



How Poor Are the Poor? Looking Beyond the Binary Measure of Income Poverty

Iryna Kyzyma

(Luxembourg Institute of Socio-economic Research)

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HOW POOR ARE THE POOR? LOOKING BEYOND THE BINARY MEASURE OF INCOME POVERTY

Iryna Kyzyma *

Luxembourg Institute of Socio-Economic Research

Summary. This paper contributes to the literature by analysing how poor the income poor are in European countries. We go beyond average estimates of the intensity of poverty and analyse the distribution of poverty gaps in each country of interest. We find that, in most European countries, half of the poor have income shortfalls not exceeding 30 percent of the poverty line whereas only a few percent of the poor have income deficits of 80 percent and more. The results also suggest that traditional poverty correlates (e.g. age, gender, educational background etc.) are not always significantly associated with the size of normalised poverty gaps at the individual level, or the nature of these associations differs as compared to when the same characteristics are linked to the probability of being poor.

Keywords: distribution of normalized poverty gaps, European countries, intensity of poverty, poverty indices

1. Introduction

The increase in relative income poverty over recent decades has been raising debates among researchers and policy-makers in most developed countries (OECD, 2008; OECD, 2013; Atkinson et al., 2017). The main limitation of these debates, as well as recent academic literature evaluating the trends in cross-sectional income poverty (e.g. Dickens and Ellwood, 2003, 2004; Hoynes et al., 2006; Thompson and Smeeding, 2013) is their explicit focus on the headcount ratio as a measure of income poverty. Using absolute or relative definition of poverty, scholars analyse, above all, the prevalence of poverty in a given country or across different population sub-groups. In this case, all income poor are treated in the same way regardless of how far away their incomes are from the poverty line. For example, a person whose income falls just one euro below the poverty threshold contributes the same to the poverty measure as someone with a zero income.

The focus on the incidence rather than intensity of poverty has been widely criticised in the literature as such that provides only crude evidence on the extent of poverty. Recognizing the problem, a number of scholars have proposed to estimate poverty indices, which could account not only for the incidence but also for the intensity of poverty, i.e. the distance of individual incomes from the poverty line (see, among others, Sen, 1976; Thon, 1979; Blackorby and Donaldson, 1980; Kakwani, 1980; Clark et al., 1981; Chakravarti, 1983; Foster et al. 1984; Mendola et al., 2011). The main limitation of these indices, as any aggregate

* *Address for correspondence:* Iryna Kyzyma, Luxembourg Institute of Socio-Economic Research, 11, Porte des Sciences, L-4366 Esch-sûr-Alzette, G.D. Luxembourg; e-mail: iryna.kyzyma@liser.lu.

measures, is that they hide individual experiences of poverty and largely depend on the definitions they are based on. Due to these limitations, aggregate measures of poverty are difficult to interpret and link to individual characteristics, which limits their usefulness for the development and evaluation of policy actions.

This paper aims to look beyond the summary measures of income poverty and analyse how poor the poor are at the disaggregate level. To do that, we move from the binary definition of poverty status (poor versus non-poor) to a continuous individual poverty measure, which represents the shortfall of equalised disposable income from the poverty line. In the first step, we look at the distributions of such shortfalls across the European Union (EU) countries and examine whether countries with similar aggregate measures of poverty also face similar distributions of income shortfalls from the poverty line. As a next step, we identify which individual and household characteristics predetermine how far away income of a given individual falls from the poverty line and whether these are the same characteristics as the ones predetermining whether an individual is poor in the first place. The estimations are based on data from the European Union Statistics on Income and Living Conditions (EU-SILC) for the year 2016.

The contribution of the paper to the literature is twofold. First, the paper demonstrates that inspecting the entire distribution of income shortfalls from the poverty line brings additional insight into the intensity of poverty, as compared to the summary measures of poverty. In contrast to the latter, the distributional approach allows identifying the proportions of the poor with income shortfalls of a given size. Using multiple country setting, we find that this information cannot be even approximated from the aggregate measures of poverty because countries with similar summary measures of poverty often face completely different distributions of income shortfalls from the poverty line.

Second, the paper yields the first evidence on the correlates of poverty gaps at the individual level. To the best of our knowledge, studies available in the field focus either on the determinants of someone's poverty status (e.g. Bárcena-Martín and Pérez-Moreno, 2017) or on the factors associated with the transitions across the poverty line (Bane and Ellwood, 1986; Duncan et al., 1993; Stevens, 1999; Devicienti, 2002; 2011; Hansen and Wahlberg, 2009; McKernan and Ratcliffe, 2005; Jenkins, 2011). At the same time, little, if not nothing, has been done to identify which factors predefine how far away someone's income falls from the poverty line. Our paper partially fills this gap in the literature by analysing how demographic and labour market characteristics of individuals underlie the size of their poverty gaps in a set of EU countries.

We show that most of the traditional poverty correlates at the individual and household levels (e.g. age, gender, household type, educational attainment, employment status, and migration background) are also significantly associated with the size of normalised poverty gaps. These associations, however, sometimes work in the opposite direction as compared to when the same covariates are linked to the probabilities of being poor. More specifically, we find that women have significantly higher chances of being poor but, once poor, they have smaller income shortfalls from the poverty line than men. We also find that some individual and household characteristics, which are significantly associated with the probability of being poor, lose their importance as soon as we relate them to the size of poverty gaps. For example, we find that households with more children, or where the head is retired, have a higher probability of being poor but once poor face the same income shortfalls from the poverty line as households with fewer children or where the head is employed. In contrast, individuals living in households with a highly educated head have relatively low chances of becoming poor but once poor they have the same income shortfalls from the poverty line as those living in households with a low educated head.

The paper has the following structure. Section 2 presents the estimation approach and Section 3 describes data used for the analysis. Section 4 provides the main estimation results whereas Section 5 tests them for robustness. Section 5 concludes.

2. Estimation approach

2.1. The intensity of poverty at the aggregate level

Consider a population of N individuals where each individual i ($i = 1, 2, \dots, N$) has equalised disposable income of a given size y ($y = y_1, y_2, \dots, y_N$). Let z stand for the poverty line. Then, for each individual i with $y_i < z$ we can define how far away his or her income falls from the poverty line:

$$g_i = z - y_i, \tag{1}$$

where g_i is a shortfall of individual equalised disposable income from the poverty line (a poverty gap). This specification implies that for all individuals with $y_i > z$, the poverty gap, g_i , equals zero.

In Equation (1) g_i reflects the income deficit of an individual in absolute terms. This measure is not scale invariant and the magnitude of the estimates might change with the change

of the currency (Ziliak, 2006). For comparative cross-country studies, it poses a further problem because, apart from the differences in costs of living, countries have different poverty lines. As a result, the same income shortfall of 500 Euros might be considered as big in one country but as small in another one. To overcome this issue, we follow the literature on poverty measurement and normalize individual poverty gaps with respect to the poverty line:

$$g_i^{norm} = \frac{z - y_i}{z}, \quad (2)$$

where g_i^{norm} reflects the percentage shortfall of income from the poverty line for individual i .

The vector of normalised poverty gaps for all individuals, $g_i^{norm} = (g_1^{norm}, g_2^{norm}, \dots, g_N^{norm})$, contains information on the prevalence and intensity of poverty in a given population. The traditional way to summarize this information is by using various indices of poverty (see, among other, the indices developed by Sen, 1976; Thon, 1979; Blackorby and Donaldson, 1980; Kakwani, 1980; Clark et al., 1981; Chakravarti, 1983; Foster et al. 1984). In this paper, we calculate three summary measures of poverty, which are based on the Foster-Greer-Thorbecke (1984) poverty index and are often used to characterize the prevalence and intensity of poverty on the country level:

$$I_c(y_c; z_c) = \frac{1}{N_c} \sum_{i=1}^{Q_c} \left(\frac{z_c - y_{ic}}{z_c} \right)^a, \quad (3)$$

where I_c is a poverty measure for country c ; y_c is a vector of equalised disposable income in country c ; z_c is a poverty line in country c ; and Q_c is a number of people with $y_i < z$ in country c .

The parameter a in Equation (3) can take any value between zero and infinity, with larger values putting more weight on poorer individuals in the calculation of poverty indices. In this paper, we let a take the values of 0, 1, and 2 which yields three well-known measures of poverty – the headcount ratio, the average normalised poverty gap, and the average squared normalised poverty gap.

When $a = 0$, Equation (3) collapses to

$$I_c(y_c; z_c) = \frac{Q_c}{N_c}, \quad (4)$$

and captures the proportion of individuals living in income poverty in a given country (the headcount ratio). The headcount ratio distinguishes whether individuals are poor or not but it ignores how far away incomes of the poor fall from the poverty line.

