

A new poverty indicator for Europe: the extended headcount ratio

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Abstract

The methodology currently used to measure poverty in the European Union faces some important limitations. Importantly, capturing the major aspects of poverty is done using a dashboard of indicators, which often tell conflicting stories. We propose a new income-based measure of poverty for Europe that captures in a consistent way the level of relative poverty, the intensity of poverty, poverty with a threshold anchored in time and a pan-European perspective of poverty in a single indicator. To do so, we work with a recently developed poverty index, the Extended Headcount ratio (EHC), and derive the relevant poverty lines to apply the index to poverty in Europe. We show empirically that our measure consistently captures the aspects typically monitored using a variety of indicators, and yield rankings that seem more aligned with intuitions than those obtained by these individual indicators. According to our measure, Eastern Europe is much poorer than Southern Europe, which, in turn, is much poorer than North-Western Europe. The evolution of our measure over time correlates most strongly with the at-risk-of-poverty rate in North-Western Europe and correlates most strongly with at-risk-of-poverty with the threshold anchored in time in Southern and Eastern Europe.

Keywords

Poverty, Europe, at-risk-of-poverty, Europe 2020 poverty reduction target, extended headcount ratio, social indicators, EU-SILC

1 Introduction

Not only do economic crises lead to increases in poverty, they also, at least in the European Union (EU), often result in new debates about how to monitor poverty. These recurring debates are primarily the result of the difficulty to come up with a comparable poverty measure when living conditions differ so strongly across countries (e.g. Beblavy and Mizsei, 2006; Fahey, 2007; Whelan and Maître, 2010a) or change very quickly over time (e.g. Whelan and Maître, 2010b). The solution adopted by the EU is to use a dashboard of social indicators to monitor

poverty (Atkinson et al., 2002; Marlier et al., 2007), which usefully captures various perspectives. This allows for a nuanced view on reality, but has as a downside that indicators regularly contradict one another with regard to patterns across countries, and trends within countries over time. Furthermore, the list of indicators to keep an eye on is fairly large, if one wants to fully grasp the situation. For these reasons, others have proposed to combine indicators, for instance in measures of ‘consistent poverty’ that combine income indicators with indicators of material deprivation (e.g. Nolan and Whelan, 2011). However, given that poverty policies mainly work through increasing and redistributing incomes, these indicators may be less helpful for guiding concrete policies and ex-ante policy evaluations. Therefore, in this paper, we propose a new indicator of poverty, which in spirit and design stays close to existing income-based indicators of poverty used by the EU, but which captures the situation in a consistent way in a single number, for which otherwise at least four other dashboard indicators are required. We show its added value compared to current indicators by analysing poverty trends between 2007 and 2017.

In the EU, poverty is defined as “individuals or families whose resources are so small as to exclude them from the minimum acceptable way of life of the member state in which they live” (Council of the European Communities, 1975). To the best of our knowledge, this definition is relatively well accepted within Europe, with rather little conceptual discussion (cf. Goedemé and Rottiers, 2011)¹. The measurement of poverty is a different matter entirely, though, with long-standing academic and political debates. For quite a while, the so-called at-risk-of-poverty indicator (AROP60) has been the main tool to measure poverty in the EU, although with some variations on its implementation (Eurostat, 1990; Atkinson et al., 2002; Eurostat, 2010). Until today, it remains a key component of the EU poverty reduction target as defined by the at-risk-of-poverty or social exclusion indicator (AROPE). The key characteristic of AROP60 is that the level of the poverty threshold is defined as a percentage of the average or (in the EU dashboard) median income in the country in which one lives, and those with an income below the threshold are considered at-risk-of-poverty. Its main strengths are the relative easiness with which it can be implemented in a large number of countries, with a relatively straightforward interpretation as the ‘low-income proportion’.

The principal criticism the indicator has received, refers to its use as an indicator of poverty, as defined above (cf. Jenkins, 2020). For instance, according to the indicator, poverty seems to evolve in counterintuitive ways during periods of strong economic growth – indicating increased poverty levels while the purchasing power of the poor increased (cf. Whelan and Maître, 2010b on Ireland; Nolan and Maître, 2010), as well as during periods of rapid economic decline, when the indicator suggests falling or barely increasing poverty rates, even if the living conditions of the poor have deteriorated in many respects (see for instance Finland in the early 1990s (cf. Halleröd and Heikkilä, 1999, p. 186-88; Ministry of Social Affairs and Health, 1998) and Southern Europe in the wake of the previous financial crisis (e.g. Matsaganis and Leventi, 2014; Cutillo et al., 2020)). Furthermore, the indicator seems to overlook vast cross-country differences in living standards that are relevant for understanding poverty: some of the poorer EU member states appear to have relatively low poverty rates compared to others, although those at the bottom of the income distribution clearly have a much lower purchasing power (e.g. since 2007 Hungary has had a consistently lower poverty rate than Germany, although disposable incomes in the bottom half of the distribution have consistently been considerably

¹ As argued by Goedemé and Rottiers (2011) and Yamamori (2019) conceptual discussions are often rooted in misinterpretations of the debate between Amartya Sen (1983, 1985) and Peter Townsend (1985), which in important respects had more to do with mutual misunderstandings (primarily on the part of Peter Townsend) than fundamental conceptual disagreements. For an alternative view, see Hick (2014).

higher in Germany compared to Hungary in terms of purchasing power)². As a result, the at-risk-of-poverty threshold has been criticized for not representing very well the minimum acceptable living standard across countries (e.g. Goedemé et al., 2019), and especially for being too low in the poorest EU Member States³, as well as for being relativistic, dismissing too quickly that it is also relevant to directly compare living standards of European citizens at the bottom of the distribution across countries (Fahey, 2007; Brandolini, 2007).

The dashboard of indicators that the EU currently uses, includes indicators which help to overcome these shortcomings. However, these indicators sometimes tell conflicting stories about the poverty situation across the EU, making it hard to make an integrated assessment of the distribution of poverty in the EU. Therefore, we propose a new income measure of poverty, building on the extended headcount ratio (EHC) developed by Decerf and Ferrando (2020).

In our view, the indicator that we propose overcomes the aforementioned criticisms in a coherent way, while staying as close as possible to the indicators that are currently used in the EU to monitor poverty. Furthermore, our indicator helps to grasp a number of intuitions about poverty that are currently captured by looking at four indicators separately: (1) The understanding that one's risk of being poor is in some circumstances affected by one's *relative* position in the income distribution – currently captured by the at-risk-of-poverty indicator; (2) The notion that the level of the poverty threshold in real terms is essential contextual information for comparing one country to the next – currently captured by expressing the at-risk-of-poverty threshold in purchasing power standards (PPS, an international currency which allows to directly compare the amount of goods and services that can be bought at the level of the threshold)⁴; (3) The notion that when the median income increases or falls relatively quickly, it is relevant to assess poverty with the same poverty threshold – in constant prices – for several years in a row – currently captured by the 'at-risk-of-poverty indicator with the poverty threshold anchored at a fixed moment in time'; (4) The notion that the severity of poverty matters: having an income further below the poverty line is a worse condition compared to having an income closer to the poverty line – currently monitored by the median at-risk-of-poverty gap. Furthermore, our proposed measure of poverty also ties in with the conceptual notion of an "irreducible core of absolute deprivation" (Sen, 1981, p. 17) that is inherent to the poverty concept (for a discussion, see, for instance, Goedemé and Rottiers (2011)). In addition, the indicator we propose ties in with Atkinson et al. (2017)'s suggestion that the EU should include indicators of extreme poverty and real income growth at the bottom of the income distribution, which the European Commission is currently investigating with regard to the development of an 'absolute' poverty indicator (Cutillo et al., 2020). To do so, our indicator includes a benchmark that is the same for all EU citizens, which also responds to the need to include a pan-European perspective on poverty, as has been voiced by some authors for sociological, political and policy reasons (e.g. Fahey, 2007; Brandolini and Rosolia, 2019; Brandolini, 2007).

² See Eurostat online database for at-risk-of-poverty rates and, for instance, quartile cut-offs in purchasing power standards (<https://bit.ly/2WYf9FE>, last consulted 15/05/2020).

³ These comments were also made on various occasions by representatives of people living in poverty in Eastern Europe (personal correspondence with Anne Van Lancker, policy coordinator of the European Minimum Income Network).

⁴ PPS is the 'international currency' while purchasing power parities (PPPs) are the conversion factors used to correct for price level differences and exchange rates. More information can be found here: [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Purchasing_power_standard_\(PPS\)](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Purchasing_power_standard_(PPS)) (last accessed 09/07/2020).

Other than making adjustments for accommodating these concerns, we keep most of the features of our indicator in line with the AROP60 indicator, e.g. in terms of working with disposable income, and the assumptions in terms of household economies of scale. A key difference with the AROP60 indicator is that it combines information on the poverty status of individuals based on two poverty thresholds, a (low) fixed threshold (constant in real terms across space and time) and a floating threshold (defined as a percentage of median income in each country and year, equal to the 60% at-risk-of-poverty threshold). The EHC integrates this information in a consistent way. It equals the percentage of the population below the fixed threshold plus a weighted percentage of the population with an income above the fixed, but below the floating threshold, with the weight being determined by how far the poor are below the floating threshold.

Using EU-SILC data, we show that poverty according to our measure is much more concentrated in Eastern Europe than according to alternative measures (AROP60 and AROPE). The reason is that, on top of having a larger incidence of poverty, the intensity of poverty in Eastern countries is larger than elsewhere, because these countries have higher levels of poverty in terms of our fixed poverty threshold. Furthermore, we find that for the period 2007-2017 our poverty measure decreased for the EU as a whole, while AROP60 and AROPE remained stable. Different regions of the EU experienced different evolutions, though. Our measure barely changed for Western EU countries, increased by about 22% for Southern EU countries and decreased by about 45% for Eastern EU countries. These differences are much larger than those found by alternative measures (AROP60, AROPE) because, unlike these alternative measures, our measure is reduced (resp. increased) when an individual's status changes from having an income below the fixed threshold to having an income between the fixed and floating threshold.

