Subjective Equivalence Scales in Eastern vs Western European Countries

ABSTRACT:

We show that economies of scale estimated individually for each EU country differ from the officially adopted OECD-modified scale; the differences across the countries further confirm the prevailing East-West disparity. Using the minimum income question in the 2019 EU–Statistics on Income and Living Conditions survey, we demonstrate that applying the estimated country-specific subjective equivalence scales, instead of the uniform OECD-modified scale, results in up to a 6 pp change in the at-risk-of-poverty rate. If inadequate equivalence scales are used, the equivalised income fails to inform the statistics of income poverty and prevents national social policies from being correctly targeted.

Keywords: Europe; equivalence scale, income poverty, subjective poverty line.

JEL codes: I32, P36, P46.

I INTRODUCTION

The European Union applies a concept of relative income poverty for reporting on and studies into the economic wellbeing of its citizens. The at-risk-of-poverty rate, the official income poverty measure in the EU, is defined as the share of people whose equivalised disposable household income falls below 60% of the median equivalised national income, resulting in different poverty lines across different countries. In the relative concept adopted in the EU, equivalent income is based on an OECD-modified scale, a modified version of the original OECD (Oxford) scale developed in the 1980s, which has been used since the 1990s. The modified scale gives a weight of 1 to the first adult, 0.5 to each additional adult and 0.3 to each child in a given household.

Early studies of the OECD-modified scale recommended attention to cross-country comparisons and argued that the key question of whether to use a single equivalence scale for all countries or a

single methodology to estimate equivalence scales, which likely differ across countries, should be resolved (Hagenaars et al. 1994, p. 194). This study opts for the latter route, recognizing that economies of scale can be strongly country-specific, and depend on the national structure of living costs, consumption rates of durable and non-durable goods as well as goods with different economies of scale in general. This has been shown in previous research across countries and in studies based on different sets of consumption goods and services (among many, see Buhmann et al. 1988; Hagenaars et al. 1994; Goedemé et al. 2017).

As far as we can determine, the OECD (-modified) equivalence scale was based on available research related to equivalence scales derived using various methods with data from Western European countries and other market-oriented OECD countries. While it was not possible to locate an original study providing arguments for adopting the OECD-modified scale, Hagenaars et al. (1994, p. 194) call it "*a pragmatic choice and should be considered as arbitrary as the choice of the original OECD scale*", supported by its closeness to the average of the scales derived in the literature. Moreover, the official equivalence scale used in the EU has not been updated since the 1990s despite numerous countries with different economic levels joining the EU since the 2000s.

Dennis and Guio (2004) have argued that the change of the original OECD scale with lower economies of scale to the OECD-modified scale resulted from a decreased share of food consumption expenditures, supposedly exhibiting relatively low economies of scale. However, the consumption structure has continued to evolve since the 1990s with a decreasing food share.[1] After joining the EU, the former socialist Eastern European block adopted the OECD-modified equivalence scale, overlooking the notable differences in the structure of household consumption expenditures between the Eastern block and Western European (WE) countries. The Eastern

[1] Eurostat database, variable hbs_str_t211; shares derived by the authors.

European (EE) countries have experienced a similar decreasing trend of expenditure shares on food, with the trend lagged behind WE.

It is thus questionable whether the OECD-modified equivalence scale is applicable to current European societies. In this vein, it is expected that the current economies of scale are higher than those assigned by the OECD-modified scale. Further, they may differ across countries, especially when contrasting Eastern and Western European countries as a result of the different consumption structures in the two regions. Economies of scale may also be affected by cultural differences, which may result in inconsistencies with the theoretical expectations. Daley et al. (2020) have discussed the possible impacts of "eating out" on different scale estimations based on food consumption in the US and Canada. Similar cultural differences can also potentially be observed in the EU. For instance, in some Southern European countries, larger families spend disproportionally more on food.[2]

Based on equivalence scales derived from subjective data, Bishop et al. (2014) have noted that WE countries with well-developed welfare states (a high degree of in-kind transfers) show greater economies of scale than those with less well-developed welfare states, represented by three Southern European countries. This argument could be valid for in-kind benefits, but less for cash benefits. Nevertheless, there might be differences based on aggregate income level that would support our expectations of East-West differences. In such a case, richer countries and their populations with relatively high living standards would exhibit higher subjective economies of scale simply because they perceive additional household members as being less costly than in

[2] Household Budget Survey 2015 microdata.

poorer countries with lower living standards. This could even mean that subjective and expenditure-based weights may differ in Eastern and Western European countries.

In order to estimate the equivalence scales, we have adopted an approach which utilises responses to a subjective question about the minimum income required to make ends meet. This subjective approach is outlined in Section II as part of the literature review. This choice is primarily based on the availability of data.[3] In particular, we use the internationally harmonised and comparable survey Statistics on Income and Living Conditions (EU-SILC) for 24 EU countries to derive the specific equivalence scales for each country; the data and variables used are described in Section III.

The methodology is explained in detail in Section IV. While the main contribution of our study has empirical value, we have developed a simple methodological approach that represents a compromise in terms of similarity, simplicity, transparency and comparability of the estimated equivalence scales to the OECD-modified scale. To the best of our knowledge, the methodological novelty of this study lies primarily in providing estimations of the equivalence scale with the same structure which are directly comparable to the adult and child weights assigned by the (country-uniform) OECD-modified equivalence scale. We compare our subjective-based scales (Section V) with a focus on the prevailing East-West division of the European Union.