When $a = 1$, Equation (3) yields the average normalised poverty gap and with $a = 2$ the squared normalised poverty gap is calculated. In contrast to the headcount ratio, these two measures of poverty account for the relative size of income shortfalls from the poverty line. The average normalised poverty gap shows the size of the income deficit per individual in a given population. Derived as a simple average, this measure treats large and small poverty gaps equally and, hence, does not account for inequality among the poor. The average squared normalised poverty gap accounts for such inequality by putting more weight on those who have large income shortfalls from the poverty line before averaging the results across population.

As any summary measure of poverty, the indices from Equation (3) provide only limited information on how poor the poor are. In particular, they tell us nothing about the distribution of the poor in terms of the size of their income shortfalls from the poverty line. To derive this information, we propose to construct and analyse the entire cumulative distribution function (CDF) of normalized poverty gaps, $F(G_c)$, in each country of interest:

$$F(G_c) = \Pr(G_{ic} \leq p). \quad (5)$$

If interpreted at the individual level, this function provides a set of probabilities that a randomly taken poor individual has a normalised poverty gap, G_{ic} , smaller or equal to a certain value, p (where $0 < p \leq 1$). At the aggregate level, these probabilities reflect the shares of the poor with income shortfalls not exceeding a given value p . For example, one might want to identify the percentage of the poor with income shortfalls not exceeding 10 percent of the poverty line, or the share of the poor who would need to double their income to reach the poverty line. The way how $F(G_c)$ is constructed resembles the ‘Three ‘T’s of Poverty’ (TIP) curve of Jenkins and Lambert (1997), which plots the cumulative sum of poverty gaps per capita against the cumulative population share. The two, however, differ substantially in what they portrait. Whereas the TIP curve depicts the incidence, intensity and inequality of poverty,

Equation (5) captures the cumulative distribution of the poor by the size of their income shortfalls from the poverty line.

2.2. Determinants of the intensity of poverty at the individual level

The CDF of normalised poverty gaps and a set of Foster-Greer-Thorbecke poverty measures provide information on how poor the poor are but they tell us nothing about why some people are poorer than others. In order to identify which factors predetermine the size of the normalised poverty gap at the individual level, we link g_i^{norm} to a set of observed covariates, which have shown themselves as important predictors of poverty and might potentially explain the differences in income shortfalls from the poverty line among individuals:

$$g_{ic}^{norm} = a_c + \beta X_{ic} + \varepsilon_{ic}, \quad (6)$$

where g_{ic}^{norm} is a normalised poverty gap of individual i in country c ; a_c is a vector of country-specific intercepts (country fixed effects); X_{ic} is a vector of observed individual and household characteristics; β is a vector of parameters associated with X_{ic} ; and ε_{ic} is an individual-specific error term.

Given that g_{ic}^{norm} is a continuous variable, we apply the Ordinary Least Squares (OLS) estimator to derive the vectors of parameters a_c and β . The OLS insures that the sum of the squared predicted errors is minimised so that the error term has zero mean (Wooldridge, 2013). An important assumption for causal interpretation of parameters β is that characteristics they refer to are exogenous, i.e. not correlated with individual-specific error terms. This assumption holds for some of the covariates (e.g. age, gender) but it might not hold for other covariates, which reflect individual choices during the life cycle (e.g. household type, education, employment). Due to this reason, the estimates from Equation (6) should be interpreted as associations rather than as causal effects of the covariates on the dependent variable.

Equation (6) yields benchmark estimates of the associations between individual and household characteristics, on the one hand, and the size of the normalised poverty gap experienced by an individual, on the other. The estimates are benchmark in a sense that they are set to be the same across all countries. The cross-country differences in tax-benefit policies, labour market institutions and other unobserved factors, which are shared by all individuals within the country and may influence the size of income shortfalls from the poverty line, are captured in the model with the distinct country specific intercepts, a_c .

In order to identify, to what extent the associations between covariates and the size of the normalised poverty gaps differ across countries, apart from the pooled model for all countries together, we estimate a series of country-specific regressions:

$$g_{ic}^{norm} = \beta_c X_{ic} + \varepsilon_{ic}, \quad (7)$$

where β_c is a vector of country-specific parameters associated with X_{ic} .

The differences in the coefficient estimates between the benchmark model and the country-specific models can be partially attributed to economic conditions and public policies, which are in place in a given country.

3. Data and sample construction

The empirical part of the paper is based on data from the EU-SILC. The EU-SILC provides information on different types of income, social exclusion, labour market participation and demographic characteristics of individuals and households residing in different EU member states, as well as for some countries outside the EU area. Member states are allowed to use different instruments to collect data which afterwards go through the process of harmonisation to insure data comparability across all countries (Iacovou et al., 2012). Albeit there have been a lot of discussions that heterogeneity in the ways of data collection and processing hampers data comparability across countries (see, among others, Berger and Schaffner, 2015; Krell et al., 2017), the EU-SILC remains the main dataset for monitoring poverty and well-being indicators in the EU. It is also the only dataset used for the regular assessment of the progress on the way to poverty reduction in line with the Europe 2020 Strategy (for more details on this strategy, see Marlier et al., 2010).

In this paper, we take advantage of the scientific-use release of EU-SILC cross-sectional data for 2016 covering 24 EU member states. Data for Ireland, Italy, Luxembourg, and Malta were not available at the moment of calculations (October 2017). For each of these countries, the EU-SILC provides detailed data on households and living in them adult individuals. In addition, it collects some basic information for children below 16. As most large-scale household surveys, the EU-SILC covers only private households and ignores individuals who live in institutional establishments (hospitals, student houses, military institutions etc.).

In order to identify whether an individual is poor or not, as well as to calculate the size of the normalised poverty gap for those who are poor, we use information on total net

household income assigned to each individual in the dataset. This variable represents income received by all household members during the reference year from all possible sources, with the deduction of taxes and social contributions paid. The income reference year is the calendar year prior to the survey year in all countries except the United Kingdom, where it is the current year, and Ireland, for which it is the last twelve months. To make the values of total net household income comparable across households of different size, we adjust them by the modified OECD equivalence scale. The scale assigns the value of 1 to the first adult in the household, the value of 0.5 to any subsequent adult, and the value of 0.3 to every child below 14 years old. For the main empirical analysis (Section 4), we keep in the sample all observations with non-missing values of total household equalised disposable income (a detailed information on the number of observations with zero and small income values in each country is provided in Table A1 in Appendix A). We then analyse the sensitivity of our results to low income values by performing a set of robustness checks in Section 5. Following the official definition of poverty in the EU, we set the poverty threshold at 60 percent of the median total net equalised household income in a given country. An individual is considered poor, if his / her equalised disposable income falls below the poverty threshold. For such individuals, we then calculate the size of the normalised poverty gap using Equation (2). For individuals with negative values of total household equalised disposable income we set the value of poverty gap equal to 1.

Although we use household income to identify whether someone is poor and calculate the respectful shortfall of income from the poverty line, we perform the analysis at the individual level. This choice comes in line with the traditional approach to poverty measurement in the EU, which is based on the identification of the proportion of individuals (and not households) who live in poverty or experience any other type of financial hardship. Moreover, using individuals rather than households as a unit of analysis allows us to account for important personal characteristics (age and gender) while analysing the determinants of income shortfalls from the poverty line. Apart from individual characteristics, we also consider household type, the number of children, educational background, employment status and citizenship of household head as potential predictors of the size of income shortfalls from the poverty line. These variables have proven themselves as important predictors of poverty status and transitions across the poverty line in previous studies (see, among other Duncan et al., 1993; Stevens, 1999; Devicienti, 2011; Jenkins, 2011). Household head is defined in the paper as a household member with the largest personal gross income or randomly, if several household members have personal gross income of the same size. For a sensitivity check, we

also performed the analysis with data, where household head is defined as a person responsible for accommodation, but found no substantial differences in the results.

Table 1 presents descriptive statistics for the characteristics of the poor in all countries pooled together (for country-specific estimates, see Table B1 in Appendix B). It shows that an average poor is 39 years old, is more likely to be a female than a male, and has one child. The majority of the poor live in couple-based households (49.7 percent) or are single (23 percent) whereas relatively few of them are single parents (8.6 percent) or live in other household types (18.7 percent). The poor are also more likely to live in households where the head is employed, have only primary education and holds a citizenship of the country of residence. The average normalised poverty gap among the poor constitutes around 30 percent of the poverty line.

