards

To show how our new poverty measure PGR-PAN behaves when assessing the evolution of poverty within a single country, the contrasting cases of Greece and Poland are very instructive. In Greece, average income started falling after 2009, by 2013, it had fallen by more than 30% (Figure 5). This decrease in standards of living only translates in a rather moderate increase in the AROP of 10 to 20%. By contrast, PGR-PAN increases by more than 150%, while Hyb_PGR increases by about 100%, substantially less than PGR-PAN. The low set of thresholds produces the same pattern, except that the difference between PGR-PAN and Hyb-PGR is much larger.

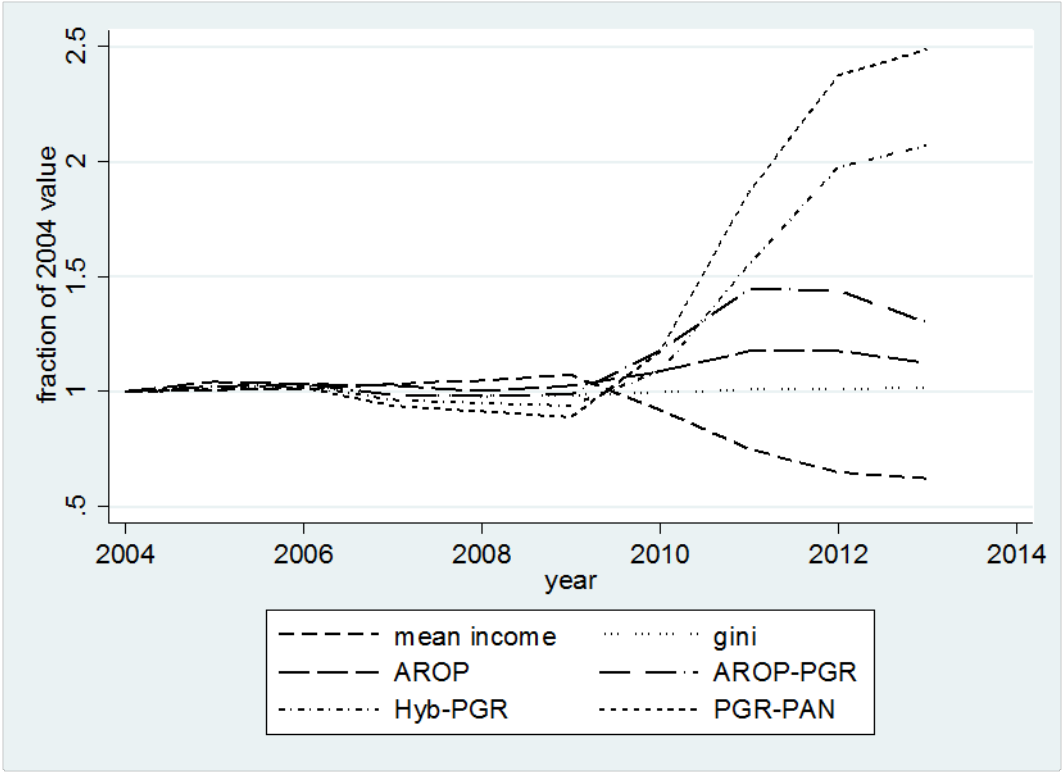

Figure 5: Comparison of evolution over time of different poverty measures for Greece.

Note: All measures are given as a fraction of their 2004 value.

Source: EU-SILC UDB 2005-2014, own calculations.

The results for Greece illustrate well how our measure PGR-PAN may be decomposed between the contributions of pan-European and relatively poor individuals. Even if pan-European poor individuals (using the fixed poverty threshold) constitute a bit less than half of the poor individuals in 2013 (Figure 6, left panel), they contribute more than 2/3 of the score on PGR-PAN (Figure 6, right panel), as they are deeper in poverty and, hence, their well-being is lower than that of relatively poor individuals. The large increase in the value of PGR-PAN for Greece between 2009 and 2013 can be attributed for 74 percent to an increase in the contributions of pan-European poor persons. After 2011, the mean income in Greece falls below the "kink" and therefore the hybrid threshold does not decrease anymore, as shown in Figure 6, left panel.