The substance of an analysis of an equivalence scale lies in its potential application. Hence, the main question is how the newly established country-specific subjective equivalence scales would change the relative income poverty rates in EU countries (Section V). Indeed, a choice of equivalence scales can influence cross-country comparisons and impact the demographic composition of the poor (Hagenaars et al. 1994). However, the difference between the official and

[3] The latest available EU-HBS microdata are from 2015; and the EU-HBS survey is harmonised to a much lesser degree than the EU-SILC survey.

estimated rates within a country is not entirely predictable as it depends on two main factors: firstly, how much the estimated country-specific scales differ from the OECD-modified scales, and secondly, how sensitive the countries' income poverty rates are to the equivalence scale (Mysíková and Želinský 2019). Importantly, an equivalence scale that does not reflect national conditions might lead to biased estimates of equivalised income and misinform social policies about the pool of income-poor population. These issues are discussed in the results and in Section VI.

II LITERATURE OVERVIEW: SUBJECTIVE POVERTY LINES AND EQUIVALENCE SCALES

In much of the existing literature, equivalence scales have been estimated based on consumption/expenditure data (for example, see Muellbauer 1980; Merz et al. 1994; Lazear and Michael 1998; Phipps and Garner 1994; Daley et al. 2020). The most well-known behavioural method for estimating equivalence scales is based on Engel (1895), with food expenditures serving as the basis for calculation. These tend to result in equivalence scales with lower economies of scale than in studies in which more expansive bundles of goods and services are considered (see Daley et al. 2020; Phipps and Garner 1994).[4]

However, there is a growing body of literature which uses data on subjective perceptions of economic well-being to derive equivalence scales. Examples include the use of income evaluation and/or minimum income questions (Bishop et al. 2014; Carbonnier 2019; De Vos and Garner 1991; Flik and Van Praag 1991; Garner and De Vos 1995; Hagenaars et al. 1994; Kapteyn at al. 1988; Martin 2017), minimum spending questions (Garner and Short 2003 and 2004), evaluation of

[4] Another behavioural approach, the Rothbarth method, was used by Lazear and Michael (1988) to derive equivalence scales based on assumptions regarding the allocation of income for collective expenditures, and private expenditures for adults and children.

income satisfaction (Bütikofer and Gerfin 2009) and personal evaluations of material well-being (Abanokova et al. 2019).

Generally, the subjective approach explicitly recognises that poverty lines are inherently subjective judgments people make about what constitutes a socially acceptable minimum standard of living in a particular society (Ravallion 1992). The best-known methods for estimating subjective poverty lines usually compare actual income to the subjective perceptions of a household's situation (Hagenaars and de Vos 1988). A seminal study by Goedhart et al. (1977) introduced two approaches for estimating subjective poverty lines: the subjective poverty line based on survey responses to a minimum income question; and the Leyden poverty line which is based on a so-called income evaluation question (see also Kapteyn at al. 1988).

Given the availability of European data, the current study focuses on the minimum income question (MIQ). This asks respondents to declare the minimum amount of income they need to make ends meet. On Dutch data from the 1970s, Goedhart et al. (1977) showed that the welfare level associated with a respondent's minimum income is dependent on her/his actual income. It follows that "*richer people are more demanding with respect to their minimum income than are poor people, not only in money terms but also in welfare terms*" (pp. 513–514). The subjective minimum household income needed is not only dependent on income but inevitably on household size as well. We apply a model-based method to define subjective poverty lines (SPL), intersecting responses to the MIQ with reported actual income, while controlling for other household demographic and economic characteristics. In particular, we estimate the SPLs for households of various sizes in order to derive specific equivalence scales for each country. We then compare our subjective-based scales with the officially used (country-uniform) OECD-modified scale by

combining the marginal income needed for adults and children into two parameters, as in the OECD-modified scale.

Studies using the same SPL approach can be divided into two streams. Some apply the SPL to derive the subjective poverty rate, typically concluding that the SPL is higher than the official "objective" income poverty line. The resulting subjective poverty rate is thus higher than the official one (Želinský et al. 2021, analysed the trends of subjective poverty in EU countries; García-Carro and Sánchez-Sellero 2019, focused on Spain in the 2010s; De Vos and Garner 1991; and Garner and De Vos 1995, compared U.S. and Dutch data from the 1980s; Saunders et al. 1994, analysed Sweden and Australia in the 1980s and 1990s;). Other studies have utilised SPLs to derive subjective equivalence scales, mostly concurring that the economies of scale estimated using a subjective approach are higher than those assigned by the OECD-modified scale.

Garner and Short (2003, 2004) estimated subjective poverty thresholds using MIQ with data collected in the U.S. The implicit economies of scale from their estimation of subjective poverty thresholds are indeed higher than those in the OECD-modified scale. Saunders et al. (1994) used an SPL approach and identified the weights of adults as 0.14 in Australia and 0.25 in Sweden, and the weights of the first child as 0.06 in Australia and 0.16 in Sweden. These results suggest that subjective equivalence scales will indicate lower weights than both the OECD and OECD-modified scales.