Table 1. Descriptive statistics for the characteristics of the poor (all countries together)

Covariates	Mean	Standard deviation
Age of the individual	39.3	22.9
Female	52.8	49.9
<i>Household type</i>		
Single	23.0	42.1
Couple	49.7	50.0
Single parent	8.6	28.1
Other	18.7	38.9
Number of children	1.0	1.29
<i>Employment status of the HH</i>		
Employed	35.4	47.8
Self-employed	13.5	34.1
Unemployed	13.8	34.4
Retired	21.8	41.2
Inactive	15.5	36.2
<i>Educational attainment of the HH</i>		
Primary	42.8	49.5
Secondary	25.2	43.4
Vocational	16.7	37.3
Tertiary	15.3	36.0
HH is a citizen, in %	89.5	30.7
Average normalised poverty gap among the poor (in %)	29.5	24.4
Number of observations		79039

Note: HH stands for the household head. All estimates are weighted using personal cross-sectional weights.

4. Results

4.1. The intensity of poverty at the country level

Figure 1 plots the relative poverty rate, average normalised poverty gap, and average squared normalised poverty gap in each of the countries studied. It shows that the countries differ substantially with respect to these three measures of poverty. Looking at the poverty rate

first, one can see that it is as low as 9.7 percent in Czech Republic and as high as 25.3 percent in Romania. In general, the percentage of people living in poverty is relatively small in Czech Republic, Denmark, Netherlands, Slovakia, and Finland, and relatively big in Bulgaria, Estonia, Greece, Spain, Latvia, Lithuania, and Romania.

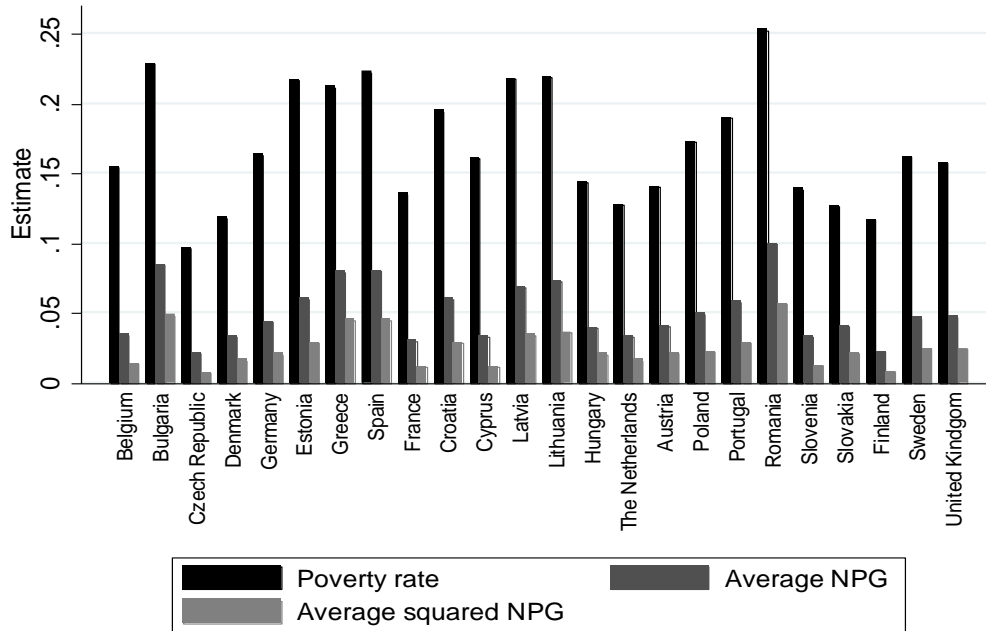


Figure 1. The Foster-Greer-Thorbecke indices of poverty, by country

Note: NPG stands for the normalised poverty gap. All estimates are weighted using cross-sectional weights.

A lot of variation across countries is also found in the indicators measuring the intensity of poverty. The average normalised poverty gap is as low as 0.022 in Czech Republic and as high as 0.10 in Romania whereas the average squared normalised poverty gap varies between 0.008 and 0.057 across the countries studied. In general, countries with low poverty rates tend to experience low intensity of poverty and the other way around. The relationship, however, does not always hold. For example, Belgium has a higher poverty rate than Austria but lower indicators of the average normalised poverty gap and the average squared normalised poverty gap. Similarly, Slovakia has a lower poverty rate than Slovenia but higher measures of the intensity of poverty.

The Foster-Greer-Thorbecke indices provide some information on the prevalence and intensity of poverty, but they tell us little about the distribution of the poor in terms of the size of their income shortfalls from the poverty line. In order to understand how poor the poor actually are, we plot the cumulative distribution function of individual normalised poverty gaps among the poor separately for each country (Figure 2).

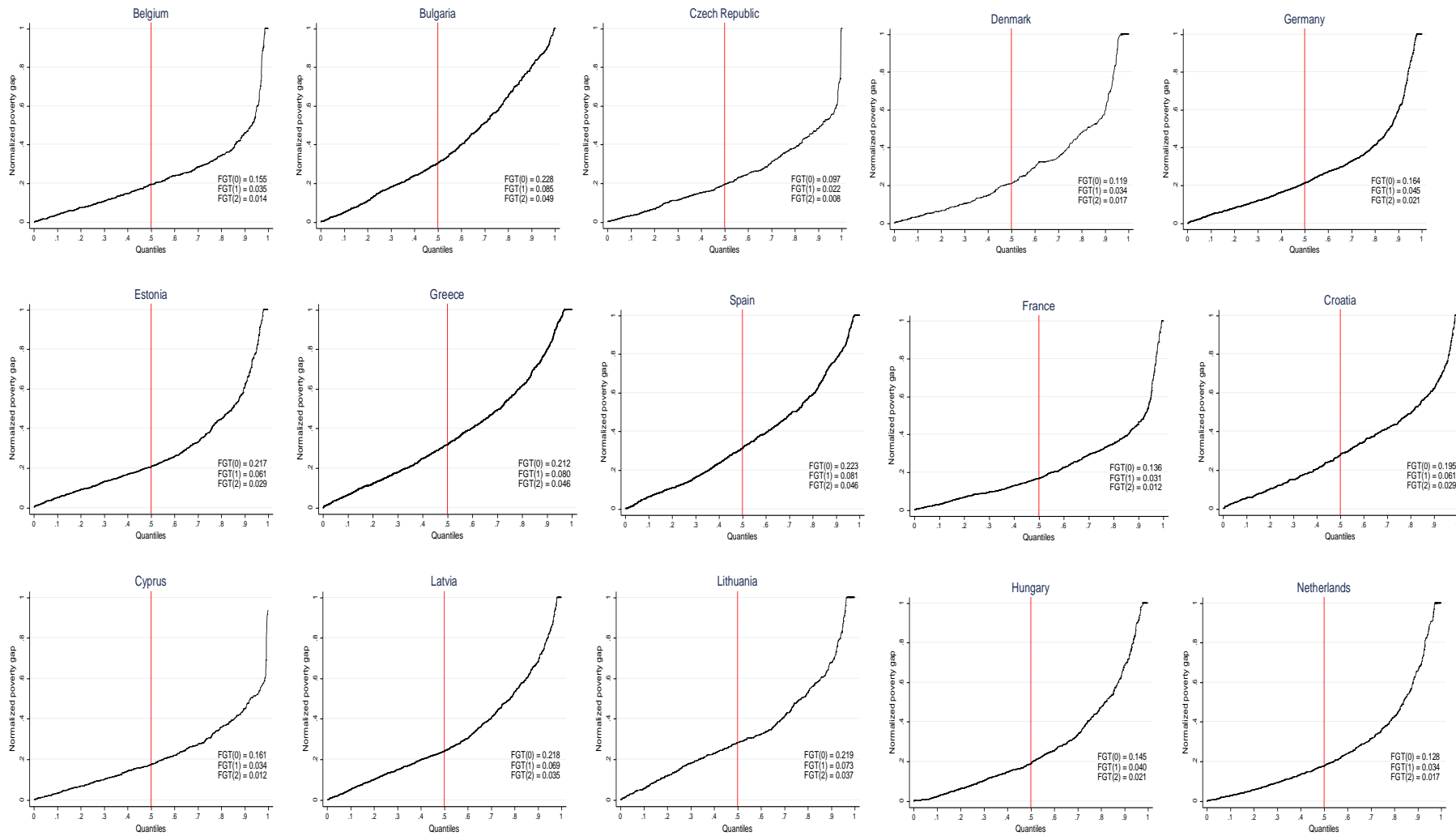


Figure 2. Cumulative distribution of normalised poverty gaps among the poor, by country