Our paper is structured as follows. First we explain the main characteristics of the poverty measure we propose. Subsequently, we explain how we derive the poverty thresholds as well as the data that we use to test the new indicator. Next, we illustrate the indicator by first discussing the distribution of poverty in the EU, and subsequently looking at trends. We pay particular attention to poverty trends in Poland and Greece, as these countries show the most striking patterns. We conclude with a summary of our findings, the limitations of our study and a discussion of ways forward to further improve the practical implementation of the indicator.

2 The new indicator: the structure of the poverty index

We propose a new measure of poverty for EU countries that is based on two poverty lines. One line is fixed and its threshold captures the minimal cost to purchase food, housing and other essentials at a basic level. The other line is floating – it is meant to capture the cost of goods and services essential for adequate social participation in a more encompassing way - and its threshold is set at 60% of median income whenever this is higher than the level of the fixed threshold. The measure aggregates income shortfalls below these lines in a coherent way using the *extended headcount* ratio (EHC) (Decerf and Ferrando, 2020).

The main advantages of our measure are:

- it is simple to produce as it is only based on income data,
- it accounts both for a national and a pan-European perspective on poverty,
- it acknowledges that the depth of poverty should be taken into account, and
- it can be decomposed rather straightforwardly, therefore allowing for an easy interpretation.

The third advantage listed above allows for improving on an important limitation of both AROP60 and AROPE, the standard poverty measures used in the EU. Indeed, none of these

two measures reflects the intensity of poverty. It is straightforward to see in the case of AROP60: a German whose income is just below 60% of median income in Germany is considered as poor as a Romanian whose income is insufficient to cover her subsistence needs. AROPE does not capture intensity either because it is based on the so-called union approach. A German who is at risk of social exclusion is considered as poor as a Romanian who is simultaneously, at risk of poverty, severely materially deprived and living in a household with very low work intensity. Because AROP60 and AROPE do not capture intensity, their cross country comparisons as well as their evaluation of poverty trends misses an important aspect of poverty. In contrast, our measure considers that an individual with an income above the fixed threshold, but below the floating threshold, is less poor than an individual with an income below the fixed threshold, regardless of the level of the floating threshold. Decerf (2017) shows that mainstream indices do not share this characteristic and Decerf (2020) provides an axiomatic foundation for this property. We first explain the definition of the two poverty lines and how they could be used for computing a ‘standard’ headcount ratio. Subsequently we explain the index (Decerf and Ferrando, 2020) which aggregates poverty into the extended headcount ratio.

2.1 The two poverty lines and a ‘standard’ headcount ratio

Let an income distribution $y := (y_1, \dots, y_n)$ be a list of non-negative incomes sorted in non-decreasing order $y_1 \leq \dots \leq y_n$. Let median income (denoted by \bar{y}) be the reference income in distribution y .

With the extended headcount ratio, the poverty status depends on two poverty lines. The fixed threshold z_f reflects a very restricted budget of minimum necessities, which should allow people to cover the cost of food, housing and other essentials at a basic level if they would spend their income exclusively on these items. This threshold is kept constant across time and space, except for adjustments with regard to national price level differences and changes in prices. The floating threshold is $z_r(\bar{y}) = 0.6 \bar{y}$, similar to the at-risk-of-poverty threshold used in AROP60. This threshold varies between countries in line with differences in median incomes, and changes over time proportionally to changes in median income. It is assumed that, especially in countries with higher incomes, this reflects the full cost of a consumption pattern in accordance with the ‘minimum acceptable way of life’ in a country. Individual i is considered as *poor* if her income is below any of the two lines, i.e. if

$$y_i < z(\bar{y}),$$

with

$$z(\bar{y}) = \max(z_f, z_r(\bar{y})),$$

where $z(\bar{y})$ is the hybrid line defined as the highest value of the two lines.

Individual i is *considered to be in severe poverty* if $y_i < z_f$ and she is (‘only’) *at-risk-of-poverty* if $z_f \leq y_i < z_r(\bar{y})$. In countries or at times when the floating threshold is lower than the fixed threshold, the floating threshold is not used.

The headcount ratio, denoted by $HC(y)$, measures the fraction of individuals who are *poor* in y . Then, $HC_F(y)$ measures the fraction of individuals who are *severely poor* and $HC_R(y)$ the fraction of individuals who are *exclusively at-risk-of-poverty* (who are poor but not in severe poverty)⁵. By definition, if $z_f \leq z_r(\bar{y})$, then $HC(y) = HC_F(y) + HC_R(y) = AROP60$.

⁵ Please note that we use this terminology purely to distinguish between situations of having an income below the fixed or the floating threshold, and not to make any judgement about the severity of experiencing poverty when living on an income below the floating, but above the fixed threshold.

2.2 The extended headcount ratio (EHC)

The index defining our poverty measure is the *extended headcount ratio*, an index based on the two poverty lines mentioned above and proposed by Decerf and Ferrando (2020). The difference with the ‘standard’ headcount ratio, is that the extended headcount ratio is not a clear headcount, as it gives a higher weight to income shortfalls below the fixed threshold as compared to income shortfalls below the floating, but above the fixed threshold. More in particular, while having an income below the fixed threshold contributes a full unit to the index, having an income below the floating but above the fixed threshold only contributes in proportion to the income shortfall.

Formally, the extended headcount ratio (EHC) can be defined as:

$$EHC(y) = \frac{1}{n} \sum_i p(y_i, \bar{y})$$

where the contribution $p(y_i, \bar{y})$ of any individual i to the index is

$$p(y_i, \bar{y}) = \begin{cases} 1 & \text{if } y_i < z_f \\ \frac{z_r(\bar{y}) - y_i}{z_r(\bar{y}) - z_f} & \text{if } z_f \leq y_i < z_r(\bar{y}) \\ 0 & \text{otherwise} \end{cases}$$

Thus, someone with an income below the fixed threshold contributes 1 to the index, and someone exclusively at-risk-of-poverty contributes in proportion to the distance between her income and the two poverty thresholds. If her income is close to the fixed threshold z_f , her contribution is close to 1; and if her income is close to the floating threshold $z_r(\bar{y})$, her contribution is close to 0. This definition implies that a severely poor person always contributes more than an individual who is not severely poor. Furthermore, with regard to income shortfalls below the floating threshold, the index assumes that falling one euro short is worse when the floating threshold is closer to the fixed threshold, compared to a situation where the difference between the two thresholds is larger. To facilitate presentation, in the results section we multiply the index with 100 and present it as a percentage, although that is, strictly speaking, not accurate.

There is a straightforward relation between the extended headcount ratio and the ‘standard’ headcount ratio. When the floating threshold is lower than the fixed threshold, the floating threshold is disregarded and the extended headcount ratio is equal to the ‘standard’ headcount ratio, with the fixed threshold as the poverty line. When the floating threshold is higher than the fixed threshold, the extended headcount ratio can be decomposed as follows:

$$EHC(y) = HC_F(y) + \omega(y) HC_R(y)$$

where

$$\omega(y) = \frac{z_r(\bar{y}) - \hat{y}_r}{z_r(\bar{y}) - z_f}$$

where \hat{y}_r denotes the mean income among individuals with an income between the floating and the fixed threshold.

In the last expression, $\omega(y) \in [0,1]$ can be considered an endogenous weight whose value evolves linearly between zero and one with *the average income among those with an income below the fixed and floating threshold*. This weight is close to 1 (resp. 0) if the mean income among relatively poor individuals is close to the fixed (resp. floating) threshold. In our data in 2017, $\omega(y)$ typically takes a value in the range [0.3, 0.55].

In a nutshell, we call poor the individuals whose income is below any of the two poverty thresholds. We call severely poor the individuals whose income is below our rather frugal fixed threshold, whose level is slightly less than half the level of the floating threshold in West-European countries (see below). Our indicator is equal to the fraction of severely poor individuals in the population plus the fraction of individuals who are poor but not severely poor, multiplied by an endogenous weight. Since this weight typically takes a value close to one-half, individuals who are poor but not severely poor are weighted less than those who are severely poor. Thus, the extended headcount ratio can be interpreted as the equivalent fraction of severely poor individuals.

3 The new indicator: implementation in the EU

3.1 Data

We use the EU-SILC data to assess poverty in the EU between 2007 and 2017. 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. In most countries, except for Ireland and the United Kingdom, income data refer to the year before the survey year.⁶ In this paper, we use data from the 2008 wave (with incomes of 2007) up to SILC 2018 (incomes of 2017), except for Ireland and the UK, where we use waves 2007 up to 2017⁷. In all tables and figures below, years refer to the income reference year, so the latest year shown is 2017.

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 (note that top-bottom coding is very unlikely to affect the EHC).

⁶ For Ireland “The income reference period for SILC is the twelve months immediately prior to date of interview. Therefore, the income reference period differs from household to household (depending on the interview date)” (Central Statistics Office, 2020, p. 8), and interviews are spread quite evenly across the year.

⁷ In the current release (April 2020), no income data were included for Poland in the 2016 and 2017 waves. For more information on EU-SILC, we refer to Iacovou et al. (2012) and Decancq et al. (2014), Atkinson et al. (2017). Data were missing for several countries (including Greece, Italy and Spain) in the EU-SILC 2007 wave, which is why we start all analyses with the EU-SILC 2008 wave.

In order to apply the fixed 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 or deflated within each country to the year 2012, using the HICP (harmonized index of consumer prices), provided by Eurostat. Second, we apply purchasing power parities (PPPs) for final household consumption, referring to the year 2012 as calculated by Eurostat, to convert incomes into purchasing power standards (PPS), or Euro PPPs. We are aware that the use of PPPs is not a perfect solution for making incomes cross-nationally comparable⁸. 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, 2010)). The estimation of the sampling variance is complicated by EU-SILC's complex sample design and the limited quality of the sample design variables in the microdata. We follow Goedemé (2013) to compute robust standard errors that take clustering within the data as much as possible into account. As regards the EHC, we take a simplified approach to the computation of standard errors, by disregarding the fact that the floating poverty line has been estimated on the basis of the data. Based on findings for the low-income proportion, this can be expected to be a 'conservative' approach in the sense that we will probably moderately over-estimate standard errors (cf. Berger and Skinner, 2003; Preston, 1995).