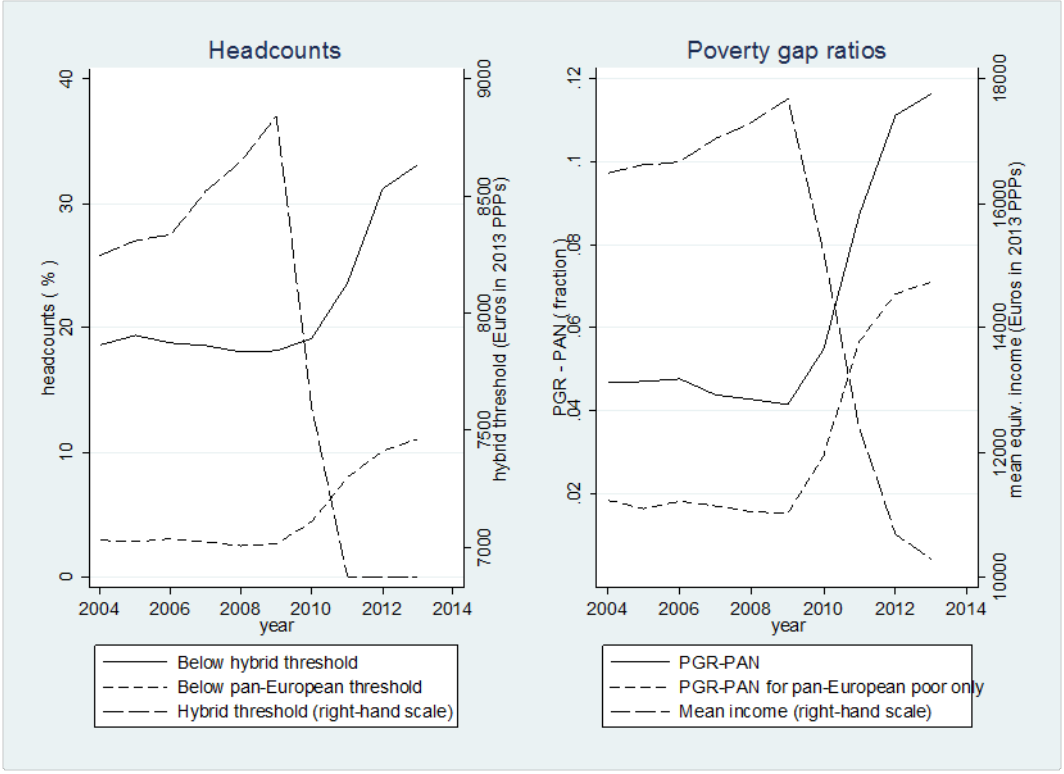

Figure 6: Evolution over time of the poverty headcount (left) and PGR-PAN (right) in Greece

Source: EU-SILC UDB 2005-2014, own calculations.

In sharp contrast to what happened in Greece, in Poland between 2004 and 2013 mean income rose by more than 40% (Figure 7). This increase in standards of living is accompanied by a moderate decrease of about 15 percent in the AROP headcount, and a larger one of about 35 percent in AROP-PGR. In contrast, our new poverty measure PGR-PAN decreases by more than 60 %. In this case, Hyb_PGR is always equal to PGR-PAN, as 50 per cent of mean income is below the "kink". The steep fall in poverty is mostly due to the large decrease in the contribution of individuals with an income below the fixed threshold, even if relatively poor persons also contribute less in 2013 than in 2004, as can be observed from Figure 8.

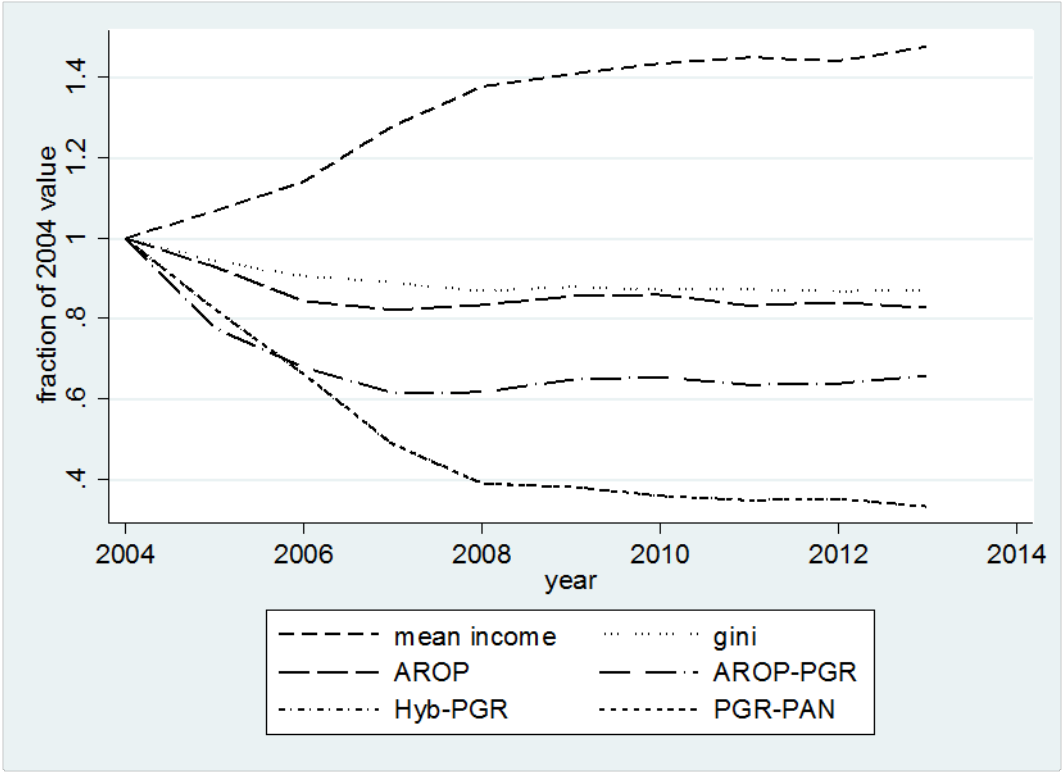

Figure 7: Comparison of evolution over time of different poverty measures for Poland.