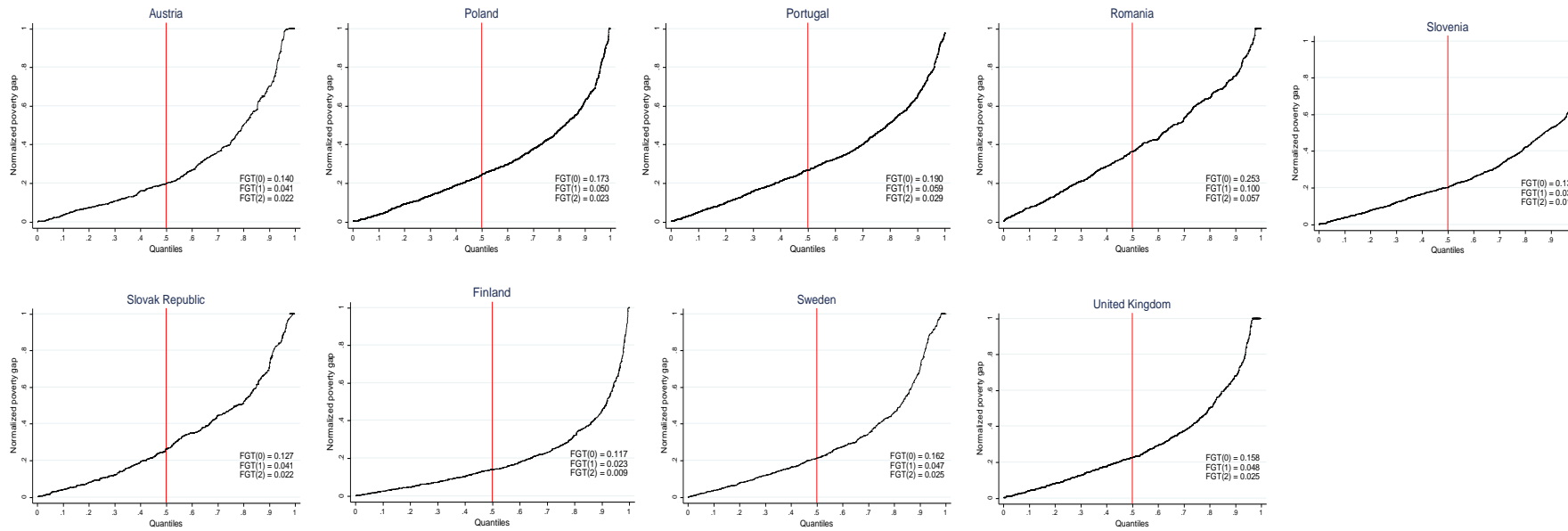


Figure 2 (continued)

Note: FGT(0) stands for the headcount ratio (poverty rate), FGT(1) stands for the average normalised poverty gap, FGT(2) stands for the average normalised squared poverty gap. All estimates are weighted using personal cross-sectional weights.

Figure 2 shows that in most countries half of the poor have income shortfalls not exceeding 30 percent of the poverty line (the exceptions are Bulgaria, Greece, Spain, and Romania). Moreover, in 13 out of 24 countries – Belgium, Czech Republic, Denmark, Germany, Estonia, France, Cyprus, Hungary, the Netherlands, Austria, Slovenia, Finland and Sweden – this indicator is even smaller, not exceeding 20 percent of the poverty line. In contrast, the share of those with large poverty gaps is relatively small: in all countries studied, no more than 10 percent of the poor have income shortfalls exceeding 80 percent of the poverty line. This share is the smallest in Czech Republic and Cyprus and the largest in Bulgaria, Greece, Spain, and Romania.

In general, Figure 2 reveals that countries with relatively low poverty rates and intensity of poverty also tend to have not very steep distributions of income shortfalls from the poverty line. In such countries, the stock of the poor is composed mainly from people with small income shortfalls from the poverty line whereas the percentage of those with large income deficits is negligible. This relationship, however, does not always hold. For example, Belgium and Cyprus have very similar summary measures of poverty but very different distributions of normalised poverty gaps. At its lower tail, the distribution is less steep in Cyprus, where half of the poor have income shortfalls not exceeding 18 percent as compared to 20 percent in Belgium. At the upper tail, the distribution becomes much steeper in Cyprus resulting into a larger share of the poor with big income shortfalls in this country, as compared to Belgium. Latvia and Lithuania constitute another example. The countries have similar summary measures of poverty but the distribution of normalised poverty gaps is much steeper at the bottom in Latvia than in Lithuania whereas the latter catches up between the 50th and 70th percentile of the distribution. This evidence suggests that, although summary measures of poverty might shed some light on the prevalence of large or small poverty gaps among the poor, they tell us nothing about how big the respective proportions of the poor are.

4.2. Determinants of income shortfalls from the poverty line at the individual level

Table 2 presents the results of the regression analysis for the relationship between the characteristics of the poor and the size of their income shortfalls from the poverty line. The first column reports the estimates from the pooled OLS model for all countries together, where we control only for individual and household characteristics of the poor. The second column provides the estimates from the model, which, on top of it, includes country specific fixed effects. The inclusion of fixed effects allows us to account for country-specific time-invariant characteristics, which, if not controlled for, might interact with demographic and labour market

characteristics of the poor and influence their impact on the dependent variable. These are, above all, country specific economic conditions, rules for the provision of public benefits, cultural norms which might influence living arrangements of individuals, labour market behaviour of the latter etc. Apart from the estimates on the determinants of income shortfalls from the poverty line in columns 1 and 2, Table 2 also presents the estimates of the effects of the same set of covariates on the probability of being poor (column 3). We provide these estimates in order to identify whether individual and household characteristics, which are associated with poverty gaps, are associated in a similar way with a poverty risk. If this is the case, focusing only on the determinants of being poor might be sufficient for policy-makers for evaluating existent and developing new policy measures.

Table 2. Regression estimates for the size of normalised poverty gaps and the probability of being poor, all countries together

Covariates	OLS estimates for the size of normalised poverty gaps		Fixed effects logistic model for the probability of being poor
	without country fixed effects	with country fixed effects	
	(1)	(2)	(3)
Age of the individual	-0.001 (0.000)***	-0.001 (0.000)***	-0.010 (0.000)***
Gender of individual (reference: male)	-0.014 (0.002)**	-0.014 (0.002)***	+0.037 (0.012)**
<i>Household type (reference single)</i>			
Couple	-0.032 (0.006)***	-0.044 (0.006)***	-0.831 (0.029)***
Single parent	-0.074 (0.009)***	-0.071 (0.009)***	-0.157 (0.061)**
Other	-0.013 (0.008)	-0.046 (0.008)***	-0.885 (0.040)***
Number of children	-0.007 (0.002)**	-0.008 (0.002)***	+0.233 (0.019)***
<i>Educational attainment of the HH (reference: primary)</i>			
Secondary	-0.025 (0.006)***	-0.014 (0.006)*	-0.635 (0.035)***
Vocational	-0.049 (0.007)***	-0.017 (0.008)*	-0.732 (0.042)***
Tertiary	+0.009 (0.008)	+0.030 (0.008)***	-1.519 (0.039)***
<i>Employment status of the HH (reference: employed)</i>			
Self-employed	+0.143 (0.009)***	+0.124 (0.009)***	+1.064 (0.044)***
Unemployed	+0.129 (0.008)***	+0.130 (0.007)***	+2.323 (0.054)***
Retired	-0.001 (0.006)	-0.000 (0.006)	+0.763 (0.034)***
Inactive	+0.111 (0.008)***	+0.117 (0.008)***	+1.945 (0.049)***
<i>Citizenship of the HH (reference: citizen)</i>			
Immigrant	+0.036 (0.011)*	+0.049 (0.011)***	+0.996 (0.060)***
Constant	+0.311 (0.009)***	+0.287 (0.018)***	-1.027 (0.078)***
R-squared	0.0896	0.1236	-
Number of observations	79039	79039	498395

Note: HH stands for the household head. All estimates are weighted using personal cross-sectional weights. The standard errors in the parentheses are all robust estimates calculated accounting for clustering of individuals within households and sampling probabilities. * signifies that the estimate is statistically significant at 0.05 level, ** signifies that the estimate is statistically significant at 0.01 level, and *** signifies that the estimate is statistically significant at 0.001 level.

Table 2 reveals substantial differences in the estimates of the coefficients on the determinants of income shortfalls from the poverty line in the models that control and do not control for country-specific fixed effects. The sign of the associations between covariates and the dependent variable is consistent across the two models (columns 1 and 2) but the size of the associations differs substantially for most of the household characteristics. The largest differences are observed for the estimates of the coefficients on the household type, educational attainment, and migration background of the household head. This evidence implies that there is a substantial interaction between the observed characteristics of individuals and country-specific features, which one needs to account for while estimating the associations between individual characteristics and the size of normalised poverty gaps in a multiple-country setting. The importance of accounting for country fixed effects is also reflected in the model performance: the model with country fixed effects has a much higher R-squared than the model without fixed effects. Given that it performs better, in what follows we will discuss the results from the model with fixed effects (column 2).