3.2 Identifying an acceptable fixed threshold

As explained above, the extended headcount ratio works with two poverty thresholds, a fixed threshold which represents the same bundle of goods and services across time and space, and a floating threshold which varies with the average living standard in each country, approximated by the median equivalised disposable household income. As is the case with the at-risk-of-poverty indicator, the main purpose of our proposed indicator is to monitor levels and trends of poverty in the EU. Its purpose is not to identify a decent minimum income or the level of income support that specific households should receive so as not to be poor. Therefore, consistency of the indicator across countries and time is more important than validity at any moment in time, and it is recommendable to vary the exact level of the thresholds in sensitivity analyses. That being said, the thresholds should have an obvious connection with the definition of poverty and generate a sufficient level of acceptability. Given its widespread use within and beyond the EU, our floating threshold is therefore exactly the same as the at-risk-of-poverty threshold: 60 per cent of the country and year-specific median equivalent disposable household income⁹. In contrast, there is no readily available alternative for defining the level of the fixed threshold. Also in this case, consistency across time and space is key to give it a clear interpretation. This means that, at least in principle, the amount of goods and services that could be bought with an income at the level of the threshold does not differ across countries or change over time. This is best done with a set of inflation factors (to adjust the threshold to changes in prices within countries) and purchasing power parities (to adjust the threshold to differences in prices across countries) that is consistent with the factors used for converting household incomes in the

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).

⁹ In line with Eurostat practice, household income is equivalised using the so-called modified OECD scale which computes the equivalent household size by assigning a value of 1 to one adult household member and a value of 0.5 for each remaining person aged 14 and over and a value of 0.3 for each person younger than 14. The equivalent disposable household income is obtained by dividing disposable household income by the equivalent household size.

microdata into a common currency (cf. above). Therefore, this threshold is defined in terms of real incomes, by using the same sets of inflation factors and purchasing power parities as the ones used for converting disposable incomes in the microdata into real incomes. This implies that in terms of purchasing power standards (PPS), i.e. real incomes, the fixed threshold is represented by a single number, which only varies by household composition, in the same way as the floating threshold does.

So as to derive this number and give it an intuitive interpretation, we inquire into the actual cost of two basic goods: food for a healthy diet and minimum adequate housing. The threshold is derived in two steps.

In the first step, we calculate a budget to cover the consumption domains mentioned for a reference family of two adults and two children. The food budget is computed in each country from research results on reference budgets for food in 2015. These low-cost comparable food reference budgets were developed in a cross-country study in 24 EU countries, based on national dietary guidelines (Carrillo-Álvarez, Penne, et al., 2019; Goedemé et al., 2015). The housing budget is computed by regressing (within each country and by using a linear regression) the rent paid by tenants in 2012 in the private sector on the size of the dwelling in square meters, and calculating from that regression the cost of a 56m² apartment in each country.¹⁰ French and Italian laws converge on a value of 56m² as the minimum size of a dwelling for a family of four.¹¹ Regulations in some German cities generally require only 30m² as a minimum size for rental apartments for the reference family¹². On the other hand, a detailed study by the UK Department for Communities and Local Government (2013, 2015) finds that a family of two adults and two children needs a dwelling of at least 73m² (see also Van den Bosch et al., 2016). Non-legal building standards for the minimum size of a dwelling are often close to 56m² for the reference family, which therefore seems a reasonable choice for defining our threshold of severe poverty¹³. For consistency with the housing budget, we deflate the food budget to prices to 2012 by making use of the harmonised consumer price index for food. Finally, we added 10% of the sum of the two budgets to cover minimally other needs. Thus, we obtain for almost all EU countries¹⁴ in 2012 a very frugal budget necessary to cover basic needs.

However, at this stage, these budgets cannot be readily used for identifying the fixed threshold. First of all, we would like a threshold that can be applied to all EU Member States, so we should try to find some way to extrapolate it to countries for which no data on the cost of a healthy diet is available. Second, these budgets are expressed in national currency. Therefore, we first convert the budgets into PPS using the Eurostat PPPs. Given that this results in a different value for each country¹⁵, we subsequently compute the unweighted country-average of the budgets in

¹⁰ For Bulgaria and Romania, we use the simple mean rent of rented apartments, because of the very small number of observations of rented apartments in those countries.

¹¹ Code de la construction et de l'habitation. - Article R*111-2, see legifrance.gouv.fr; Decreto Ministeriale 05/07/1975, (Gazzetta ufficiale 18/07/1975 n. 190), Modificazioni alle istruzioni ministeriali 20 giugno 1896, relativamente all'altezza minima ed ai requisiti igienico-sanitari principali dei locali di abitazione.

¹² Deutsche Bundestag, Wissenschaftliche Dienste, 2017, «Mindestwohnfläche pro Person in Mietwohnungen », Sachstand WD 7 - 3000 - 102/17.

¹³ E.g. <http://www.umacon.com/noticia.php/es/cuantos-m2-necesitamos-para-una-vivienda/443> for Spain and <https://www.wonenvlaanderen.be/lexicon/aangepast-aan-de-grootte-van-uw-gezin> for Flanders.

¹⁴ No comparable food budgets are available for DK, IE, NL and UK.

¹⁵ The reason is that the price differences reflected in the Eurostat PPPs take account of the full range of goods and services consumed by households and is based on a more extensive price survey. In principle, a direct comparison of the budgets in national currency could offer an alternative set of purchasing power parities that represent the same consumption bundles. However, this would only reflect differences in the cost of food (in line with a healthy

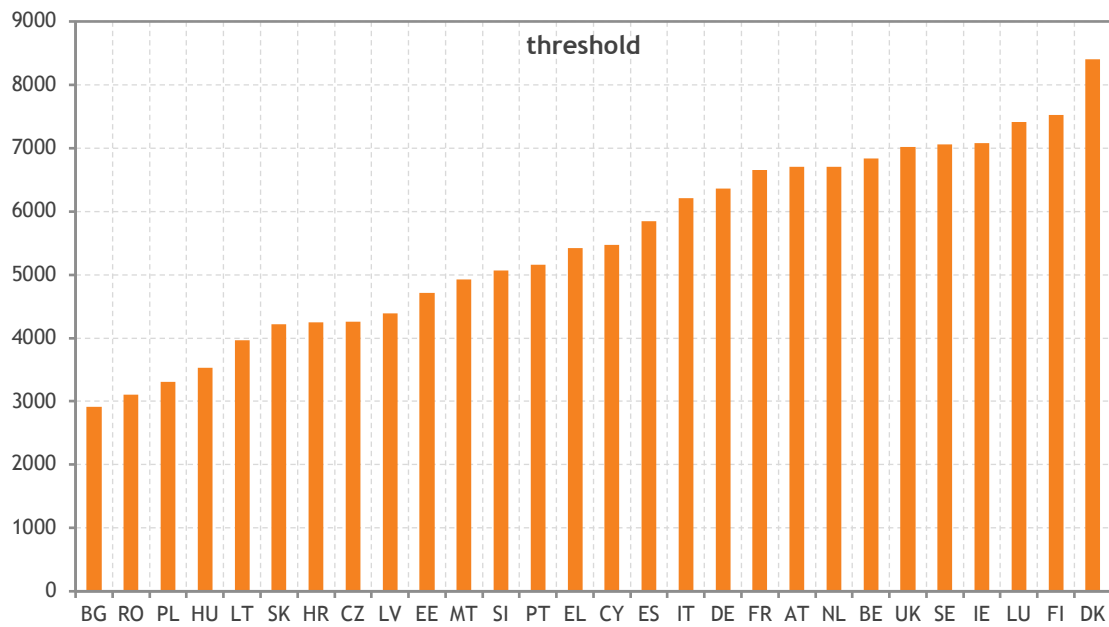
PPS to identify the fixed threshold (cf. the approach adopted used by the World Bank in order to define its extreme poverty threshold, see Ravallion et al. (2009) and Ferreira et al. (2016)). As this threshold is expressed in real income, we can apply our poverty threshold also to countries for which we have no estimate of the cost of the basic bundle food and housing, and to the entire period under consideration¹⁶.

This procedure has as an added value that an average across countries can be expected to be closer to the real cost of these basic bundles than the individual country estimates, given that these are likely to be subject to some error. For instance, the estimation of the cost of food was based on a relatively small-scale survey in a few shops at one point in time (mostly in Spring 2015) (Goedemé et al., 2015), while the quality of the food-based dietary guidelines on which the food budgets are based varies across countries (Carrillo-Álvarez, Boeckx, et al., 2019). In addition, the housing costs estimated on the basis of EU-SILC are subject to sampling variance and the situation for which we estimate housing costs is more representative for some countries than for others. The implication of this approach, however, is that, when converted back into national currency, the fixed threshold will in some countries differ from the income required for buying the food and housing items from which we started in the first place. In other words, we assume that an important part of this deviation is measurement error and that the fixed threshold can be expected to better reflect an overall low consumption bundle that is more comparable across countries as it also takes account of other goods and services that people consume. The fixed threshold for a single-person household is approximately equal to about 500 PPS a month (2012 real prices), or equivalently 5950 PPS a year. Although the threshold is the same for all countries in PPS in 2012, it is not the same in actual current country prices in 2017. Figure 1 shows the differences of our fixed threshold in current country prices in 2017. About three times as much is necessary to meet the fixed threshold in Denmark than in Bulgaria.

diet) and housing, and in accordance with the underlying assumptions of how these costs were derived. Given that even at low levels of income people do not spend their budget exclusively on housing and food, the use of PPPs that consider the full range of expenditures is more adequate. Note that when we regress the budgets (in PPS) on the national median equivalent disposable household income, the regression coefficient is small and not significant.

¹⁶ More details about the derivation of our fixed threshold are provided in Appendix.

Figure 1: Fixed threshold in current country prices in 2017 (EUR)



Source: own calculations.