Note: All measures are given as a fraction of their 2004 value. Values of Hyb-PGR and PGR-PAN are the same for all years.

Source: EU-SILC UDB 2005-2014, own calculations.

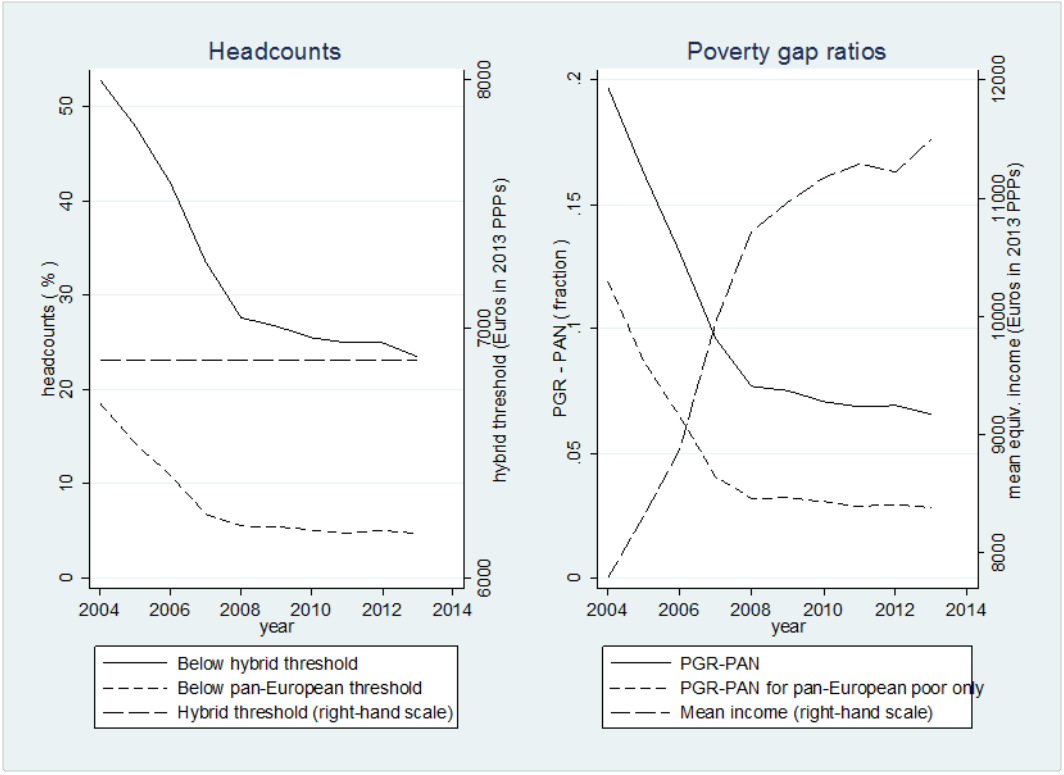

Figure 8: Evolution over time of the poverty headcount (left) and PGR-PAN for Poland

Source: EU-SILC UDB 2005-2014, own calculations.

5. Summary and conclusion

Currently, the at-risk-of-poverty indicator, using a poverty line set at 60 per cent of median income within each country and for each year, is the headline poverty indicator in the European Union for income poverty. It is generally recognised that this indicator leads sometimes to counterintuitive findings, in particular in times of quickly changing median incomes, or when comparing rich and poor countries. As a result, the EU uses a set of indicators of poverty and social exclusion, some of which keep the poverty threshold constant across time or use the same threshold across countries. We contend that presenting several measures of poverty side by side provides a more complete picture of the extent and distribution of poverty in the EU, but at the price of certain loss of clearness. Often, different indicators bring a quite different message.

Therefore, in this article we proposed and illustrated an alternative indicator which accommodates in a more consistent way concerns about changes in living standards across time and place, while paying specific attention to those confronted with more severe forms of poverty. The new measure uses a set of two lines. The first, pan-European, line is fixed across time and space at a level that is low in the context of the European Union. The second, hybrid, line is set at 50 percent of average income above a certain level, and has a fixed value below that level. We combine these two lines with an index proposed by Decerf (2015), which has the unique feature that it accounts for both pan-European and relative poverty while always considering that an individual who is poor from a pan-European perspective is poorer than another individual who is only relatively poor. This indicator is restricted to the income space, making interpretation of trends much more straightforward and consistent, as we have tried to show. Given that our proposed indicator is able to show at once the importance of changes in living standards over time and differences in cross-national living standards, we believe that, as a measure of poverty, it is superior to a proposed alternative indicator where the threshold is set at a percentage of the pan-European median income (e.g. Brandolini, 2007; Eurostat, 1990; Goedemé and Collado, 2016)[15]. We do not claim that this poverty indicator should replace any of the already existing indicators, but contend that it is a very valuable addition to the current set of indicators, especially for researchers and policy makers who care about changes and differences in living standards across time and place, while not ignoring the relativity of living conditions.