Column 2 in Table 2 shows that almost all individual and household level characteristics, which are included in the model, are significantly associated with the size of normalised poverty gaps. Recall that as OLS estimates, the coefficients show the change in the dependent variable (the size of the normalised poverty gap) due to one unit change in the independent variable (or a category change in the case of a dummy variable). The dependent variable itself varies between 0.01 (the income deficit does not exceed 1 percent of the poverty line) and 1 (a person does not have any income, hence, the deficit is 100 percent of the poverty line).

Looking at the individual characteristics first, one can see that both age and gender are negatively associated with the size of normalised poverty gaps among the poor. Other things being equal, older individuals tend to have smaller normalised poverty gaps than those who are young. For example, someone who is 50 years old will have a normalised poverty gap only 0.03 points smaller than a 20-year old person does. The coefficient estimate for gender suggests that, on average, women have 0.014 points smaller poverty gaps than men.

The estimates for household types show that individuals living in any type of households are better off than singles. Other things being equal, those who live in a couple tend to have a 0.044-point smaller poverty gap than singles. Single parents also face 0.071 points smaller income shortfalls than single individuals whereas for other types of households the advantage is about 0.046 points. Remarkably, that the association between the number of children and the size of the normalised poverty gap is negative and relatively small. On average, with one additional child the normalised poverty gap decreases by 0.008 points. This implies that, once

poor, families with many children do not experience larger income shortfalls from the poverty line than families with a few or no children.

Individuals living in households where the head has secondary education or vocational training experience poverty gaps of a smaller size than those living in households where the head has only primary education. At the same time, the poor living in households with a highly educated head have larger income shortfalls from the poverty line than those living in households where the head has only primary education, other things being equal. There might be different explanations of this finding. Such individuals, for example, might work smaller number of hours than primary educated people, they might end up in low-paid jobs due to some job-skills mismatch, or receive low pensions because of previous labour market arrangements. The results might also be driven by data limitations, for example, if individuals with a tertiary degree tend to underreport income or report implausibly low income values. We explore some of these possibilities in Section 5.

While looking at the estimated coefficients for different types of employment status, one can see that, other things being equal, people living in households with a self-employed, unemployed or inactive (other than retired) head have larger income shortfalls from the poverty line. Remarkably, that the estimates are very similar in size for self-employed and unemployed – e.g. 0.124 and 0.130. For households with inactive heads, the estimated coefficient is slightly smaller and constitutes 0.117. In contrast, individuals living in households with a retired head once poor experience the same income shortfalls from the poverty line as those living with an employed head. Finally, people living in households, where the head is not a citizen of the country of residence, on average, have a 0.049-point higher normalised poverty gap than their counterparts from the households where the head is in the possession of the citizenship.

The estimates from the fixed effects logistic model for the probability of being poor in Column 3 provide further interesting results. In particular, they allow us to identify whether correlates of the size of normalised poverty gaps include the same individual and household characteristics, which are associated with a higher probability of being poor. The estimates show that older individuals, people living in multiple-person households, and those living in households where the head has secondary or vocational education, on average, are less likely to be found among the poor than their counterparts (younger individuals, single persons or those living in households where the head has only primary education). These are also the population sub-groups, which, once poor, face smaller income shortfalls from the poverty line. In contrast, individuals living in households with a self-employed, unemployed or inactive head, or where the head does not hold the citizenship of the country of residence, are not only

more prone to poverty but also, once poor, experience larger income shortfalls from the poverty line than their counterparts from the households with an employed or non-immigrant head.

Such consistency in the estimates for the size of normalised poverty gaps and the probability of being poor does not hold for other individual and household characteristics. In particular, women and households with more children have much higher probability of being poor but, once poor, face smaller income shortfalls from the poverty line compared to men and households with fewer children. Individuals living in households with a retired head have higher chances to be poor but, once poor, experience poverty gaps of the same size as those from the households with an employed head. Members of the households, where the head has a tertiary degree, have substantially lower chances of being poor but once poor face relatively large poverty gaps.

Figure 3 presents associations between individual and household characteristics, on the one hand, and the size of normalised poverty gaps, on the other, separately for each country. In half of the countries studied, age is an important predictor of the size of the normalised poverty gap at the individual level. Once significant, the estimates are always negative meaning that older people have smaller income shortfalls from the poverty line, other things being equal. Similarly, the estimates on gender are always negative once they are statistically significant implying that women tend to have smaller income deficits than men. The effects are significant in half of the countries and the largest in Latvia and Sweden, where women have around 0.05 points lower normalised poverty gaps than men, other things being equal.

The number of children is also an important predictor of the size of normalised poverty gaps in 9 out of 24 countries. In Estonia, Greece, France, Croatia, Lithuania, Slovenia, Sweden and the UK households with more children tend to have smaller income shortfalls from the poverty line, other things being equal. In these countries, each additional child is associated with a decrease in the normalized poverty gap somewhat between 0.01 and 0.03 points. In other countries, apart from Spain, the estimates are not statistically significant. In Spain, each additional child is associated with a 0.023-point increase in the normalised poverty gap, other things being equal.

With regard to household types, in general, individuals living in any type of households are not worse off, and in many countries are even better off, than singles. The exceptions constitute only Greece, Croatia and Belgium. In Greece and Croatia, individuals living in couples, on average, have larger income shortfalls from the poverty line than single person households. In Belgium and Greece, a positive effect is found for those who live in other types of households (typically multigenerational households).

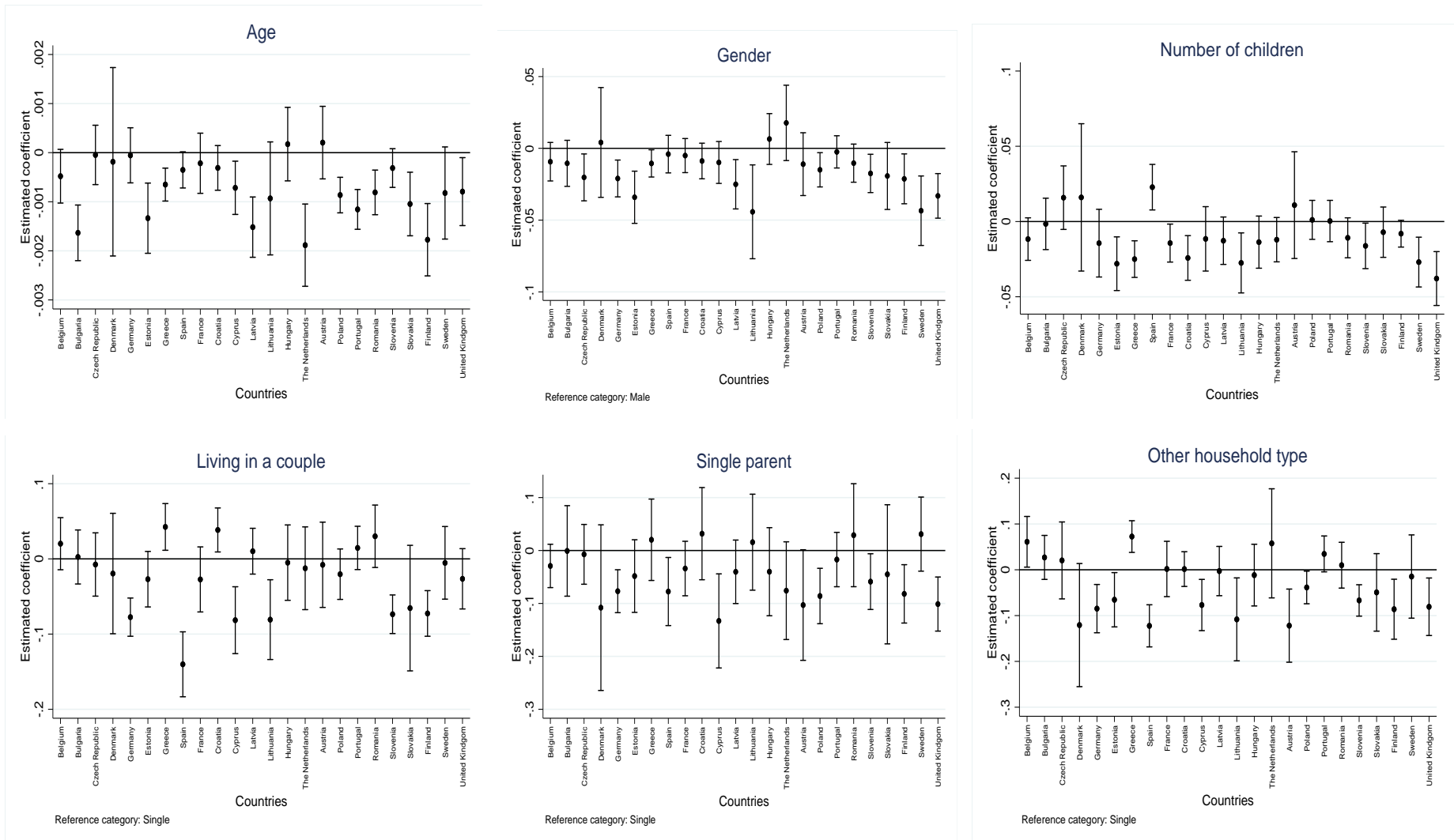


Figure 3. Coefficient estimates for the determinants of the size of normalised poverty gaps, by country