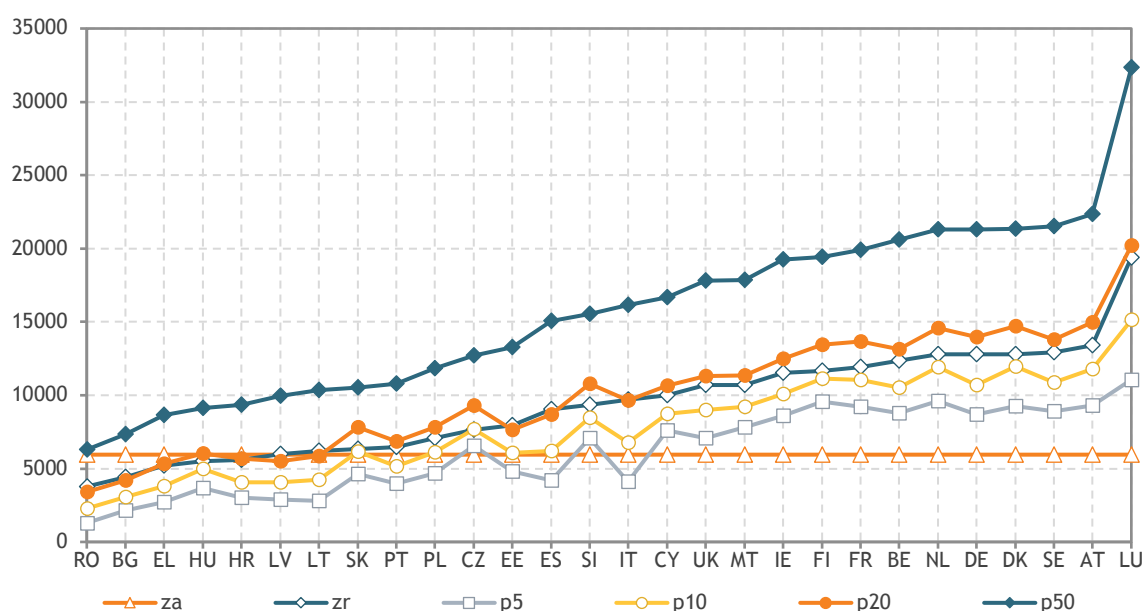
4 Results

We first discuss the level of the fixed threshold compared to the bottom of the income distribution in each country and the level of poverty in Europe as measured by the new poverty measure in 2017. Subsequently, we analyse in more detail the distribution of poverty across the EU for the same year. In the following subsection we look into how the new poverty indicator sheds another light on changes in poverty levels between 2007 and 2017.

4.1 Standard of living and poverty rates in 2017

In Figure 2 we show the level of the fixed and the floating threshold in each country (in PPS), and contrast this with 5th, 10th, 20th and 50th percentile in 2017. Countries are arranged by median equivalent income from low to high. For five countries, including Romania, Bulgaria, Greece, Hungary and Croatia, the fixed threshold is higher than the floating threshold. In contrast, the floating threshold is considerably higher than the fixed threshold in Luxembourg, Austria, Sweden, Denmark, Germany and the Netherlands.

Figure 2: Poverty thresholds and percentiles of the income distribution in 2017



Source: EU-SILC 2018 UDB (release March 2020) and own calculations.

In almost all countries, the floating threshold is close to the 20th percentile, or slightly below, which implies that AROP60 does not vary much across EU countries. In contrast, there is a much larger heterogeneity for headcounts below the fixed threshold. The fixed threshold is close to the 50th percentile in Romania, slightly above the 20th percentile in Bulgaria, close to the 20th percentile in Croatia, Hungary, Greece, Lithuania and Latvia, and then drops even below the 5th percentile in high-income countries.

Hence, the large difference in income levels in the EU translate into large differences in severe poverty, compared to a much smaller variation in AROP60. Given that the extended-headcount ratio does take the intensity of poverty into account, by also using the fixed threshold, we can expect a larger heterogeneity in the EHC compared to AROP60 as well.

Living standards across countries are very different, and it will prove useful to categorize countries in three groups:

- North-Western EU (high median income): AT, BE, DE, DK, FI, FR, IE, LU, NL, SE and UK.
- Southern EU (intermediate median income): CY, EL, ES, IT, MT, PT.
- Eastern EU (low median income): BG, CZ, EE, HR, HU, LV, LT, PL, RO, SI, SK.

Note that there is some overlap between these groups in terms of median income: Portugal and Greece have lower median income than Slovenia and, in recent years, Estonia, the Czech Republic and Poland. Table 1 below shows that in terms of purchasing power standards in 2017, median income (and the AROP60 poverty threshold) in North-Western EU is nearly twice the median income in Eastern EU.

Table 1 presents for all countries the level of the EHC, alongside information on key poverty indicators of the EU dashboard of social indicators, and a decomposition of the EHC into its subcomponents. Figure 3 shows the key indicators again at the country level. As Table 2 and Figure 3 show, the EHC ranges between 4.5% in Finland and 45.7% in Romania. It is also relatively low in France, Denmark, the Netherlands and the Czech Republic, and relatively high in Bulgaria, Greece and Latvia, although with considerable heterogeneity between the latter countries. As the graph also shows, the EHC figures can be estimated with a relatively high

degree of statistical precision on the data, sufficiently precise to allow for identifying substantial differences between countries.

At first sight, some results of the EHC seem to align better with more intuitive understandings of the distribution of poverty in the EU. Compare for instance Poland and Germany, which are highlighted in Table 2. Both countries have a floating threshold that is higher than the fixed threshold, very similar AROP60 rates, and very similar AROPE rates. However, the fraction of severely poor individuals is much larger in Poland (9.1%) than in Germany (1.8%). This implies that the fraction of the poor who are not severely poor is much smaller in Poland (5.7%) than in Germany (14.1%). Since those who are exclusively at-risk-of-poverty are weighted down in the EHC, the EHC is much higher in Poland (11.9%) than in Germany (7.3%). Another contributing factor, which plays a secondary role in this comparison, is that the poor who are not severely poor get a larger weight in Poland (0.48) than in Germany (0.39), because they are relatively closer to the severe poverty threshold in Poland. This gives:

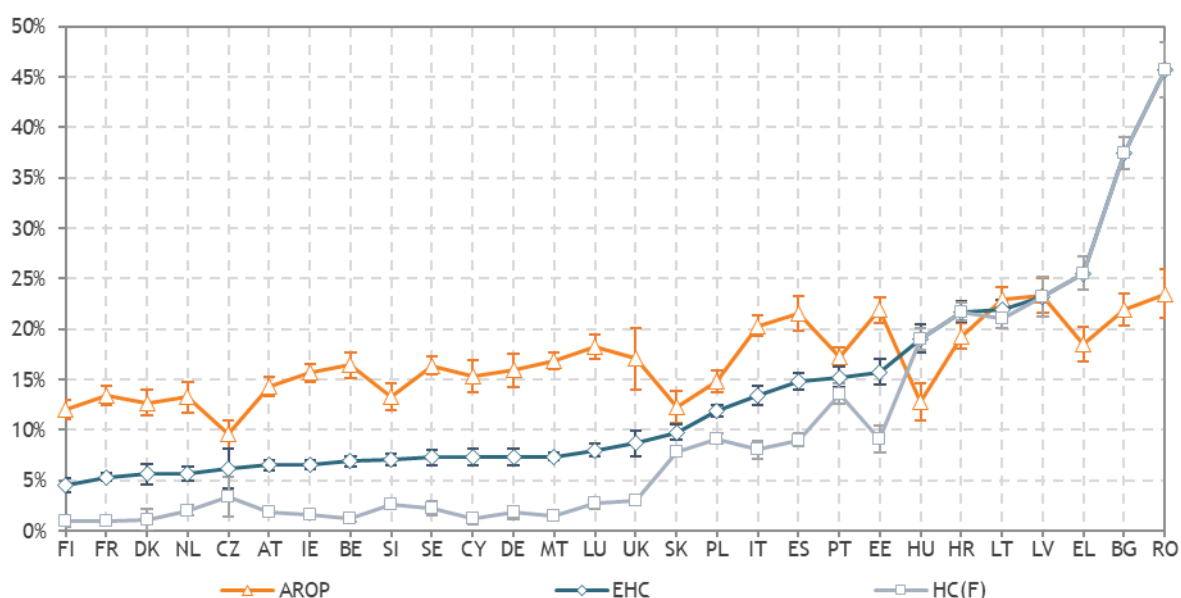
$$\text{EHC(Poland)} = 9.1\% + 0.48 \times 5.7\% = 11.9,$$

$$\text{EHC(Germany)} = 1.8\% + 0.39 \times 14.1\% = 7.3\%.$$

Likewise, while both AROP60 and AROPE are relatively similar for France and Hungary, the EHC is remarkably lower in France as compared to Hungary.

More generally speaking, it is interesting to see how the EHC is substantially higher for Eastern Europe (21.1%) than for Southern Europe (15%), while also highlighting more strongly how poverty in both regions is substantially higher than in North-Western Europe (6.9%). The reason for these marked comparisons is again that they reflect the very different fractions of individuals below the fixed threshold in Eastern Europe (19.5%), Southern Europe (10.2%) and North-Western Europe (1.9%), but also that income is more unequally distributed in Southern Europe than in North-West Europe, which is implied by the much higher share below the 60% threshold in Southern Europe (20%) as compared to North-West Europe (15%). Observe also that the variation across countries is considerably smaller for AROP60 (range: 9.6 - 23.5) and AROPE (range: 12.2 – 32.8) than it is for EHC (range: 4.5 – 45.7).

Figure 3: The at-risk-of-poverty rate, the extended headcount ratio and HC_F in 2017



Note: Countries sorted by EHC. Error bars indicate 95% confidence interval. Note that for HC_F and EHC many error bars are ‘hidden’ by the graph marker.

Source: EU-SILC 2018 UDB (release March 2020) and own calculations.