We applied this new measure – called Poverty Gap Ratio with Priority to the pan-European poor (PGR-PAN) – to the EU-SILC data, using purchasing power parities to bring all incomes to the same footing, and reference budgets to set the value of the fixed poverty thresholds. This leads to substantively different findings regarding the distribution and evolution of poverty across and within the countries of the European Union, compared to the AROP. Across EU countries, the AROP is moderately related to the average standards of living, but is strongly correlated with income inequality measured by the Gini coefficient. By contrast, PGR-PAN decreases strongly with increasing average

[15] For other purposes an indicator of material deprivation or an income poverty indicator with a pan-European poverty threshold may still be preferable.

income, especially among EU countries with relatively low or moderate income; it is affected by income inequality mainly in countries with a relatively high standard of living. As a result of these characteristics of the poverty measures, when comparing groups of EU countries in 2013, the AROP in the Eastern countries is lower than that of the Southern countries, even though average income in the former group is much below that of the latter. Also, the AROP in Eastern Europe is not much higher than that of the rich countries of Northwestern Europe. By contrast, PGR-PAN suggests that poverty is much more prevalent in Eastern Europe than in the other European regions. When looking at what happened over time between 2008 and 2013 within these country groups, it turns out that AROP rose slightly in Eastern Europe, even though this region enjoyed a substantial rise in the average standard of living. By contrast, again, PGR-PAN indicates that the extent of poverty had declined by about 12 per cent in Eastern Europe.

On the country level, the differences between the various poverty measures are often even more glaring. We highlighted three contrasting cases of countries with high versus low average income, where AROP in the richer country or countries exceeds that in the poorer countries. Each time, application of PGR-PAN leads to findings that are the direct opposite of those with AROP. Also instructive are the contrasting cases of Greece and Poland. In Greece, even though average income had fallen by more than 30 percent between 2009 and 2013, the AROP registered only a moderate increase. By contrast, PGR-PAN rises by more than 150 per cent, which is mainly due to an increase in the number of persons below the pan-European poverty threshold. Poland shows the opposite evolution: average income rose by more than 40 percent between 2004 and 2013, but this is accompanied by only a moderate decrease of the AROP. PGR-PAN drops by more than 60 per cent, mostly because in 2013 there are far fewer persons below the pan-European threshold than in 2004.

Of course, the new measure of poverty also has limitations. One difficulty is that it can only be applied if incomes from all countries are transformed into the same currency. For this purpose there is no alternative than to use Purchasing Power Parities, even though the basket of goods and services on which these are based may be more representative for some countries than for others, and may not adequately reflect consumption patterns of low-income households. The biggest challenge associated

to the use of PGR-PAN is that there is no turnkey procedure to choose or to set the poverty thresholds. To a great extent, this is a matter of judgment. Of course, any measure based on a poverty threshold is faced with these limitations, but the number of reasonable choices is more limited for poverty lines set at a proportion of median or mean income. In order to overcome this difficulty, we have used reference budgets, which are based on a well-specified basket of goods and services, providing a substantive foundation and meaning to the level of the thresholds. However, at the moment complete and comparable reference budgets are available only for a limited set of countries. Also, we used the budgets for a single person, and subsequently applied the modified OECD scale, ignoring possible differences in economies of scale across countries, as is common practice for AROP. A sensitivity test shows that with a lower set of thresholds, largely similar conclusions can be drawn. Further work should show how sensitive the results of PGR-PAN are to other valid choices. Irrespective of the exact choices made, though, we are strongly convinced that the new measure will be a valuable addition to the toolbox of researchers studying poverty in Europe.

6. Acknowledgement

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Appendix 1

Table A1.1: Cross-country poverty comparisons in 2013.