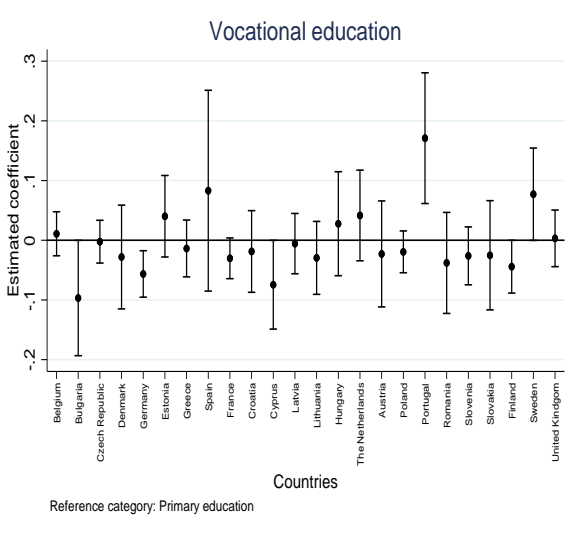
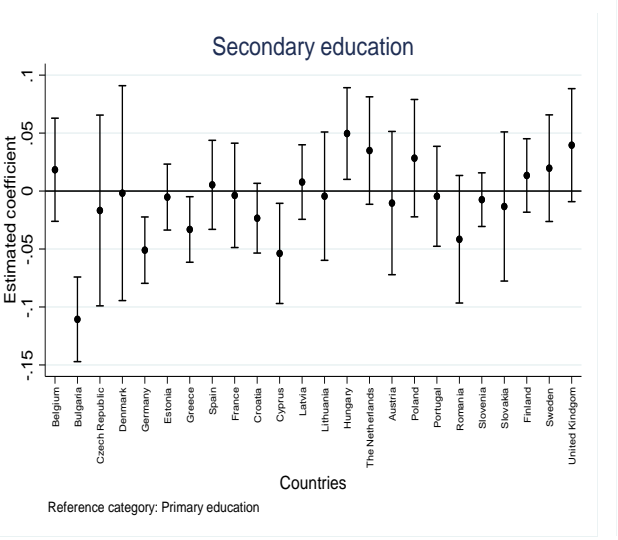
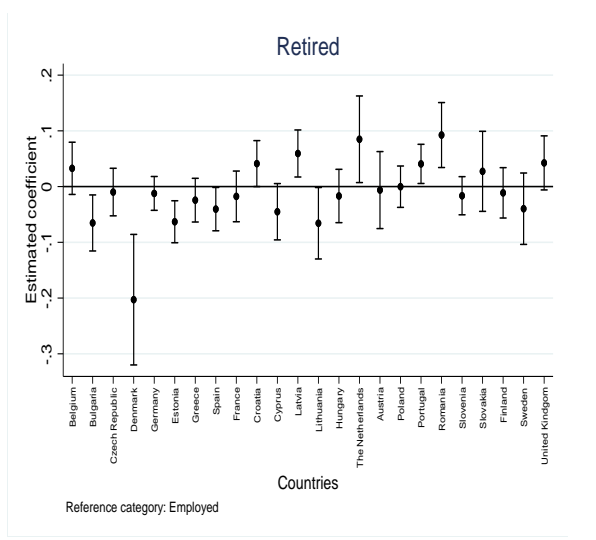
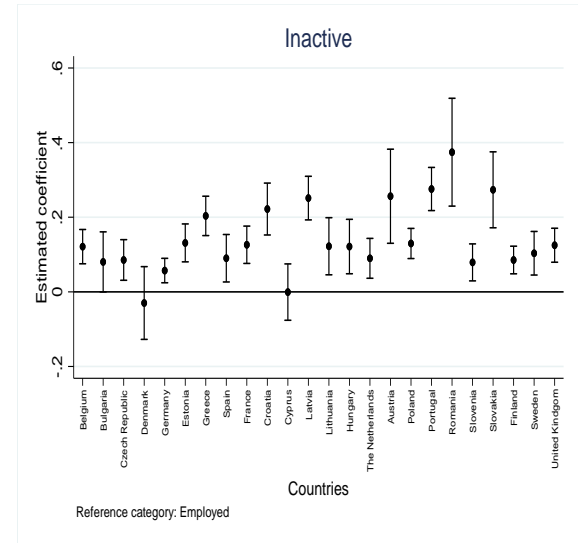
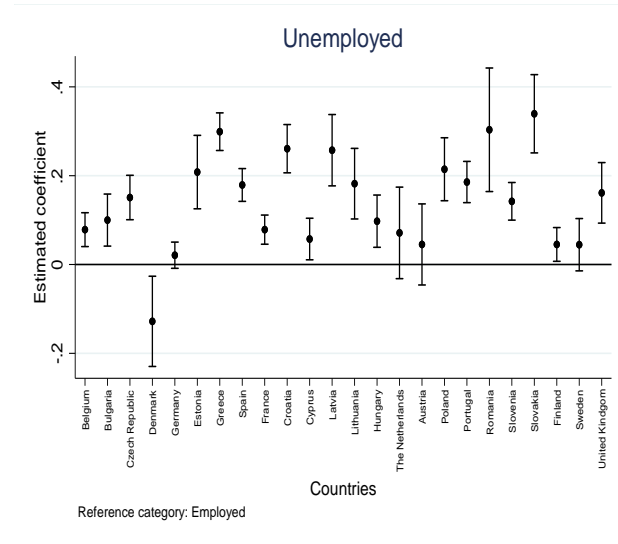
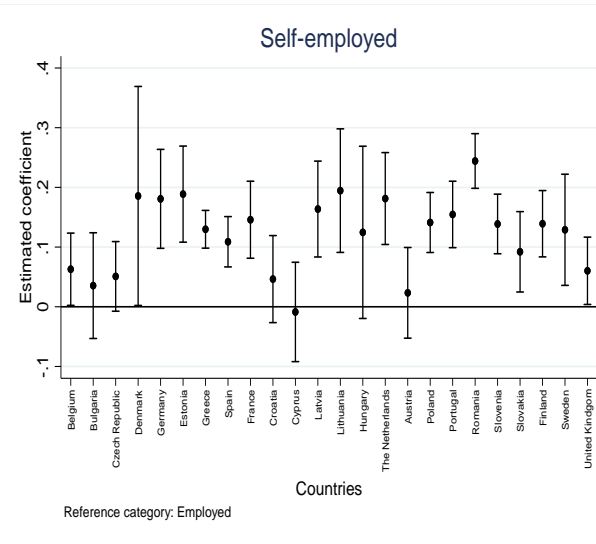


Figure 3 (continued)

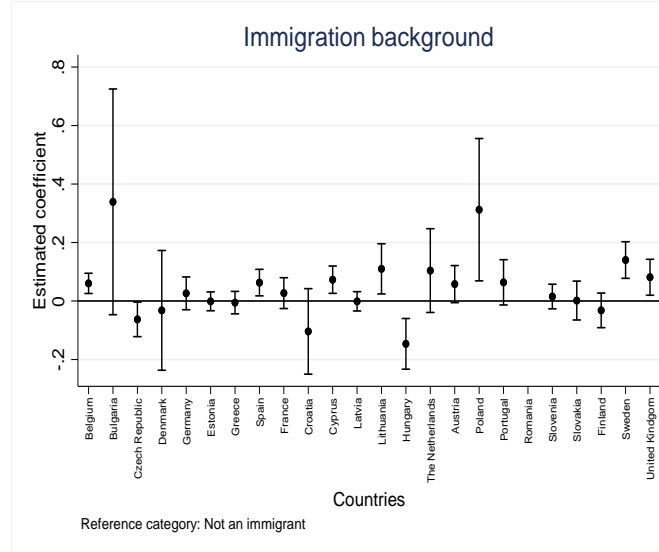
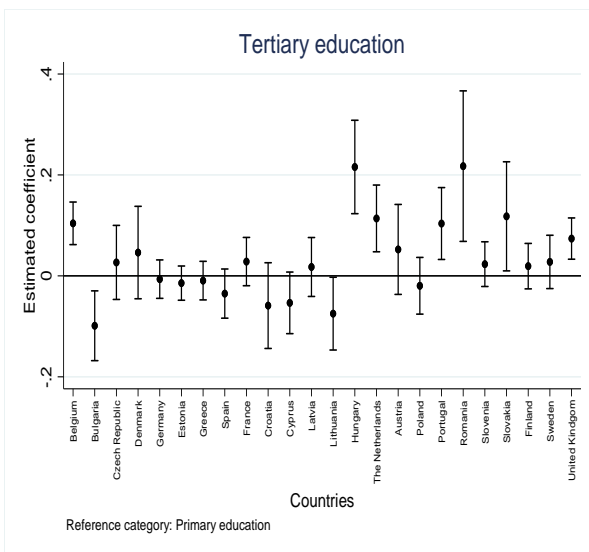


Figure 3 (continued)

Note: All estimates are weighted using personal cross-sectional weights. The standard errors are all robust estimates calculated accounting for clustering of individuals within households.