Table 1: Distribution of poverty in the EU in 2017

	EHC	AROP60 threshold	AROP60	Relative median poverty gap	MD	AROPE	HC _F	Omega	HC _F /EHC
	(%)	PPS	(%)	(%)	(%)	(%)	(%)		(%)
EU total*	11.8	10,031	16.9	23.4	13.3	21.7	7.5	0.41	33.8
North- Western*	6.9	12,062	15.3	20.3	9.6	19.0	1.9	0.38	11.9
Southern*	15.0	8,830	20.3	28.6	17.2	26.7	10.2	0.45	48.1
Eastern*	21.1	6,071	16.8	25.5	18.3	22.4	19.5	0.47	74.8
RO	45.7	3,776	23.5	35.2	32.2	32.5	45.7	-	100.0
BG	37.4	4,404	22.0	26.9	32.9	32.8	37.4	-	100.0
EL	25.5	5,182	18.5	29.1	33.6	31.8	25.5	-	100.0
LV	23.2	5,969	23.3	27.8	21.0	28.4	23.2	0.33	99.5
LT	21.9	6,205	22.9	28.2	23.1	28.3	21.0	0.48	91.5
HR	21.7	5,599	19.3	28.9	23.3	24.8	21.7	-	100.0
HU	19.0	5,486	12.8	24.1	19.6	19.6	19.0	-	100.0
EE	15.8	7,969	21.9	21.9	9.9	24.4	9.1	0.52	41.7
PT	15.3	6,464	17.3	24.5	16.6	21.6	13.6	0.46	78.5
ES	14.8	9,025	21.5	28.5	13.9	26.1	9.0	0.46	41.8
IT	13.4	9,692	20.3	29.5	16.8	27.3	8.0	0.44	39.6
PL	11.9	7,090	14.8	23.3	10.5	18.9	9.1	0.48	61.6
SK	9.8	6,315	12.2	25.6	17.2	16.3	7.9	0.43	64.3
UK	8.7	10,676	17.0	23.0	12.3	22.0	3.0	0.40	17.6
LU	8.0	19,391	18.3	24.4	4.8	21.9	2.7	0.34	14.7
MT	7.4	10,705	16.8	17.0	8.7	19	1.5	0.38	9.1
CY	7.3	10,009	15.4	18.6	27.0	23.9	1.2	0.43	7.6
DE	7.3	12,788	15.9	22	7.8	18.7	1.8	0.39	11.3
SE	7.3	12,917	16.4	19.9	4.5	18.0	2.3	0.35	13.9
SI	7.1	9,331	13.3	17.5	10.4	16.2	2.6	0.42	19.5
BE	6.9	12,370	16.4	19.4	10.7	20.0	1.2	0.38	7.1
IE	6.5	11,537	15.6	15.3	14.8	22.7	1.6	0.35	10.3
AT	6.5	13,404	14.3	21.7	6.3	17.5	1.8	0.38	12.8
CZ	6.2	7,624	9.6	15.0	7.8	12.2	3.4	0.45	35.1
NL	5.7	12,782	13.3	18.3	6.5	16.7	2.0	0.32	15.4
DK	5.6	12,797	12.7	19.1	7.2	17.0	1.1	0.39	8.6
FR	5.3	11,930	13.4	16.8	11.0	17.4	1.0	0.35	7.1
FI	4.5	11,641	12.0	14.2	8.0	16.5	1.0	0.32	7.9

Notes: Countries sorted by EHC. EHC: Extended headcount ratio; AROP60 = at-risk-of-poverty rate; AROPE = Percentage at risk-of-poverty or social exclusion; MD = rate of material deprivation (enforced lack of at least 3 out of 9 items); HC_F = Percentage below the fixed threshold; omega = average relative income shortfall below the floating threshold for those with an income above the fixed threshold; *weighted average by population size.

Source: EU-SILC UDB (release March 2020) and own calculations.

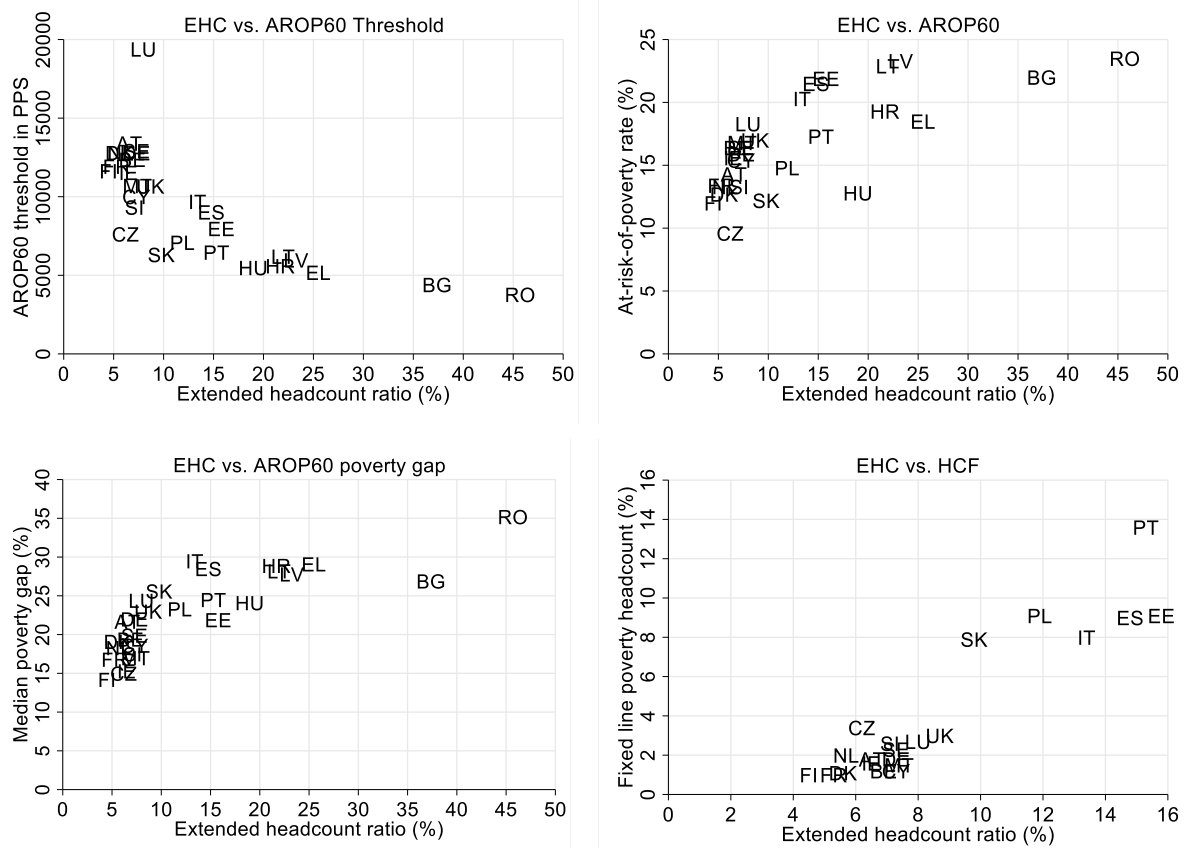
In the introduction we claimed that the EHC combines in a consistent way aspects such as the level of the at-risk-of-poverty threshold, the notion that the poverty threshold should, at least to some degree, increase with living standards (AROP60), the intensity of poverty (the poverty gap) and the need for a pan-European perspective of poverty. Table 2 and the graphs below illustrate that the new income measure indeed incorporates all these aspects from a comparative perspective, for the situation in 2017: Although the relation is not perfect, EHC succeeds in being clearly correlated with the level of the 60% at-risk-of-poverty threshold, the at-risk-of-poverty rate, the median relative at-risk-of-poverty gap and the HC_F as indicators of the four notions mentioned above. This can also be observed from Table 2, which shows Pearson's correlation coefficient and Spearman's rank correlation coefficient between the EHC and the other dashboard indicators. This contrasts with how AROP60 correlates with these other indicators: on each account, the EHC correlates more strongly with the level of the poverty threshold, the median poverty gap and HC_F than AROP60 does. Similarly, although not an indicator of poverty based on income, the indicator of material deprivation, which largely uses the same benchmark across countries, is not able to capture all these aspects of poverty as well as the EHC does. Therefore, we believe it is safe to conclude that the EHC does a good job in capturing key dimensions of the poverty concept and summarising them in a consistent way to allow for meaningful cross-country comparisons.

Table 2: Country-level Pearson's correlation coefficient and Spearman's rank correlation between the EHC, AROP60, Material deprivation and several other indicators, 2017

		EHC	AROP60 threshold in PPS	AROP60	Relative median poverty gap	MD	AROPE	HC_F
Pearson	EHC	1.00	-0.73	0.72	0.80	0.82	0.83	0.99
	AROP60	0.72	-0.36	1.00	0.75	0.53	0.89	0.65
	MD	0.82	-0.76	0.53	0.66	1.00	0.82	0.83
Spearman	EHC	1.00	-0.80	0.78	0.87	0.72	0.81	0.92
	AROP60	0.78	-0.41	1.00	0.72	0.49	0.91	0.64
	MD	0.72	-0.84	0.49	0.61	1.00	0.71	0.63

Source: EU-SILC 2018 UDB and Eurostat online database. Authors' calculations.

Figure 4: The relation between the Extended headcount ratio (%) and other income-based indicators of poverty, 2017



Note: In the graph EHC vs. HCF only countries shown with an EHC below 16%, given that above that level EHC and HC_F are virtually the same.

Source: EU-SILC 2018 UDB and Eurostat online database, authors' calculations.