Bishop et al. (2014) have provided an analysis similar to our study regarding subjective equivalence scales. Based on pooled EU-SILC data for 2004–2007, they include 15 Euro-Zone countries (thus excluding most EE countries, though the Euro-Zone does include Slovenia and Slovakia), using MIQ and applying the intersection method. In contrast to our study, they limit the sample to the six most common household types (e.g., excluding single-parent families) and do not control for any

additional household characteristics. Their study was further extended by Kalbarczyk-Steclik et al. (2017) who analysed 23 European countries, including Central and Eastern European (CEE) countries. This took place over a longer period (2005–2012), employing the same sample and control variables restrictions. They showed that economies of scale were lower in CEE than in the Euro-Zone (EZ, including Slovakia), when pooled data for the two regions were used. Moreover, while the subjective equivalence scale was stable in the EZ, the estimated values were declining in CEE.

Our study is based on a similar methodological approach to Bishop et al. (2014) and Kalbarczyk-Steclik et al. (2017), using updated data. However, there are important differences relevant to policy application. First, we produce estimated subjective equivalence scales in values that are directly comparable to the adult and child weights implicit in the OECD-modified scale. If a change in the scale were to be implemented into the official European statistics, it is important to provide a clear and simple comparison. While prior studies share the same motivation, they leave the estimates at the stage of various equivalence scales for different types of households. Second, previous studies have limited their samples to six types of households, thus providing five combinations of applicable weights. In contrast, we provide estimates based on the whole sample, not excluding any household types. We believe that less common household types such as single parent households, make up a non-negligible share of populations, especially when the results are applied to identify the poor. Lastly, Bishop et al. (2014) "*use exogenously determined poverty cutoffs*" (p. 274) so the impacts of the estimated scales on income poverty rates are incomparable with our results.

III DATA AND VARIABLES

The analyses presented in this study are based on the 2019 version of the EU-SILC[5] household survey, which has been conducted annually since 2005. It is collected by national statistical offices, harmonized by Eurostat, and is compulsory for all EU member countries. The survey collects data at both the household and individual levels; all household members older than 15 are surveyed. Self-evaluation of living conditions, including the MIQ, is collected at the household level, meaning that the household reference person answers on behalf of her/his household. Characteristics of demographics and economic activity are collected at the individual level. Actual income is collected at both the individual and household level, depending on the income source and the country's specificities. This is to ensure all income sources are captured as accurately as possible. A variable of total household disposable income is then constructed by the national statistical offices.

The analyses performed in this study are based on household level data as well as several individual characteristics. Households with non-positive or missing actual income were excluded (about 0.4% of the European sample). As the focus is on the distinctions between Eastern (post-communist EU member countries) and Western Europe, all EU countries are included with the exception of Cyprus and Malta which do not conform to our definition of "Eastern Europe". Croatia was excluded due to the high number of missing values (14%) of the dependent variable MIQ, the values, moreover, seems to be missing unevenly across the distribution of the actual income. Western European countries are defined as the "old EU member" states (the UK was not included in the dataset). A list of abbreviations of countries indicating the East-West division appears in Table 1.

[5] EU-SILC – Cross UDB 2019 – version of 2021-03.

TABLE 1

Country abbreviations

Eastern Europe (EE):				**Western Europe (WE):**			
BG	Bulgaria	**RO**	Romania	**AT**	Austria	**FR**	France
CZ	Czechia	**SI**	Slovenia	**BE**	Belgium	**IE**	Ireland
EE	Estonia	**SK**	Slovakia	**DE**	Germany	**IT**	Italy
HU	Hungary			**DK**	Denmark	**LU**	Luxembourg
LT	Lithuania			**EL**	Greece	**NL**	Netherlands
LV	Latvia			**ES**	Spain	**PT**	Portugal
PL	Poland			**FI**	Finland	**SE**	Sweden

We follow the stream of literature employing control variables in the regression model used to estimate the SPL (e.g., De Vos and Garner 1991; Gustafsson et al. 2004; Gustafsson and Ding 2020), whereas Goedhart et al. (1977) used only household size and actual income (see also Saunders et al. 1994; Bishop et al. 2014). Kapteyn and van Praag (1976) did not include control variables but estimated the results separately for subsamples according to education, degree of urbanization and wife's economic activity.

The logic behind our approach is that people do not assess their living conditions solely based on income. Indeed, it can be assumed that they also consider their costs and expenditures (Večerník and Mysíková 2016). Even households with identical incomes and structures may require different minimum incomes for various reasons. Therefore, in addition to actual income and household structure, we control for other household demographic and economic variables.[6] Goedhart et al. (1977, p. 518) have argued that: "*In fact, any quantifiable factor that has a measurable effect on the individual's welfare parameter* μ *(and thus presumably on* y_{min} *as well) might be incorporated into the definition of the poverty line*".

[6] Note, however, that subjective equivalence scales estimated using models without controls appear in Table A.3 in the Online Annex: We have not identified any single control variable that alone would cause a substantial change in the resulting weights; rather the contrary – adding the controls step by step alters the weights gradually.

The dependent variable in our regression models is the MIQ. This is answered by the household reference person, framed as: "*In your opinion, what is the very lowest net monthly income that your household would have to have in order to make ends meet, that is, to pay its usual necessary expenses? Please answer in relation to the present circumstances of your household, and what you consider to be usual necessary expenses (to make ends meet).*" The minimum income thus represents monthly net income and is transformed into its natural logarithm form.