Looking at the estimates for employment status, one can see that, in most countries studied, individuals living in households with a self-employed, unemployed or inactive head (other than retired) have larger income shortfalls from the poverty line than those living in households with an employed head. For self-employed, the estimates are not statistically significant only in Bulgaria, Czech Republic, Croatia, Cyprus, Hungary, and Austria whereas for unemployed in Germany, the Netherlands, Austria, and Sweden. In Denmark, the association is even negative implying that living under the same roof with an unemployed household head is associated with a 0.128-point smaller normalised poverty gap, other things being equal. Members of the household with an inactive head are not worse off than members of the households with an employed head only in Denmark and Cyprus. The estimates for the retired people are very diverse across countries. In most of the countries, they are not significant. The estimates are positive in Croatia, Latvia, the Netherlands, Portugal, and Romania and negative in Bulgaria, Denmark, Estonia, and Spain.

The largest heterogeneity in the estimates across countries is found for educational attainment of household heads. Poor individuals living in households with a head who has secondary rather than primary education have lower income shortfalls from the poverty line in Bulgaria, Germany, Greece, and Cyprus. Having secondary education is disadvantageous compared to primary school diploma in Hungary whereas in all other countries there is no significant difference in the size of the normalised poverty gap among those whose household heads have primary and secondary education. Individuals living in households, where the head has a vocational training diploma, on average, have smaller income shortfalls from the poverty line compared to their low-educated counterparts in Germany and Finland whereas in all other countries the results are not statistically significant (except of Portugal, where the relationship is significantly positive). The most interesting findings refer to the members of the households, where the head has a tertiary education. Individuals living in such households, enjoy poverty gaps of a smaller size compared to the low-educated households only in Bulgaria. In all other countries, the relationship is either not statistically significant or positive.

With respect to the citizenship of the household head, the estimates are positive and significant in Belgium, Spain, Cyprus, Lithuania, Poland, Sweden, and the UK. In these countries, living in a household, where the head does not have a citizenship of the country of residence, is associated with larger income shortfalls from the poverty line. In Czech Republic and Hungary, the relationship is the opposite: members of the households, where the head is a non-citizen, have smaller poverty gaps, other things being equal.

5. Robustness checks

In order to identify whether our main results in Section 4 are sensitive to the presence of extremely small income values in the data, we perform the same multiple-country analysis with two alternative specifications of the sample. In the first specification, we exclude all observations for which total household equivalised disposable income is either equal to zero or negative. In the second specification, we limit our sample only to the observations with the values of total household equivalised disposable income larger than 10 percent of the poverty line. The OLS estimates for these two alternative specifications, as well as for the main specification (as in Section 4), are provided in Table 3.

Table 3. Regression estimates for the alternative sample specifications, all countries

Covariates	OLS estimates for the size of normalised poverty gaps based on		
	All observations (the same as in Column 2 of Table 2)	Only observations with incomes above zero	Only observations with incomes > 10% of the poverty line
	(1)	(2)	(3)
Age of the individual	-0.001 (0.000)***	-0.001 (0.000)***	-0.001 (0.000)***
Gender of individual (reference: male)	-0.014 (0.002)***	-0.011 (0.002)***	-0.010 (0.002)***
<i>Household type (reference single)</i>			
Couple	-0.044 (0.006)***	-0.036 (0.005)***	-0.034 (0.005)***
Single parent	-0.071 (0.009)***	-0.057 (0.008)***	-0.054 (0.008)***
Other	-0.046 (0.008)***	-0.031 (0.007)***	-0.026 (0.007)***
Number of children	-0.008 (0.002)***	-0.004 (0.002)	-0.002 (0.002)
<i>Educational attainment of the HH (reference: primary)</i>			
Secondary	-0.014 (0.006)*	-0.016 (0.006)**	-0.018 (0.006)**
Vocational	-0.017 (0.008)*	-0.023 (0.007)***	-0.024 (0.007)***
Tertiary	+0.030 (0.008)***	+0.011 (0.008)	+0.008 (0.008)
<i>Employment status of the HH (reference: employed)</i>			
Self-employed	+0.124 (0.009)***	+0.117 (0.009)***	+0.106 (0.009)***
Unemployed	+0.130 (0.007)***	+0.122 (0.007)***	+0.114 (0.007)***
Retired	-0.000 (0.006)	+0.003 (0.006)	-0.001 (0.006)
Inactive	+0.117 (0.008)***	+0.103 (0.008)***	+0.094 (0.008)***
<i>Citizenship of the HH (reference: citizen)</i>			
Immigrant	+0.049 (0.011)***	+0.042 (0.011)***	+0.039 (0.011)***
Constant	+0.287 (0.018)***	+0.275 (0.015)***	+0.255 (0.014)***
R-squared	0.1236	0.1234	0.1265
Number of observations	79039	77730	76476

Note: HH stands for the household head. Under income we mean total household equivalised disposable income. All estimates are weighted using personal cross-sectional weights. The standard errors in the parentheses are all robust estimates calculated accounting for clustering of individuals within households and accounting for sampling probabilities. * signifies that the estimate is statistically significant at 0.05 level, ** signifies that the estimate is statistically significant at 0.01 level, and *** signifies that the estimate is statistically significant at 0.001 level.

Table 3 shows that, once we exclude negative and zero income values, the estimates for all but two covariates remain very similar to the ones derived with the full sample of

observations. The two exceptions are the number of children and a tertiary education degree held by the household head. After the exclusion of negative and zero income values from the sample these two covariates become insignificant. This finding implies that, other things being equal, the number of children in the household does not have any significant relationship with the size of the normalised poverty gap. Similarly, the poor living in households, where the head has tertiary education, on average, have income shortfalls of the same size as those whose householder has only primary education.

Imposing further restrictions on small income values (Column 3 in Table 3) does not produce any further substantial changes in the estimates of the coefficients on all covariates. Once we exclude observations with income values smaller than 10 percent of the poverty line, the estimates for household type, employment status and citizenship of the householder slightly decrease in size, as compared to the baseline model in Column (1), but this decrease is negligible.

6. Conclusions

This paper investigates how poor the poor are in the European countries and to what extent individual and household characteristics of the poor predetermine the size of their income shortfalls from the poverty line. To do that we move from the binary measure of poverty at the individual level to a continuous measure, which captures the shortfall of equalised disposable income from the poverty line (the normalised poverty gap). Using EU-SILC cross-sectional data for 2016, we first analyse the distribution of individual poverty gaps in each country of interest and examine whether countries with similar distributions of poverty gaps also have similar aggregate measures of poverty. As a next step, we identify which individual and household characteristics predetermine the size of income shortfalls from the poverty line in general and whether the importance of these characteristics differs across countries. We also investigate whether individual and household characteristics, which are associated with the size of poverty gaps, are associated in a similar way with a risk of poverty.

We find that in most European countries half of the poor have income shortfalls not exceeding 30 percent of the poverty line whereas only a few percent of the poor have income deficits of 80 percent and more. The composition of the poor in terms of their income shortfalls from the poverty line, however, varies substantially across countries. For example, the proportion of the poor with income shortfalls exceeding 75 percent of the poverty line is smaller than 1 percent in Czech Republic, Cyprus and Slovenia whereas it is higher than 12 percent in Bulgaria, Spain, and Greece.

The analysis points at the importance of inspecting the entire distribution of income shortfalls from the poverty line rather than looking at the summary measures of poverty. We find that although countries with higher summary measures of poverty (i.e. income poverty rate, average normalised poverty gap, and average squared normalised poverty gap), on average, tend to have higher shares of the poor with large income shortfalls from the poverty line, this relationship is not evident. Besides, even if summary measures of poverty might partially reflect the prevalence of the poor with large or small income shortfalls from the poverty line, they tell us nothing about how big the respective shares are.