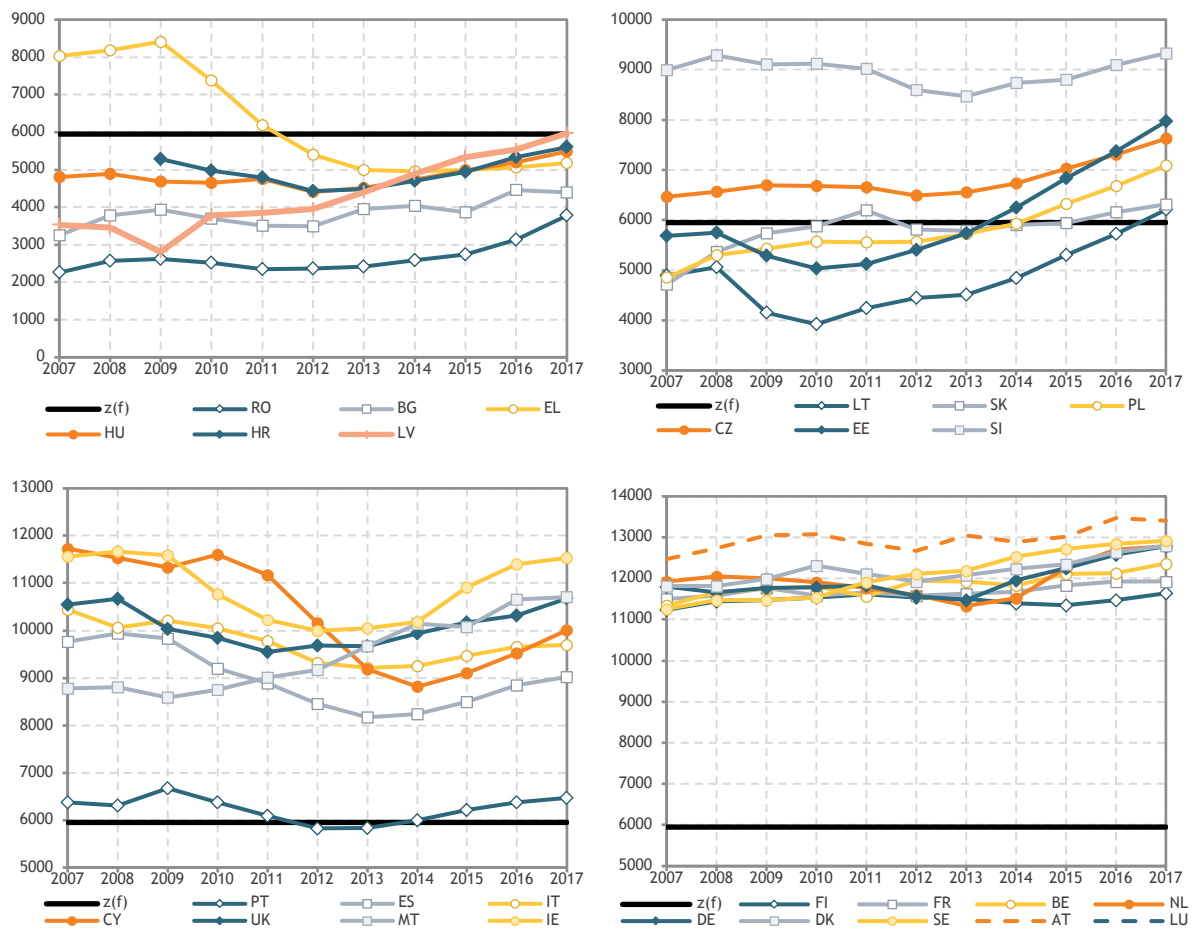
4.2 Evolution of poverty in the EU between 2007 and 2017

As announced in the introduction, the new measure of poverty that we propose is also suited for capturing trends in poverty during periods of rapid economic change. In the EU, this is currently primarily done by use of the at-risk-of-poverty rate with a threshold 'anchored' in time. First, we illustrate the trend in the fixed and floating thresholds over time to better understand how the EHC captures rapid changes in median equivalent disposable household incomes, in interaction with the fixed threshold. Figure 5 shows the evolution of the relative poverty thresholds by country for the years 2007-2017. For clarity, the graph has been split into four subgraphs. The fixed poverty threshold is always and everywhere at the same level, indicated by a straight solid black line (z_f). The upper left graph includes the EU countries with the lowest median income. Median income has increased in many countries, especially Latvia, while Romania and Bulgaria are lagging behind. The dramatic income fall in Greece between 2009 and 2013 stands out. The upper right graph includes the remaining Eastern European countries, many of which have experienced strong income growth; in the case of Estonia and Lithuania after a severe drop after 2008.

The bottom left graph shows the trends for the Southern European countries and for the UK and Ireland. In most of these countries (Malta is the only exception), median income has declined strongly between 2008 and 2013 or 2014, followed by a recovery. Note that median income in Portugal is much lower than in other Southern European countries, with the exception

of Greece. Finally, the bottom right graph includes the Scandinavian countries and the continental countries of North-Western Europe, where median income has been largely stable or moderately increasing. (Luxembourg is off this graph with a median income around 17 000 Euro PPS.)

Figure 5: AROP60 poverty thresholds and the fixed threshold 2007-2017 in Euro PPS (prices of 2017)



Source: EU-SILC UDB 2008-2018 (release March 2020) and own calculations.

Table 3 shows that the EHC fell by 24% during the period 2007-2017 for the EU as a whole. In the East of the EU, EHC was nearly halved, while it rose substantially in Southern Europe. The reason is that EHC also accounts for intensity. The trends in EHC are mainly driven by the changes in the severe poverty rate, which are in fact stronger than for EHC itself: it declines by 37% for the EU as a whole, is virtually halved in Eastern Europe, but increases by 50% in Southern Europe.

By contrast, the AROP60 rates are virtually stable for the EU as a whole, as well as for all three regions. When the floating poverty threshold is fixed at its 2012 value in real terms, the resulting ‘anchored’ AROP60 falls in Eastern countries and rises in Southern countries, just like the EHC. However, in North-Western Europe, where the severe poverty rate is very low, the anchored AROP60 has declined between 2007 and 2017. The AROPE rate declines for the EU as a whole, and in particular in Eastern Europe, while it rises in Southern Europe. So the pattern is the same as for EHC, but in a much more limited way. The EHC therefore paints a much more positive picture of the evolution of poverty and social exclusion in the EU than the current

headline measures do, reflecting better the increases in living standards that have occurred at the bottom of the income distribution in the EU.

Table 3: Evolution of poverty measures over the period 2007-2017.

2007	EHC	AROP60	AROP60 anchored	AROPE	HCF
EU	15.5	16.3	15.5	23.8	11.8
North-West	6.2	13.8	13.9	18.9	1.9
South	12.2	19.3	13.7	25.1	6.8
East	37.9	17.3	20.8	31.8	37.7
2017	EHC	AROP60	AROP60 anchored	AROPE	HCF
EU	11.8	16.9	13.1	21.7	7.4
North-West	6.9	15.3	12.2	19.0	1.9
South	15.0	20.3	18.4	26.7	10.2
East	21.0	16.7	8.6	22.3	19.4
2017 / 2007	EHC	AROP60	AROP60 anchored	AROPE	HCF
EU	0.76	1.04	0.85	0.91	0.63
North-West	1.12	1.11	0.88	1.01	1.00
South	1.23	1.05	1.34	1.06	1.50
East	0.56	0.96	0.41	0.70	0.51

Note: AROP60 anchored is based on the floating at-risk-of-poverty threshold for 2012 within each country, deflated to 2007 and inflated to 2017 by the HICP.

Source: EU-SILC 2008-2018 UDB (release March 2020) and own calculations.

Correlations between the EHC and other poverty measures across all years 2007-2017 by group of countries show that EHC correlates relatively strongly with AROP60 in the North-West of the EU, somewhat less in the South, and not at all in the East. By contrast, in the latter two regions EHC correlates very strongly with the anchored AROP60 and also with AROPE. Although at a lower level, also in the North-West of the EU the EHC correlates more strongly with anchored AROP60 than AROP60 does. (See table A3 in Appendix 2 for trends by country). Yet, it is clear that the EHC correlates most strongly with AROP60 in "higher-income" countries (where severe poverty, as defined here, is not very common) and correlates more strongly with anchored AROP60 in "lower-income" countries (where severe poverty is the dominant issue).

Table 4: Correlation of EHC and AROP60 with other poverty measures over the period 2007-2017, by group of countries.

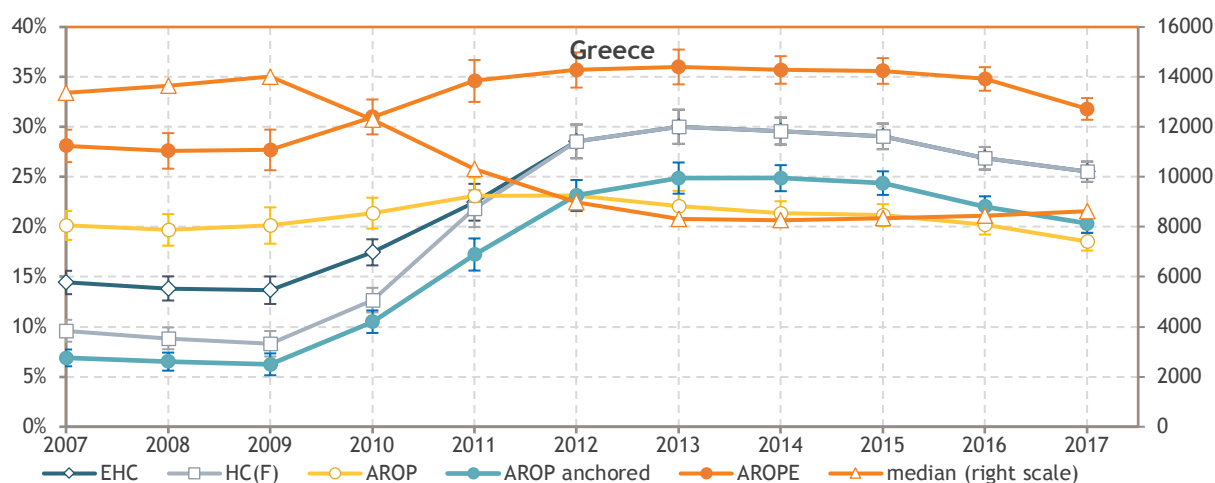
	Correlation EHC with...				Correlation AROP60 with...				
	North-West	South	East	EU	North-West	South	East	EU	
Pearson's correlation coefficient					Pearson's correlation coefficient				
AROP60	0.76	0.48	-0.01	0.40	EHC	0.76	0.48	-0.01	0.40
AROP60 anchored	0.40	0.95	0.97	0.74	AROP60 anchored	0.22	0.37	0.04	0.18
AROPE	0.55	0.75	0.68	0.64	AROPE	0.38	0.44	0.15	0.30
Spearman's rank correlation coefficient					Spearman's rank correlation coefficient				
AROP60	0.68	0.45	0.02	0.37	EHC	0.68	0.45	0.02	0.37
AROP60 anchored	0.39	0.96	0.96	0.74	AROP60 anchored	0.21	0.38	0.05	0.18
AROPE	0.53	0.73	0.64	0.62	AROPE	0.37	0.43	0.12	0.28

Note: unweighted average of correlation between indicators within countries over the period 2007-2017.