The key explanatory variables are the (log of) actual income and household size. The actual total disposable household income includes the net labour and non-labour income of all household members after taxes and social deductions, and the various social benefits (including pensions) received at either the individual or household level.[7] Household size is specified in terms of dummy variables to facilitate the derivation of the equivalence scale. We derive the equivalence scale in the same structure as the OECD-modified equivalence scale, which considers a single-adult household as a reference household. While this may not be ideal (Betti et al. 2017), as single households are not the most common type, we compromise in favour of similarity, simplicity and comparability of the construction of the equivalised household income.[8] As noted earlier, in the OECD-modified equivalence scale, the weight of the first adult is 1.0, while the weight assigned to all other adults is 0.5, and each child (persons aged 13 or younger) has a weight of 0.3. The

[7] As actual income corresponds to annual income in the EU-SILC, one twelfth of the reported value is taken into account. The EU-SILC is usually conducted in the second quarter in most countries, and the income reference period corresponds to the previous calendar year. However, some questions including the MIQ are related to the current situation. We are aware of the possible inconsistencies between the current and previous year reference periods. However, the income reference period is considered to provide the best approximation of current income, as suggested by Eurostat (2010), and is also used in this manner in official statistics.

[8] The literature includes examples in which a different type of household, e.g., the modal type, are considered as the reference. Among others, Betti et al. (2017) demonstrate on Turkish data that the sensitivity of the poverty measures to equivalence scales could be higher when more household types deviate from the reference type. According to Betti et al., the reference household type should then be the "central" household type. In the pooled EU-SILC 2019 data, one-adult households comprise 37%, while two-adult households are 44% (regardless of the number of children). Childless households (regardless of the number of adults) account for 77% of households.

actual household income is then divided by the sum of the weights of all household members (the equivalised household size) to obtain the equivalised income applied in the construction of the at-risk-of-poverty rate.

Our goal is to estimate the weights of adults and children separately to create a scale that is comparable to the OECD-modified scale. Contrary to prior studies, we aim to construct a single weight for adults and one for children, producing a two-parameter scale that is directly comparable to the OECD-modified scale. The most straightforward and transparent way is to first include the number of adult household members (16 and older)[9] in the model as three dummy variables representing households with two adults, three adults and four and more adults; the reference group consisting of households with one adult.[10] Second, the number of children is translated into three dummy variables representing households with one child, two children and those with three or more children; the reference group includes households with no children.

In addition to the key explanatory variables, we control for a range of household characteristics. In most of the seminal studies on SPL, individual characteristics of the head of the household or the reference person enter the model. We consider the concept of defining the head of a household to be unsustainable. Formerly, men were automatically regarded as the head of a household in nuclear families. Yet, with changing female labour market participation and changing gender roles in recent times, such a definition has become less universally plausible. On the other hand, reference persons (persons responding to the household questionnaire) in the EU-SILC tend to be overrepresented by

[9] Note that the OECD-modified scale defines adults as 14+, while we define them as 16+, in accordance with the EU-SILC survey. However, in the same way as we question the appropriateness of adopting the OECD-modified equivalence scale without country-specific research, the age definitions could also be questioned; we consider the age definitions to be essentially irrelevant at this stage of research. Moreover, adults are defined as 16+ in the studies most comparable to ours (Bishop et al. 2014; Kalbarczyk-Steclik et al. 2017).

[10] In the 2019 European pooled sample, households with 4+ adult members make up 7% of households, households with 3+ children amount to 2%. We intend to apply a uniform method for all countries; otherwise, the number of dummies could have been selected according to the national household structures.

women. We also hesitate to define the household head according to economic activity or individual income level. Indeed, we avoid assigning one household member's characteristics to the whole household and thus constructing an artificial status of the household (see Večerník and Mysíková 2019, for a discussion of the difficulty of establishing the status of a household).

Instead, we define the control variables describing individual characteristics as shares within adult household members. We transform the original individual-level variables, which typically influence the individuals' earnings or household level earnings, to household-level variables as a share of adult household members possessing a specific characteristic from the total number of adult members. These include: the share of members currently working in paid employment, females, members with tertiary education (defined by ISCED codes 5-6) and younger members aged 16 to 30.

Household level control variables also enter the model. These include the type of ownership of the dwelling, the degree of urbanization of the place of residence, and material deprivation of households. The type of ownership of the dwelling impacts the financial demands of a household. We distinguish between a dummy variable for outright owners (and for those with free accommodation, e.g., living at a relative's home rent free) and a dummy variable for owners paying a mortgage (the reference group being tenants paying either the full market or reduced rate rent). The financial burden of paying a mortgage or renting can be similar in some countries, while it can differ in others, depending on the conditions of the financial and housing markets. The degree of urbanization is defined in terms of two dummies for densely and medium populated areas (with "thinly populated" as the reference group). Finally, we include a binary indicator for "severely materially deprived" households, provided by official EU statistics (see Decancq et al. 2013, for

definitions), to further capture the financial strain on households.[11] The descriptive statistics of the variables are provided in Table A.1 (in the Online Annex).

The set of control variables describes the housing, material and working conditions of a household, serving as an overall proxy for household living standards. In general, these characteristics are related to varying living costs, habits, aspirations and expectations as well as to different reference groups of individuals and families to whom the respondents might compare their situations (Gustafsson and Yue 2012). In all regression models, country household cross-sectional weights are employed. Subsequently, the resulting income poverty rates are weighted by individual cross-sectional weights, so that the poverty rates represent shares of income-poor individuals (not households). This is in line with the EU official at-risk-of-poverty rate, referred to as the official or objective income poverty rate hereafter.