Group*	Country	Population (million s)	Mean	Gini	AROP	AROP_PGR	Hyb_PGR	PGR-PAN
NW	AT	8.3	23,371	0.26	14.10	3.46	2.75	1.84
NW	BE	10.8	20,745	0.25	15.46	3.43	2.36	1.68
NW	DE	80.8	21,631	0.29	16.67	5.08	4.46	3.09
NW	DK	5.5	21,678	0.24	11.95	2.50	1.77	1.22
NW	FI	5.3	20,785	0.25	12.82	2.30	1.54	1.09
NW	FR	61.4	22,385	0.27	13.32	2.68	2.22	1.51
NW	IE	4.5	18,325	0.30	15.32	3.88	3.60	2.76
NW	LU	0.5	28,375	0.27	16.45	3.53	2.78	1.71
NW	NL	16.5	20,421	0.24	11.62	2.14	1.52	1.09
NW	SE	9.5	20,124	0.24	15.14	4.00	2.93	2.12
NW	UK	61.4	18,537	0.29	15.92	3.83	3.40	2.59
S	CY	0.8	18,961	0.33	14.42	2.93	3.43	2.57
S	EL	11.0	10,275	0.33	22.10	7.61	11.65	11.65
S	ES	46.2	16,232	0.34	22.23	8.14	7.70	6.50
S	IT	60.7	17,199	0.32	19.45	6.95	6.33	5.09
S	MT	0.4	17,505	0.27	15.85	2.93	2.11	1.67
S	PT	10.6	12,126	0.34	19.47	6.42	8.17	8.17
S	SI	2.0	15,364	0.24	14.46	3.41	2.39	2.12
E	BG	7.5	8,700	0.34	21.75	7.72	16.20	16.20
E	CZ	10.4	13,297	0.24	9.72	1.87	1.61	1.61
E	EE	1.3	12,432	0.35	21.83	6.31	8.36	8.36

Group*	Country	Population (million s)	Mean	Gini	AROP	AROP_PGR	Hyb_PGR	PGR-PAN
E	HU	9.9	9,196	0.26	14.62	3.56	9.06	9.06
E	LT	3.1	10,211	0.34	19.14	5.34	11.58	11.58
E	LV	2.0	9,506	0.35	21.16	6.42	14.26	14.26
E	PL	37.5	11,496	0.30	16.99	4.63	6.56	6.56
E	RO	21.4	5,060	0.34	25.41	9.66	35.62	35.62
E	SK	5.4	11,500	0.25	12.64	3.89	4.64	4.64

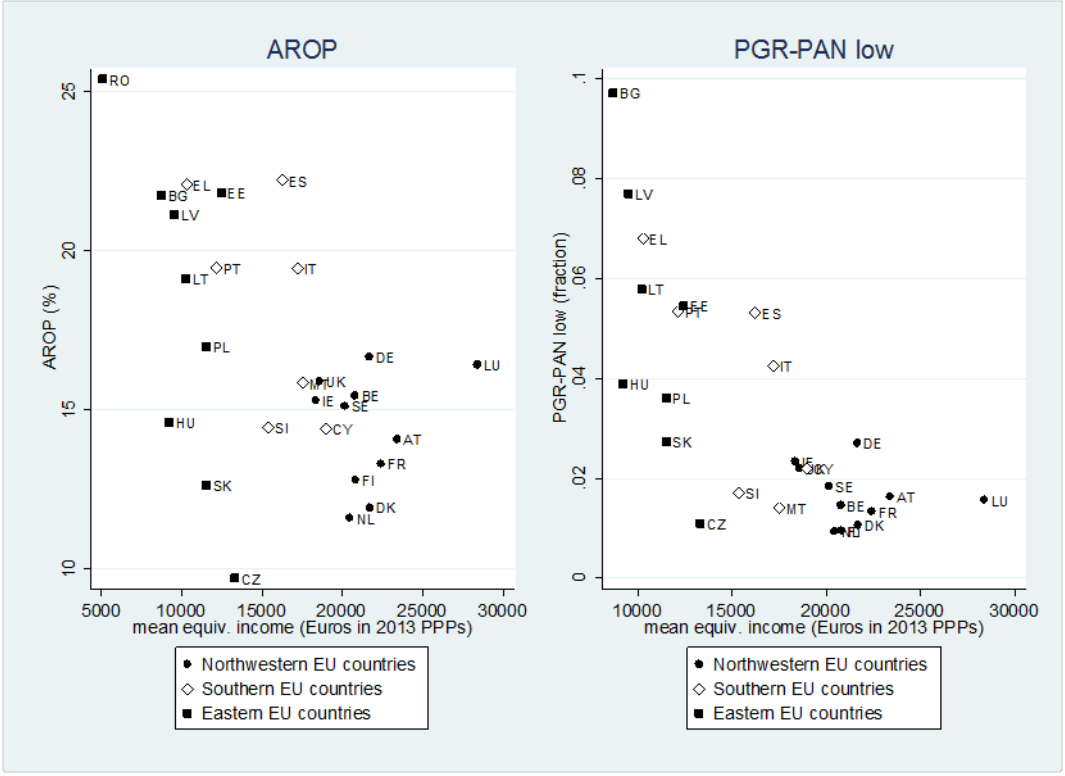
Source: EU-SILC UDB 2005-2014, own calculations.

Note: * NW: Northwestern, S: Southern, E: Eastern.