Source: EU-SILC 2008-2018 UDB (release March 2020) and own calculations.

This general point is illustrated further in Figures 5 and 6 for specific countries in which poverty followed a very outspoken pattern, Greece and Poland. Greece is a Southern country hit hard by crisis, while Poland experienced an economic boom. In Greece, median income dropped after 2009, which increased strongly the severe poverty headcount and caused a strong increase of the EHC. In contrast, AROP60 did change only by a few percentage points. The anchored AROP60, based on a threshold fixed at its 2012 real value, increases from 6% in 2009 to nearly 25% in 2013, and moves virtually parallel to EHC, though at a lower level. AROPE also increased as median income dropped, but to a much lesser extent than HC_F and EHC.

Figure 6: Evolution of poverty measures for Greece over period 2007-2017



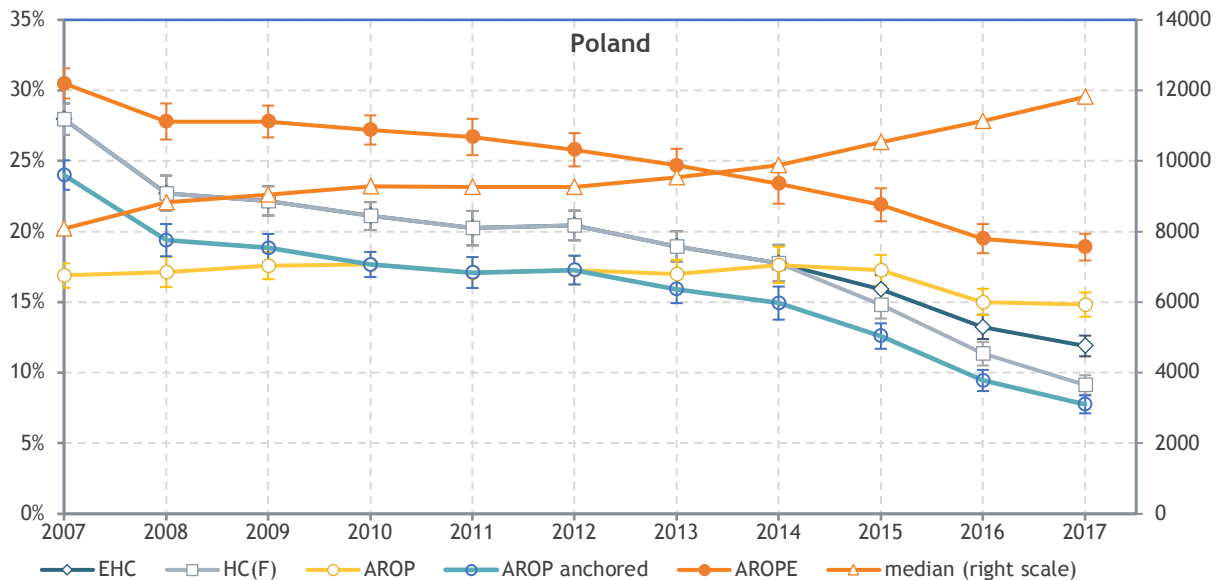
Note: Error bars indicate 95% confidence interval. From 2012 onwards, EHC and HC(F) coincide.

Source: EU-SILC 2008-2018 UDB (release March 2020) and own calculations.

In contrast, in Poland median income increased continuously between 2007 and 2017, which strongly decreased the population share below the fixed threshold. At the same time, AROP60

remained nearly stable during almost the whole period 2007-2017, except for a slight decline between 2015 and 2016. Before 2008, the fixed threshold is higher than the floating threshold, and our measure EHC is equal to HC_F , but after that year, the floating threshold is higher, and EHC does not decrease as fast as HC_F , because individuals who escape severe poverty become (exclusively) at-risk-of-poverty. As in the case of Greece, the anchored AROP60 follows the EHC rather closely. AROPE also falls during the whole period, though in relative terms its decline (-38%) is smaller than that of EHC (-53%).

Figure 7: Evolution of poverty measures for Poland over period 2007-2017.



Notes: Error bars indicate 95% confidence interval. Between 2007 and 2014, EHC and HC(F) coincide.

Source: EU-SILC 2008-2018 UDB (release March 2020) and own calculations.

5 Discussion and conclusion

Poverty is a complex phenomenon. In the EU, discussions about how it should best be measured in a context of widely varying living standards and during periods of strong economic change remain part of the poverty debate. This issue is currently solved by having a dashboard of indicators, which often tell conflicting stories about the distribution of poverty in the EU and how it is evolving over time. In particular, the dashboard of indicators includes the level of the at-risk-of-poverty threshold corrected for price differences across countries, the at-risk-of-poverty rate, the median relative at-risk-of-poverty gap, and the at-risk-of-poverty rate with the poverty threshold anchored at a point in time. Each of these stand out for capturing a particular notion of the poverty concept: the notion that the level at which one's income is judged to be low matters, the notion that more income in a context of high living standards is required in order not to be poor, the notion that the intensity of poverty matters, and the notion that when living standards change very quickly, the income required for having a minimum acceptable way of life may not change as quickly as changes in the median income suggest. We show that our new indicator is able to integrate all these concerns in a coherent way in a single poverty metric. Furthermore, our indicator responds to calls for also including a pan-European benchmark for measuring poverty. The result is an indicator which, we believe, is better suited for monitoring poverty in the EU, both across countries and across time, and which probably,

by simultaneously aligning with all four notions mentioned above, will also have higher (face) validity.

The indicator that we propose makes use of a fixed and a floating poverty threshold. The floating threshold is equal to the well-known 60% at-risk-of-poverty threshold, whenever it is higher than the fixed threshold. The (frugal) fixed threshold is constant in real terms across time and space. We operationalised this threshold by building on reference budgets research which assessed the cost of a healthy diet and the cost of housing across the EU, while adding a small additional amount for other essentials. The extended headcount ratio (EHC) aggregates the number with an income below the fixed threshold with those only below the floating threshold. To do so, shortfalls below the fixed threshold are counted as one, while shortfalls below the floating threshold are counted in proportion to the shortfall from the threshold. We show that this new indicator suggests that there is a higher concentration of poverty in Eastern Europe, a stronger decline in poverty levels in these countries (because the headcount below the fixed threshold drops) and a larger increase in Southern countries (because the headcount below the fixed threshold increases). Furthermore, we show that both for comparisons across countries the new indicator performs well in reflecting the main concerns related to the measurement of poverty highlighted above, and integrates in a coherent way the insights for which, otherwise, at least four separate indicators are required. We also showed that, in comparison to AROP60, the indicator reflects more closely changes in the at-risk-of-poverty indicator with the threshold anchored in time, especially in a context of rapid economic change.

Although we are convinced that the new measure that we propose has many benefits, the extended headcount ratio has several limitations. First, the identification of the fixed threshold may be improved. A continuation and streamlining of the pilot projects on constructing comparable reference budgets in the EU, would be very beneficial in this regard. Currently, in the ABSPO project carried out by the JRC, the European Commission is exploring further how reference budgets could be used to develop an alternative monetary poverty indicator (cf. Cutillo et al., 2020; Penne et al., 2016). Nonetheless, we believe that for the purposes set out in this paper, the development of complete reference budgets in all EU Member States covering all relevant spheres of life is not an absolute requirement, as the exact level of the threshold is less important than the fact of having a poverty measure which includes a fixed threshold. Renewed reference budget research, especially in relation to the cost of a healthy diet, housing and some other key basic amenities, could however result in a higher credibility and acceptability of the level of the fixed threshold.

Furthermore, as we tried to follow as much as possible current practice with measuring poverty in the EU, our indicator has the same limitations as the at-risk-of-poverty rate with regard to assumed economies of scale, level of the floating threshold, restriction of the measure of living standards to disposable household income, neglect of economic inequalities within the household, etc. All these factors are important, and our indicator could be adjusted in a similar way as the at-risk-of-poverty indicator should be adjusted when new ways are generally established and accepted for dealing with these issues. Another limitation is inherent to the new poverty index itself: the result is not a percentage, which might be somewhat harder to interpret by some policy-makers and the broader public. However, the possibility to interpret its value as an equivalent percentage of severely poor individuals may go some way in mitigating this limitation. This also implies that it cannot be aggregated as easily into a combined measure such as AROPE or measures of consistent poverty (e.g. the percentage with an income below the AROP60 threshold and in material deprivation). However, this comes at a significant benefit of having an income-based measure of poverty which results in poverty estimates that are likely to have a higher level of face validity both among policy-makers and the general public, while

also complying in a consistent and more valid way with common notions of how poverty varies across time and space.

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Appendix 1: derivation of the fixed threshold

The fixed threshold is based on the estimated minimum cost of food and housing for a reference family of two adults and two children. It is derived in two steps.

In the first step, we calculate a budget to cover the consumption domains mentioned. The food budget is computed in each country from research results on reference budgets for food in 2015. These low-cost comparable food reference budgets were developed in a cross-country study in

26 EU countries, based on national dietary guidelines. The choice to start from national guidelines rather than common nutritional guidelines from the WHO was motivated by the fact that the former represent the country-specific recommendations on what people need to eat to achieve and/or maintain a good health, while at the same time respecting the cross-national differences in food habits and health priorities. The items in the food basket were priced in accessible and affordable shops in the capital city of each country (Carrillo-Álvarez et al., 2018; see also Goedemé et al., 2015). The food costs were deflated to 2012 using the HICP indices for each country. Subsequently, the corresponding required income was made comparable across countries by applying the 2012 PPPs for general household consumption.