The dependent variable, MIQ, is missing for a substantial share of households in some countries: Ireland (16%), Denmark (18%), Sweden (25%), and the Netherlands (30%).[12] Though we provide outcomes for the four countries with relatively high shares of missing values, the results should be interpreted with caution. The final sample sizes range from 3,500 households in Ireland to 20,600 households in Italy. Further, the degree of urbanisation is not available for Germany, the Netherlands or Slovenia while only two categorical groups are provided in the data in Estonia and Latvia. The regression models (see Table A.2 in the Online Annex) were run without these control

[11] Bishop et al. (2014) prefer not to include control variables (e.g. marital status or age of household head) mainly because of their possible correlation with household structure, which could contaminate the results. We do not apply these particular controls. The correlation of the number of adults with control variables rarely exceeds 0.4 (correlation with shares of young adults ranges between 0.40 and 0.45 in four countries).

[12] We tested whether the key explanatory variable – actual income – differs between the groups of households with missing and valid MIQ. The means of actual income are not statistically different in these four countries.

variables for DE, NL and SI, and with one dummy only for EE and LV, which should be kept in mind.

IV METHODOLOGY

The methodology applied in this study includes two key steps. First, we identify the subjective poverty lines using the intersection method, and second, we derive the subjective equivalence scales from the estimated subjective poverty lines.

The Intersection Method

In this study, the SPL estimations are based on the survey responses to the MIQ. The minimum income is estimated as a function of actual income. The intersection of the lines representing the equality of minimum and actual incomes (i.e., the 45-degree line in Figure 1) determines the subjective poverty line. The intersection in the SPL approach assumes that only respondents with incomes equal to their subjective minimum incomes have a realistic idea of the minimum income level. Richer respondents tend to overestimate their minimum necessary income while poorer respondents tend to do the opposite. Therefore, the minimum income increases with actual income. Indeed, Goedhart et al. (1977, p. 514) have noted that a "*respondent's perception of the poverty line is distorted by the fact that his [her] actual income is not equal to his [her] minimum income level*". This misperception does not happen only at the intersection, the income level defining the poverty line. As Goedhart et al. (1977) argue, it is still not an option to include only those whose actual income covers only necessities in the estimation of subjective poverty lines. It is not *a priori* known which respondents have income equal to the MIQ and thus, all respondents' answers are needed to obtain the estimated function.

The left panel of Figure 1 depicts the intersection in double logarithmic form (see Goedhart et al. 1977, p. 513). The non-logarithmic form is then depicted in the right panel of Figure 1; the subjective minimum income function is typically concave. The vertical axis represents the subjective minimum income (Z) and the horizontal axis the actual income (X). The intersection (Z^*), where $Z = X$, determines income which can be regarded as the subjective poverty line. The SPL divides the population into two parts: (1) poor: those whose actual household income is lower than the poverty line ($X<Z^*$), and (2) non-poor: those whose actual household income is higher than the poverty line ($X \geq Z^*$).

FIGURE 1 over here

Following Goedhart et al. (1977), the subjective poverty line is thus calculated as the income level at which $Z = X = Z^*$ given the function:

$$\ln(Z) = \alpha + \beta \ln(X), \tag{1}$$

which yields

$$\ln(Z^*) = \frac{\alpha}{1-\beta}. \tag{2}$$

We run an OLS regression model to estimate the SPLs for households with various numbers of adult and child members. The additional explanatory variables enter the right-hand-side of Equation (1):

$$\ln(Z) = \alpha + \beta \ln(X) + \sum_{i=1}^{3} \gamma_i A_i + \sum_{j=1}^{3} \delta_j C_j + \sum_{l=1}^{n} \theta_l D_l, \tag{3}$$

where A stands for three (i) dummy variables for the number of adults, C stands for three (j) dummy variables for the number of children, D represents the n number of control variables. $\alpha, \beta, \gamma, \delta$, and θ represents the corresponding regression coefficients.

Subsequently, the estimate of the SPL is given by an extension of Equation (2):

$$\ln(Z^*) = \frac{\alpha + \sum_{i=1}^{3} \gamma_i A_i + \sum_{j=1}^{3} \delta_j C_j + \sum_{l=1}^{n} \theta_l D_l}{1-\beta}. \quad (4)$$

The thresholds across the EU countries not only differ based on the intersection points, but also on the differences in characteristics across the countries. In order to derive the SPLs for various household types for each country (applied to derive the subjective equivalence scales presented in Section V), the relevant household size variables are kept at the required values to represent the implicit equivalence scale weights for adults and children, with the rest of the explanatory variables at their national means; actual income does not enter equations (2) or (4).[13] For instance, the SPL for a one-adult household is derived with the values of the three dummies for adults set to zero, and the three dummies for children (and other explanatory variables) set to their country means.[14] The SPLs for adults are thus valid regardless of the number of children in a household. As noted earlier, household size enters the estimation in terms of dummy variables for adult and child household members; the averages for each thus reflect the national household structure.

Equivalence Scale

Subjective equivalence scales (SES) are derived from the SPLs for various household types. For comparability with the OECD-modified scale, single final weights W^A and W^C for adults and children respectively, can be derived from the SPLs.

As a first step, the partial weights, *p* for adults and children are derived separately as the relative change in the adult and child specific SPLs when an additional person is added, as noted in

[13] See Garner and Short (2004, pp. 331-332 and Table 8) for a discussion of whether to set the other characteristics to country means or to allow them to vary through the production of household-specific subjective thresholds.
[14] Deriving an SPL for the average number of household members is common practice in the literature (e.g., Gustafsson and Yue 2012).

equations (5) and (6) below. The weights are defined as the additional income needed to meet one's needs (or marginal costs in alternative terminology), relative to the minimum income needed by the reference group (SPL_0).

$$p_i^A = \frac{SPL_i^A - SPL_{i-1}^A}{SPL_0^A}, \quad (5)$$

$$p_j^C = \frac{SPL_j^C - SPL_{j-1}^C}{SPL_0^C}, \quad (6)$$

where *A* and *C* denote adults and children, *i* stands for the additional adults, and *j* for each additional child (as in Equation (3)).