Appendix 2: Results with the low set of lines

As a sensitivity test, we also applied a set of lines z_a^{low} and z_0^{low} that were much lower than the set z_a and z_0 presented above. For this low set of lies, the average at-risk-of-poverty line (set at 60 percent of median equivalent income) for Bulgaria and Romania in the year when they entered the EU, 2007, was used as the value of z_a^{low}. The motivation for this choice is that this is the lowest level of a poverty threshold ever used in the EU context. The value for z_0^{low} was derived from this by dividing z_a^{low} with the ratio z_a/ z_0 obtained for the high set of thresholds. As a result, the ratios z_a/ z_0 and z_a^{low}/ z_0^{low} have the same value, meaning that PGR-PAN and PGR-PAN-low attribute the same weight to earning their pan_European threshold, z_a and z_a^{low} respectively. The low set z_a^{low} and z_0^{low} in 2013 values are 2,805 Euro-PPPs and 4,608 Euro-PPPs respectively, and are applied both to PGR-PAN and Hyb-PGR. We show results for the low set of lines together with those for the high set. For ease of reference, figures and tables have the same number as the corresponding ones in the main text.

Figure A2.4: Cross-country comparisons of mean incomes vs AROP and PGR-PAN-low in 2013.



Note: In the right graph, RO is off the chart (its value for PGR-PAN-low is 0.24)

Source: EU-SILC 2014 UDB, own calculations.

Table A2.1: Poverty comparisons by country group in 2013.

Country Group	AROP	AROP_PGR	Hyb_PGR	PGR-PAN	Hyb_PGR-low	PGR-PAN-low
Europe	1	1	1	1	1	1
Western	0.88	0.74	0.50	0.41	0.61	0.49
Southern	1.20	1.44	1.16	1.13	1.30	1.21
Eastern	1.06	1.11	2.15	2.44	1.67	2.11

Note: Poverty indicators are given as proportion of the European value. Countries weighted by population.

(1) Income is equivalent income in 2013 Euro-PPPs

Source: EU-SILC 2014 UDB, own calculations.

Table A2.2: Evolution of poverty over time across groups

Country Group	AROP	AROP_PGR	Hyb_PGR	PGR-PAN	Hyb_PGR-low	PGR-PAN-low
Europe	1.03	1.15	1.03	1.04	1.07	1.07
Western	1.01	1.07	1.04	1.06	1.04	1.05
Southern	1.06	1.27	1.42	1.54	1.32	1.42
Eastern	1.04	1.14	0.88	0.88	0.94	0.92

Note: all figures are value in 2013 divided by their value in 2007. Countries weighted by population.

Note: (1) Income is equivalent income in 2013 Euro-PPPs

Table A3.3: Poverty comparisons across countries (fractions; average over the period 2008 - 2013)

Country	AROP	AROP_PGR	Hyb_PGR	PGR-PAN	Hyb_PGR-low	PGR-PAN-low
ES	0.214	0.081	0.076	0.064	0.076	0.053
PT	0.183	0.052	0.061	0.061	0.054	0.043
PL	0.173	0.045	0.071	0.071	0.040	0.037
UK	0.169	0.044	0.042	0.031	0.042	0.027
IE	0.151	0.037	0.033	0.025	0.033	0.022
DE	0.160	0.039	0.033	0.022	0.033	0.020
SK	0.124	0.034	0.042	0.042	0.027	0.024
FR	0.136	0.028	0.025	0.017	0.025	0.015
NL	0.107	0.020	0.015	0.010	0.015	0.009
CZ	0.092	0.019	0.016	0.016	0.015	0.011
LU	0.151	0.031	0.024	0.015	0.024	0.014

Source: EU-SILC 2009-2014 UDB, own calculations.