The housing budget is computed from data from the special module on housing in EU-SILC 2012. We regressed within each country the rent paid by tenants in the private sector on the size of the dwelling in square meters, using a logarithmic specification. The results are reported in table A1.

Table A1: Results of regression of $\ln(\text{rent})$ on $\ln(\text{size in m}^2)$, EU-SILC 2012

Country	Ln(size in m ²)		Constant		Observations	R-squared
	Coefficient	Standard error	Coefficient	Standard error		
AT	0.753***	(0.024)	2.964***	(0.101)	1,512	0.385
BE	0.363***	(0.021)	4.686***	(0.086)	778	0.287
BG	0.136	(0.161)	4.284***	(0.632)	48	0.015
CY	0.560***	(0.046)	3.568***	(0.202)	355	0.293
CZ	0.479***	(0.047)	3.432***	(0.189)	957	0.098
DE	0.803***	(0.013)	2.543***	(0.053)	4,776	0.451
DK	0.583***	(0.035)	3.862***	(0.148)	602	0.319
EE	0.386**	(0.165)	3.390***	(0.607)	115	0.046
EL	0.489***	(0.030)	3.693***	(0.128)	610	0.298
ES	0.200***	(0.051)	5.252***	(0.218)	845	0.018
FI	0.525***	(0.030)	4.264***	(0.116)	750	0.287
FR	0.135***	(0.027)	5.534***	(0.111)	1,414	0.017
HR	0.960***	(0.309)	1.636	(1.226)	26	0.287
HU	0.438***	(0.114)	3.125***	(0.436)	276	0.052
IE	0.715**	(0.284)	3.672***	(1.135)	123	0.050
IT	0.266***	(0.036)	4.879***	(0.153)	1,788	0.030
LT	0.001	(0.315)	4.611***	(1.175)	36	0.000
LU	0.445***	(0.021)	4.736***	(0.089)	962	0.315
LV	0.527***	(0.123)	1.848***	(0.457)	417	0.043
MT	0.177	(0.243)	4.653***	(1.087)	35	0.016
NL	0.468***	(0.022)	4.159***	(0.090)	1,188	0.285
PL	0.517***	(0.078)	2.898***	(0.292)	401	0.099
PT	0.296***	(0.093)	4.221***	(0.401)	378	0.026
RO	-0.238	(0.221)	5.535***	(0.744)	55	0.021
SE	0.606***	(0.016)	3.823***	(0.065)	1,547	0.488
SI	0.340***	(0.057)	3.865***	(0.217)	333	0.096
SK	0.198*	(0.114)	3.689***	(0.462)	354	0.009
UK	0.311**	(0.136)	5.436***	(0.547)	35	0.137

Note: *** p<0.01, ** p<0.05, * p<0.1.

Source: EU-SILC 2012 UDB. Authors' computations.

From these regression results we calculated the cost of an apartment of 56m² in each country. French and Italian laws converge on a value of 56 m² as the minimum size of a dwelling for a family of four.¹⁷ Regulations in some German cities generally require only 30 m² as a minimum size for rental apartments for the reference family.¹⁸ On the other hand, a detailed study by the UK Department for Communities and Local Government (2013, 2015) finds that a family of two adults and two children needs a dwelling of at least 73m² (see also Van den Bosch et al., 2016). Non-legal building standards for minimum size are often close to 56m² for the reference family, which therefore seems a reasonable choice.¹⁹ For BG, and RO we did not use the regression, but the average rent, because the slope coefficient was not significant, and the average size of private apartments in those countries is equal to or below 56m². The required income corresponding to the minimal rents was made comparable across countries by applying the 2012 PPPs for general household consumption. Finally, we added 10% of the sum of the two budgets to cover minimally other needs. Thus, we obtain for almost all EU countries in 2012 a total budget necessary to cover these basic needs.

In the second step, these total budgets in real incomes are regressed on median income

$$TC_c = a + b \bar{y}_c$$

where c is a given country and the median income is also expressed in real income.

Table A2: Results of regression of total budget on median equivalent income

	Coefficient	Standard error	t	P>t
Median equivalent income	0.001	0.006	0.17	0.87
Constant	937.276	85.864	10.92	0.00

Source: EU-SILC, wave 2012.

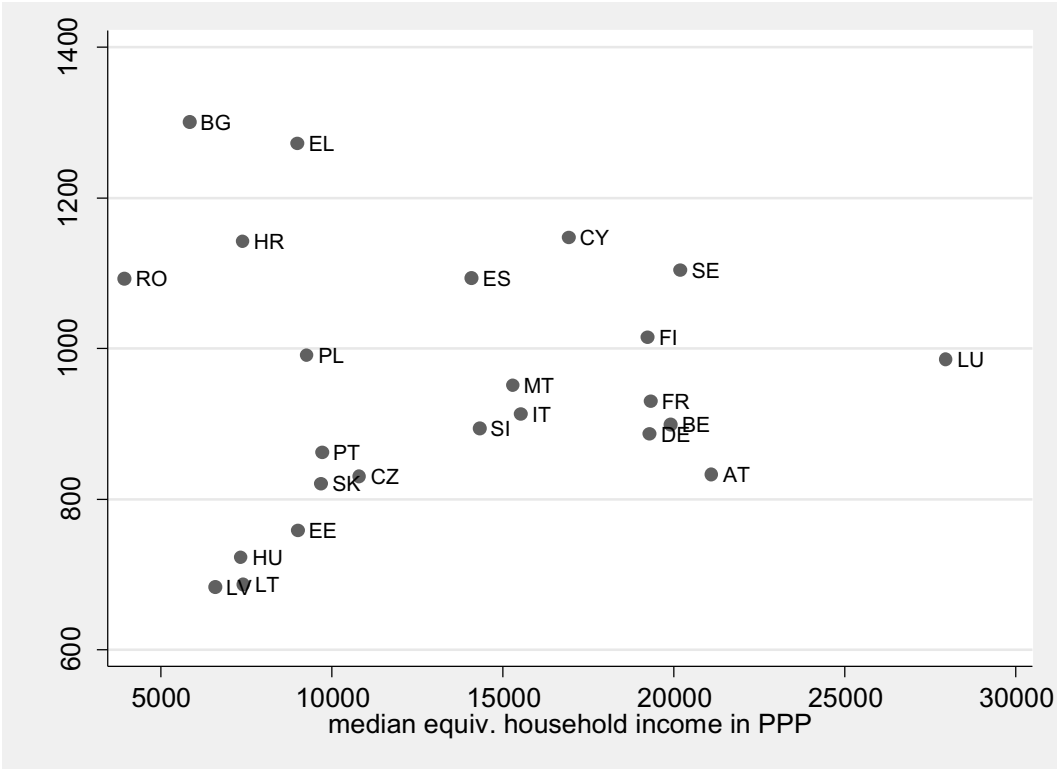
Table A2 shows that the regression coefficient is small and not statistically different from zero. As Figure A1 shows, there is indeed no visible correlation.

¹⁷ Code de la construction et de l'habitation. - Article R*111-2, available from <https://www.legifrance.gouv.fr/>; Decreto Ministeriale 05/07/1975, (Gazzetta ufficiale 18/07/1975 n. 190), Modificazioni alle istruzioni ministeriali 20 giugno 1896, relativamente all'altezza minima ed ai requisiti igienico-sanitari principali dei locali di abitazione.

¹⁸ Deutsche Bundestag, Wissenschaftliche Dienste, 2017, «Mindestwohnfläche pro Person in Mietwohnungen », Sachstand WD 7 - 3000 - 102/17.

¹⁹ E.g. <http://www.umacon.com/noticia.php/es/cuantos-m2-necesitamos-para-una-vivienda/443> for Spain and <https://www.wonenvlaanderen.be/lexicon/aangepast-aan-de-grootte-van-uw-gezin> for Flanders.

Figure A1: Total budgets and median equivalent household income, 2012



Source: Computations by authors, see text.

The mean of TC_c therefore defines our fixed threshold in real terms. The fixed thresholds for other family sizes is obtained using the AROP60 (modified OECD) equivalent scale. These fixed thresholds are applicable to all other years and countries for which we do not have food prices, as incomes have been expressed in international prices of 2012 (see above).

Appendix 2: Trends in poverty at the country level

Table A3: Evolution of poverty measures over period 2007-2017

Country	EHC	HCF	AROP60	AROP60 anchored	AROPE
AT	0.95	0.90	0.94	0.77	0.85
BE	1.08	0.71	1.11	0.83	0.96
BG*	0.68	0.68	1.03	0.55	0.73
CY	1.17	2.05	0.96	1.84	1.03
CZ	0.79	0.51	1.06	0.53	0.80
DE	0.97	0.71	1.05	0.84	0.93
DK	1.03	0.51	1.07	0.81	1.04
EE*	0.72	0.42	1.12	0.40	1.12
EL	1.77	2.66	0.92	2.95	1.13
ES	1.20	1.42	1.09	1.31	1.10
FI	0.83	0.92	0.88	0.77	0.95
FR	1.10	0.99	1.07	0.94	0.94
HU	0.77	0.77	1.03	0.81	0.70
IE	0.90	0.94	0.91	0.94	0.98
IT	1.24	1.59	1.07	1.31	1.07
LT	0.70	0.67	1.10	0.67	1.00
LU*	1.89	7.35	1.37	1.18	1.41
LV	0.46	0.46	0.90	0.30	0.83
MT	0.79	0.34	1.10	0.57	0.95
NL*	1.25	1.14	1.26	0.94	1.12
PL	0.43	0.33	0.88	0.32	0.62
PT	0.88	0.84	0.93	0.84	0.83
RO	0.59	0.59	1.00	0.43	0.74
SE	1.15	0.97	1.21	0.79	1.08
SI	1.00	0.83	1.08	0.98	0.88
SK	0.41	0.33	1.13	0.32	0.79
UK*	0.85	0.78	0.90	0.84	0.97

Note: The value given is the value of the indicator in 2017 divided by its value in 2007. *break in time series between 2007 and 2017

Source: EU-SILC 2008-2018 UDB (release March 2020) and own calculations.