As a second step, we derive the final adult (child) weight W^A (W^C) as the weighted average of the partial weights *p* according to the shares (*s*) of households with two-, three- and four-or-more-adults (one child, two children, and three or more children) in each country. Such an approach allows us to directly compare a two-parameter equivalence scale (a single weight for additional adults and a single weight for children) based on the derived partial weights and household structures, to the OECD-modified equivalence scale.

This approach can be formalised by the following equations:

$$W^A = \sum_{i=1}^{3} p_i^A s_i^A, \quad (7)$$

$$W^C = \sum_{j=1}^{3} p_j^C s_j^C, \quad (8)$$

where *W* stands for the final, weighted average marginal income needed. This can be contrasted with the weights assigned by the OECD-modified equivalence scale. The share (*s*) of the corresponding households with their differing numbers of adults and households with differing numbers of children in a country represents the structure of households. Moreover, it holds that

$\sum_{k=1}^{m} s_k = 1$, where m is the number of additional adults or children considered (i.e., the number of dummy variables used for adults or children).

Table 2 demonstrates this approach on the example of Czechia which has the lowest official at-risk-of-poverty rate in the EU. The estimated functions and the intersections (SPLs) for households of 1 to 4+ adult household members and for households with 0 to 3+ children are displayed for all countries in Figures A.1 in the Online Annex. In comparison to a one-adult household, a household of two adults requires an additional 34% higher minimum income (p^A for the second adult).[15] A third adult member creates the need for an additional 23% higher minimum income (p^A for the third adult) while fourth and subsequent adult members require an additional 24% (p^A for fourth and next adults). This implies that as the number of adults increases beyond a certain point, fewer economies of scale result. In some countries, the higher partial weight of fourth and subsequent adults than that of the third adult is partly given by the fact that the top group of 4+ adults is open (includes up to 12 adults, however, only 1.4% of households in the EU sample have 5+ adults). As the final weight W is weighted by the household structure in a country, we consider the upward bias to be relatively negligible. Nevertheless, a higher weight for the top adult category can also be found in Kalbarczyk-Steclik et al. (2017), though their top categories are not open. This phenomenon can be seen in nine out of the twenty-three countries in their study.

The weights for children are similarly derived; with the addition of a child to a childless household, an additional 14% higher minimum income is needed (p^C for the first child).[16] Although the weight of the top child category is likely to be upward biased because the category is open, the final child weight is less affected due to a low share of households with large numbers of children as

[15] With an average number of children, which is 0.40 in CZ (0.37 in the EU sample).
[16] Analogously, we compare households of average number of adults, which is 1.94 in CZ (1.90 in the EU sample).

represented by the top category. There might be an additional reason for the relatively higher weight for 3+ children. When there are 3+ children in a household, the oldest child can be sometimes close to adult age. As the adult marginal minimum incomes needed are generally higher, this can affect the weight of 3+ children. Economies of scale are likely to differ for new-borns and teenagers. However, distinguishing child weights by age is beyond the scope of this study.

TABLE 2

Monthly Subjective poverty lines (in Euros) and an equivalence scale derived for Czechia

Adults	SPL^A	Partial weight of additional adult (p^A)	Structure of households (s^A)	**Children**	SPL^C	Partial weight of additional child (p^C)	Structure of households (s^C)
1 adult	609			Childless	741		
2 adults	815	0.340	0.715	1 child	842	0.136	0.548
3 adults	956	0.230	0.199	2 children	877	0.047	0.383
4+ adults	1,099	0.235	0.087	3+ children	957	0.107	0.070
Final weight (W^A)		**0.309**	**$\sum = 1.0$**	**Final weight (W^C)**		**0.100**	**$\sum = 1.0$**

Source: EU-SILC 2019. Authors' computations.
Notes: SPL is estimated using OLS regression; see Section III for control variables.

Hence, as opposed to the OECD-modified scale in which economies of scale are assumed to be uniform (the weight of 0.5) for each additional adult, the marginal minimum income needed declines with adult household members and the weight for each additional adult diminishes. The resulting single weight W^A of the second and subsequent adults is 0.309. The same exercise for children yields a weight W^C of 0.100. As expected, the subjective equivalence scale shows higher economies of scale (weights of 0.309 and 0.100) than the OECD-modified scale (0.5 and 0.3).

We intend to test the statistical significance of the estimated final weights being different from the OECD-modified ones. However, as the final weights are a product of several steps described by equations (1) to (8), we performed bootstrap hypothesis testing based on 2,000 resamples. In each country, we tested the estimated means of the adult and child weights against the values 0.5 and

0.3, respectively. Further, we pooled the resulted final weights for the Eastern and Western regions to test whether the mean weights are different in the two regions. The results suggest that in all countries, the resample mean adult (child) weights are statistically different from 0.5 (0.3). Moreover, the mean adult (child) weights are statistically different in EE and WE when the resample weights are pooled in the two regions.