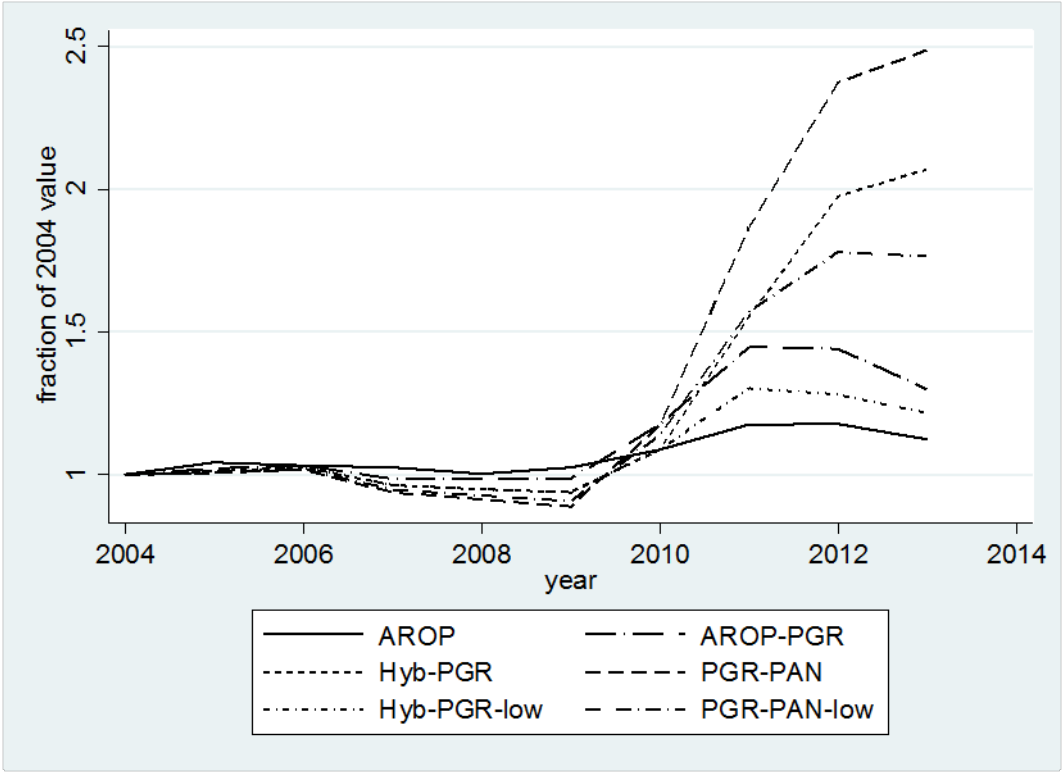


Figure A2.5: Comparison of evolution over time of different poverty measures for Greece.

Note: All measures are given as a fraction of their 2004 value.

Source: EU-SILC UDB 2005-2014, own calculations.

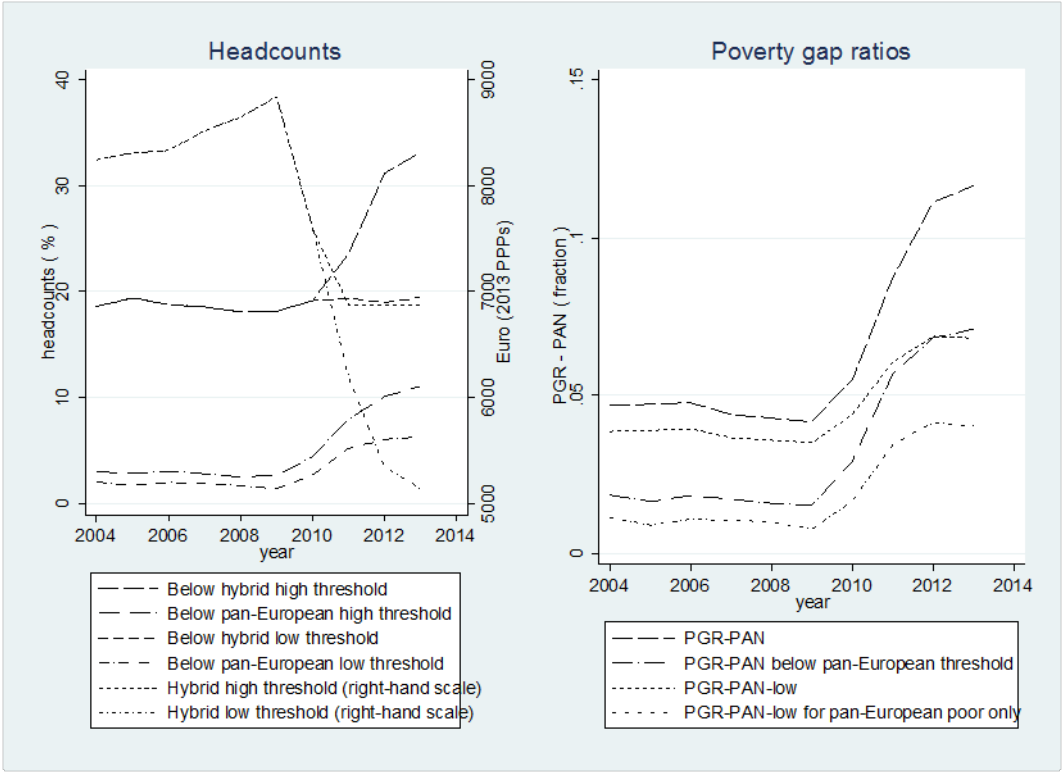


Figure A2.6: Evolution over time of the poverty headcount (left) and PGR-PAN (right) in Greece