The multiple-country regression analysis reveals that older individuals, people who do not live alone, and those living in households where the head has either secondary education or a vocational training diploma, on average, are less likely to be poor than their counterparts (younger individuals, single persons, and those whose household head has only a primary education). Once poor, such people also face smaller income shortfalls from the poverty line. An opposite applies to individuals from the households, where the head is unemployed or inactive, or where the head does not hold the citizenship of the country of residence. Such individuals are not only more likely to be poor compared to those living in households with an employed head or where the head is a citizen, but also experience larger income shortfalls from the poverty line.

One of the most important findings from the multiple-country regression analysis is that women, on average, have a higher probability of being poor but, once poor, face smaller poverty gaps compared to men. Individuals living in households with a retired head or with a larger number of children, also have higher chances of being poor but, once poor, do not have larger income shortfalls from the poverty line than their counterparts (those who are employed or those who live in households with a smaller number of children), other things being equal. In contrast, members of the households, where the head has a tertiary education, face much lower chances of becoming poor but, once poor, have income shortfalls of the same size as those with primary education.

While looking across countries, we find some similarities but also a substantial variation in the effects of covariates on the size of normalised poverty gaps. The cross-country results are the most consistent for the estimates on age, gender, number of children, and household types. Once significant, age and gender are negatively associated with the size of poverty gaps implying that older individuals and women have smaller income shortfalls from the poverty line than young people and men. The number of children is an important predictor of the size of normalised poverty gaps in 9 out of 24 countries. In all these countries, but Spain, it has a

negative association with the size of income shortfalls from the poverty line. With respect to household types, once statistically significant, the estimates are negative in all countries but Belgium, Greece, and Croatia implying that individuals who are not single have at least the same, but often even smaller income shortfalls from the poverty line as those who live alone in most European countries.

The differences across countries are more noticeable for other characteristics. For example, we find that individuals living in households where the head is unemployed have larger income shortfalls from the poverty line in most of the countries studied. However, the estimates are not statistically significant for Germany, the Netherlands, Austria, and Sweden and they are even positive in Denmark. Similarly, having a vocational degree rather than primary education helps to decrease the poverty gap only in Germany and Finland whereas in other countries it does not bring any benefit in terms of a reduction of income shortfalls from the poverty line. Further investigations are needed to understand which country-specific economic and policy conditions underlie the cross-country variation in the effects of household characteristics on the size of normalised poverty gaps. We leave these questions for future research.

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APPENDIX A

Table A1. Number of observations with small values at the bottom of the distribution of total household equivalised disposable income, by country

Country	Total number of observations among the poor	Number of observations with negative or zero income values	Number of observations with incomes < 10% of the poverty line
Belgium	2087	26	44
Bulgaria	4074	21	112
Czech Republic	1439	6	8
Denmark	695	44	48
Germany	4065	92	155
Estonia	3079	39	73
Greece	9091	351	629
Spain	6794	106	244
France	3350	24	48
Croatia	3915	48	96
Republic of Cyprus	1673	0	5
Latvia	3350	44	85
Lithuania	2141	49	70
Hungary	2695	43	85
The Netherlands	2396	80	117
Austria	1551	14	63
Poland	5857	35	103
Portugal	5608	0	110
Romania	3698	119	183
Slovenia	2863	0	1
Slovakia	1985	29	60
Finland	2024	2	18
Sweden	1364	22	52
The United Kingdom	3245	115	154
Total	79039	1309	2563

Note: The data refer only to the sample of the poor. Under income we refer to total household equivalised disposable income.

APPENDIX B

Table B1. Mean values of the covariates among the poor, by country

<i>Covariates</i>	BE	BG	CZ	DK	DE	EE	EL	ES	FR	HR	CY	LV
Age of the individual	40.16	41.18	39.20	35.21	44.09	48.19	38.76	36.89	34.28	45.17	39.34	49.93
Gender of individual (female)	54.01	53.97	56.84	51.26	54.44	58.60	51.17	50.11	54.51	54.27	54.91	59.44
<i>Household type</i>												
Single	22.06	21.63	27.33	52.46	41.31	44.19	10.58	9.24	18.19	19.08	12.01	33.66
Couple	49.69	41.66	51.10	32.57	43.31	40.06	50.79	58.91	55.18	44.09	59.28	42.11
Single parent	14.39	5.43	13.23	11.25	10.13	6.63	1.94	5.46	14.27	2.27	3.83	7.35
Other	13.86	31.28	8.34	3.72	5.24	9.12	36.69	26.39	12.37	34.56	24.87	16.89
Number of children	1.020	1.137	1.033	0.620	0.542	0.675	0.926	1.000	1.269	0.984	0.900	0.639
<i>Employment status of the HH</i>												
Employed	23.28	39.22	32.86	30.24	34.45	32.55	28.59	34.51	43.83	28.52	43.45	32.68
Self-employed	6.15	5.28	13.39	3.29	4.26	7.81	28.32	15.27	13.57	3.88	5.50	4.69
Unemployed	17.61	16.14	19.24	12.39	16.38	5.56	14.16	25.41	16.55	17.13	17.63	7.65
Retired	26.22	30.14	23.21	15.31	27.38	41.70	19.84	13.42	15.81	44.61	25.96	45.88
Inactive	26.74	9.21	11.29	38.77	17.53	12.37	9.09	11.39	10.23	5.85	7.46	9.11
<i>Education of the HH</i>												
Primary	46.70	58.42	28.01	27.31	21.12	29.01	48.72	68.14	39.91	49.32	46.27	33.24
Secondary	12.00	31.26	5.09	25.40	48.76	41.53	31.61	16.24	9.75	36.49	40.16	43.61
Vocational	23.80	4.85	60.33	18.11	10.39	7.29	7.83	1.95	34.78	12.04	5.14	10.26
Tertiary	17.50	5.46	6.57	29.18	19.73	22.17	11.84	13.67	15.56	2.16	8.41	12.89
HH is an immigrant	18.83	0.24	2.86	6.24	7.47	22.11	12.36	19.61	16.31	2.68	25.93	19.45
Average normalised poverty gap among the poor (in %)	22.53	35.71	22.32	27.97	27.00	7.96	37.08	35.79	22.36	31.52	21.28	31.02

Table B1 (continued)

<i>Covariates</i>	LT	HU	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK
Age of the individual	43.18	37.02	37.28	39.30	38.41	42.75	36.38	44.32	32.96	41.06	38.49	40.75
Gender of individual (female)	57.37	52.41	50.17	52.58	52.02	54.45	52.17	55.29	51.24	50.75	52.72	52.44
<i>Household type</i>												
Single	35.01	18.33	32.55	27.42	14.32	12.45	13.59	32.35	10.03	51.58	41.27	22.16
Couple	42.87	52.61	53.39	46.39	41.00	54.56	48.23	48.38	50.58	37.31	37.76	54.64
Single parent	11.54	11.59	9.42	7.03	2.93	6.58	2.63	6.10	4.49	8.44	13.37	11.76
Other	10.58	17.46	4.65	19.16	41.75	26.40	35.56	13.17	34.90	2.66	7.60	11.43
Number of children	0.892	1.099	0.988	0.886	1.068	0.828	1.546	0.625	1.600	0.818	1.004	0.892
<i>Employment status of the HH</i>												
Employed	32.77	54.88	32.89	39.00	39.88	42.23	23.63	29.82	38.53	17.83	33.20	35.91
Self-employed	5.09	4.17	11.40	9.59	17.75	9.66	39.96	12.01	21.34	8.73	7.33	13.84
Unemployed	13.83	14.93	8.14	16.56	4.49	12.74	2.56	15.19	18.72	20.18	11.16	5.89
Retired	32.31	13.56	11.93	22.71	20.80	26.89	24.83	35.94	14.26	24.28	23.38	22.86
Inactive	16.01	12.46	35.64	12.14	17.07	8.48	9.02	7.03	7.13	28.97	24.93	21.50
<i>Education of the HH</i>												
Primary	24.18	41.60	33.26	28.37	26.75	84.79	63.35	36.01	26.47	28.00	40.32	45.56
Secondary	37.87	38.71	35.86	35.73	7.79	9.26	31.02	43.71	50.70	42.76	25.28	14.70
Vocational	24.94	8.75	7.35	10.55	59.21	1.95	3.53	9.32	14.23	14.33	12.39	13.59
Tertiary	13.01	10.94	23.53	25.35	6.25	4.00	2.10	10.96	8.61	14.90	22.01	26.15
HH is an immigrant	2.18	0.20	6.51	38.66	0.19	3.33	0.00	10.16	0.03	4.26	19.85	13.34
Average normalised poverty gap among the poor (in %)	32.79	27.07	26.42	26.81	28.61	30.61	39.01	24.24	31.75	19.88	26.78	30.12

Note: HH stands for the household head. All estimates are weighted using personal cross-sectional weights.