V RESULTS

The estimated SPLs for various household types allow us to derive subjective equivalence scales, which we hypothesised to differ for Eastern European countries and for countries in the Western European region. This section describes the results confirming our hypothesis. As noted earlier, the equivalence scales for Eastern and Western European countries are based on each country's SPLs. These are obtained from OLS regression models for each country; the model results appear in Table A.2 in the Online Annex. The estimated SPLs are displayed in Figures A.1 in the Online Annex.

Subjective Equivalence Scales

As expected, the estimated subjective equivalence scales (SES) generally reveal higher economies of scale (lower weights) than the OECD-modified scale, with few exceptions. Table 3 shows the partial (p) and final weights (W) derived for 24 European countries. The partial weights for the second adult range from 0.16 in Sweden to 0.62 in Estonia; about half of the weights for the 24 countries range between 0.25 and 0.45. For the third adult, the range is primarily between 0.15 and 0.30.[17] These ranges include the weights reported by Bishop et al. (2014) in an analysis of data for

[17] Note that the partial weight for 4+ adults is negative in NL and DK, and the weight for 2+ and/or 3+ children is negative in DK, IE, NL, and SI. Although similar results have been produced by previous research (e.g., for a third adult in NL in Bishop et al. 2014; for a second child in RO in Kalbarczyk-Steclik et al. 2017), these countries' partial weights should be viewed with caution when deriving any implications from these results.

a 2004–2007 pooled sample of Euro-Zone countries: the reported partial weight of the second adult was 0.34, with the third adult coming in at 0.18 and the fourth at 0.21. Similarly, for 2005–2012, Kalbarczyk-Steclik et al. (2017) estimated the weights of the second, third, and fourth adults at 0.32, 0.21 and 0.24 in the Euro-Zone, and 0.49, 0.44 and 0.30 in CEE. Despite the differences in the methodology and countries involved, our simple means of the partial adult weights are only slightly lower than those of these previous studies.[18]

The final weight of adults in our construction, which can be applied in the same way as the OECD-modified equivalence scale, is higher than the OECD-modified weight of 0.5 only in Estonia (0.62) and Bulgaria (0.52). The lowest adult weights are found in the Netherlands, Romania and Sweden (0.17). With the exception of Romania, which is located at the tail of low adult weights, the ranking of countries roughly corresponds to the East-West division: the weights for adults are mostly higher and economies of scale lower in Eastern than in Western Europe (see also the simple averages of 0.392 and 0.283, respectively, in Table 3).

In terms of the final child weight, its maximum (in LV at 0.157) is barely half of the OECD-modified weight (0.3) while it is lowest is in the Netherlands, Poland, France and Romania (about 0.07). The child values are more homogeneous across the EU, and the East-West division is less clear. However, six out of ten EE countries are still located in the upper part of the EU ladder of the final child weight.

[18] More precisely, the methodological differences between our and their estimations should result in slightly lower adult weights estimated by our method. The reason is that we estimate the SPLs for adult household members when the variables of number of children are kept at the national means (ranging from 0.29 child per household in DE to 0.60 in IE, with the EU average of 0.37, in fact weighted by the national structure). All our estimated SPLs for adults are then higher by income needed roughly for 0.37 child, compared to their estimations for childless households. This makes our SPLs slightly higher, i.e., the partial weights (relative SPLs) lower.

TABLE 3

Subjective equivalence scales: weights for adults and children (2019)

	Partial weight (*p*) of:			**Final weight (W^A)**	**Partial weight (*p*) of:**			**Final weight (W^C)**
	2nd adult	3rd adult	4th and further adults	**Adults**	1st child	2nd child	3rd and further children	**Children**
Eastern Europe								
BG	0.572	0.454	0.396	**0.517**	0.152	0.164	0.075	**0.150**
CZ	0.340	0.230	0.235	**0.309**	0.136	0.047	0.107	**0.100**
EE	0.623	0.571	0.685	**0.618**	0.150	0.052	0.258	**0.129**
HU	0.324	0.303	0.287	**0.315**	0.076	0.069	0.106	**0.078**
LT	0.450	0.412	0.397	**0.438**	0.126	0.099	0.136	**0.117**
LV	0.469	0.412	0.739	**0.477**	0.159	0.127	0.255	**0.157**
PL	0.433	0.251	0.356	**0.372**	0.074	0.056	0.151	**0.075**
RO	0.236	0.125	0.025	**0.171**	0.088	0.026	0.196	**0.076**
SI	0.417	0.310	0.182	**0.363**	0.151	0.046	-0.015	**0.092**
SK	0.393	0.245	0.304	**0.340**	0.106	0.125	0.182	**0.120**
Simple average	*0.426*	*0.326*	*0.359*	***0.392***	*0.128*	*0.081*	*0.145*	***0.109***
Western Europe								
AT	0.459	0.234	0.616	**0.428**	0.114	0.058	0.103	**0.092**
BE	0.389	0.217	0.211	**0.347**	0.118	0.111	0.119	**0.115**
DE	0.332	0.191	0.199	**0.306**	0.166	0.096	0.126	**0.137**
DK	0.285	0.196	-0.127	**0.262**	0.225	-0.058	0.014	**0.082**
EL	0.368	0.291	0.310	**0.342**	0.092	0.103	0.058	**0.092**
ES	0.243	0.177	0.227	**0.225**	0.103	0.100	0.047	**0.097**
FI	0.280	0.269	0.324	**0.281**	0.141	0.176	0.034	**0.136**
FR	0.462	0.258	0.292	**0.426**	0.137	0.001	0.087	**0.076**
IE	0.224	0.059	0.325	**0.207**	0.249	-0.027	-0.023	**0.097**
IT	0.232	0.157	0.185	**0.208**	0.108	0.055	0.144	**0.091**
LU	0.360	0.187	0.266	**0.322**	0.158	0.072	0.007	**0.113**
NL	0.184	0.175	-0.028	**0.169**	0.146	0.041	-0.035	**0.072**
PT	0.274	0.231	0.279	**0.264**	0.132	0.091	0.235	**0.124**
SE	0.163	0.270	0.142	**0.173**	0.119	0.123	0.078	**0.115**
Simple average	*0.304*	*0.208*	*0.230*	***0.283***	*0.143*	*0.067*	*0.071*	***0.103***

Source: EU-SILC 2019. Authors' computations.