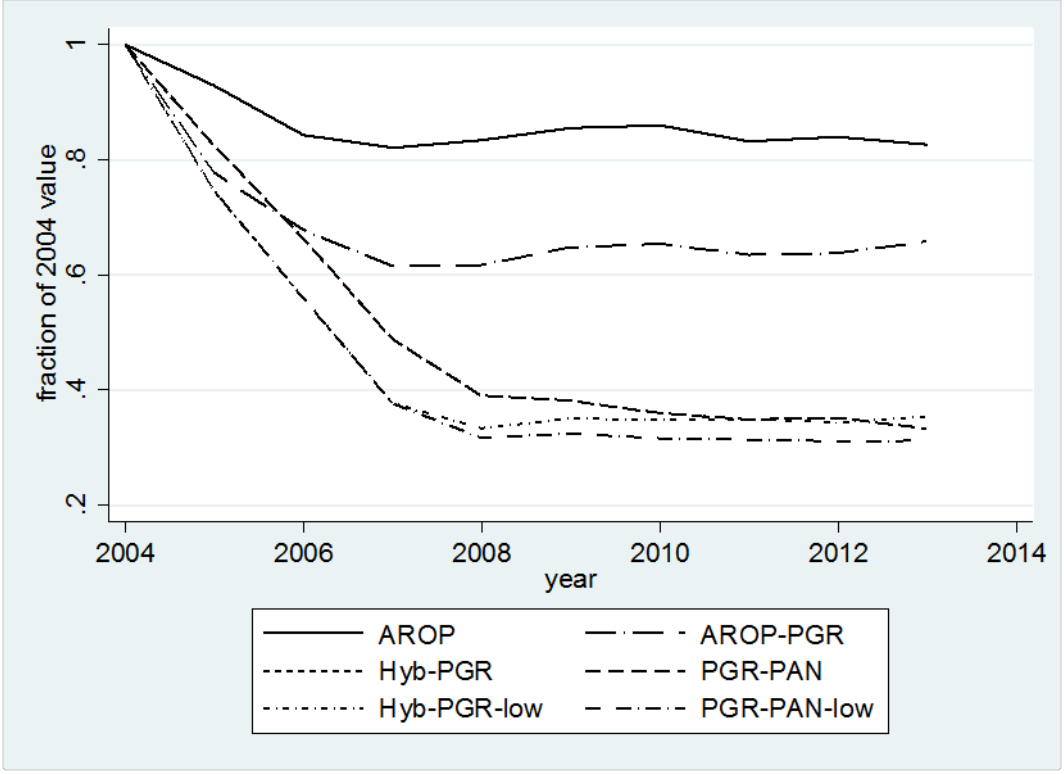


Figure 7: Comparison of evolution over time of different poverty measures for Poland.

Note: All measures are given as a fraction of their 2004 value. Values of Hyb-PGR and PGR-PAN are the same for all years.

Source: EU-SILC UDB 2005-2014, own calculations.

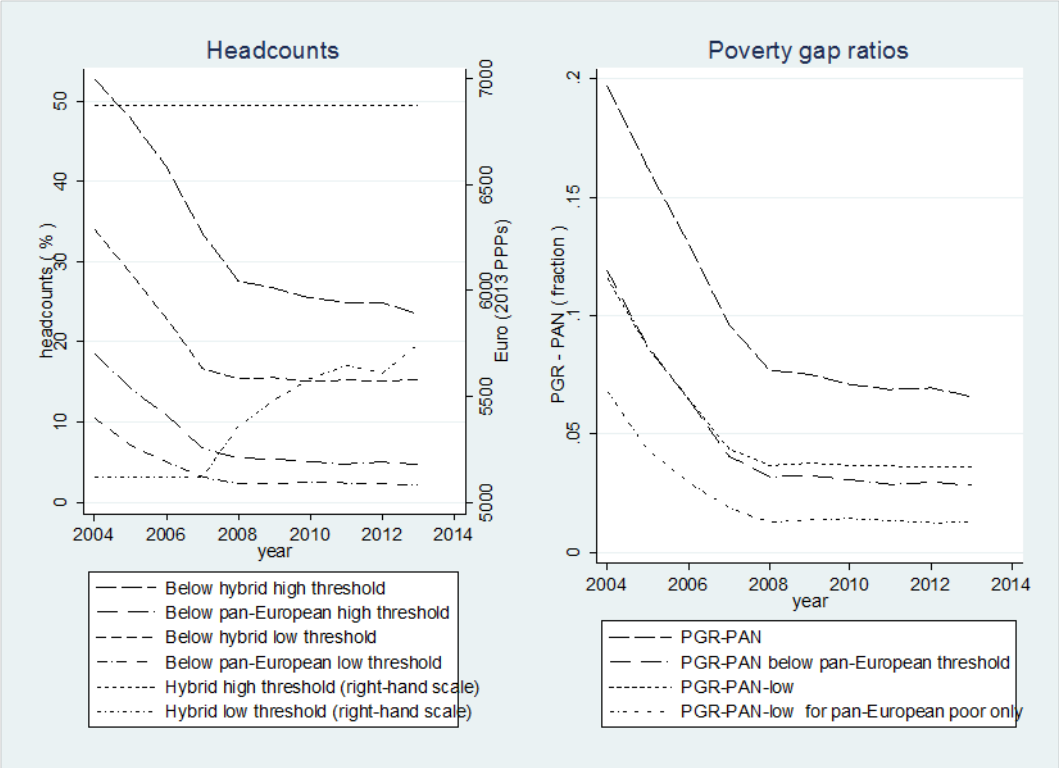


Figure 8: Evolution over time of the poverty headcount (left) and PGR-PAN for PL

Source: EU-SILC UDB 2005-2014, own calculations.