Notes: SPL is estimated using OLS regression; see Section III for the control variables. EE as a country abbreviation stands for Estonia (not Eastern Europe). Bootstrap hypothesis testing with 2,000 resamples was performed for each individual country. The mean final adult weight is statistically significantly different from 0.5 in all countries; the mean final child weight is statistically significantly different from 0.3 in all countries; the mean final adult/child weights in pooled EE and WE regions are statistically significantly different.

Bishop et al. (2014) and Kalbarczyk-Steclik et al. (2017) both based their studies on two-adult households with only one or two children. They report higher weights for the first child: 0.30 and 0.37 in the Euro-Zone, respectively, while the latter study reported 0.45 for the first child in the CEE pooled area. The partial weights for the second child produced by our approach are similar to theirs. Our results thus indicate a decrease in child weights in both regions over time.[19]

As our results confirm, economies of scale differ across countries and tend to be lower in EE than in WE. However, the difference is mainly apparent for adult weights, with more homogeneous child weights across countries and regions. Further, the results conform our assertion that the equivalence scale has changed over the last few decades and hence we contribute to the discussion on updating the equivalence scale adopted by the EU. The appropriateness of the OECD-modified scale for both EE and WE countries does seem to be in doubt.

Income Poverty Rates Based on Subjective Equivalence Scales

The importance of analysing equivalence scales is in their application. We show how the at-risk-of-poverty (AROP) rate is affected when the MIQ-based scales (SES) are applied to income, with the ranking of EU countries in terms of income poverty changing. We compare the AROP rate based on the (country-uniform) OECD-modified scale with an AROP rate generated using the country-specific subjective equivalence scales, keeping all other steps of AROP rate construction unchanged.[20] Figure 2 displays the same information twice to make the difference in country

[19] The methodological differences between our and their studies are less relevant for the estimations of child weights. They estimate the child weights based on two-adult households only; while we estimate the child weights based on SPLs for the average number of adults – which is 1.90 adults in the EU sample (ranging from 1.55 adults per household in SE to 2.40 in SK).
Moreover, we ran the estimations according to their sample restrictions and definitions of household types, reaching the first child weight of simple average 0.150 in EE, and 0.158 in WE, indicating that the subjective child weights decreased over time.

[20] The only exception is that we define adults as household members aged 16+, instead of 14+. Note also that the equivalised income of each household changes, as does the national median equivalised income and poverty line.

rankings more visual. We apply the SES based on models with and without control variables; however, the additional effect of controls on AROP rates is usually less extensive than the shift from OECD-modified scale to the SES.

FIGURE 2 over here

The changes in the rankings are relatively moderate. The upper tail of both rankings is essentially occupied by the same countries, while the lower tail has partially changed.[21] The most substantial shift can be seen in the Netherlands which jumps from 7th to 16th. In the opposite direction, France changes rankings considerably going from 8th to 1st. The change of ranking occurring at the lower tail while the upper tail remains unchanged concurs with Želinský and Mysíková (2021) who did an analysis of the sensitivity of the AROP rate to the OECD-type equivalence scale. If we compare their sensitivity measures with the official AROP rate, the sensitivity highly negatively correlates with the AROP rate. This means that high AROP rates change much less with the equivalence scale than rates in countries with low values. For instance, a 1-percentage-point increase in the weight of an adult in the household is associated with a 0.161 percentage change in the value of income poverty in Romania but a 0.855 percentage change in Czechia (Želinský and Mysíková 2021). In most countries, the AROP rate is substantially more sensitive to the adult weight than to the child weight.

Therefore, the country rankings not only depend on how much the estimated SES differs from the OECD-modified scale, but also on the sensitivity of the AROP rate to the equivalence scale within a country. In the case of Czechia, Germany and Luxembourg, the estimated adult weight is about

[21] Similarly, Bishop et al. (2014) concluded that using subjective scales for poverty rates did not alter the rankings of Euro Zone countries. However, as opposed to our study, they applied fixed exogenously determined poverty lines. With estimated economies of scale higher than the OECD-modified ones, their poverty rates inevitably result in lower values. The definition of a poverty line is crucial for the resulting poverty rates. Therefore, we do not compare the impacts of alternative equivalence scales on AROP rates with their results.

0.30 and the child weight about 0.11 in all three countries. However, the AROP rate increased by 3.8 pp in Czechia, by 1.5 pp in Germany and decreased by 0.3 pp in Luxembourg when the SES was used as opposed to the OECD-modified scale. In fact, the AROP rates decreased in two countries when the SES is used (FR and LU). Although the poverty line in a country inevitably increases when the equivalence scale is lower, the equivalent income changes differently in households of various sizes. The distribution of equivalised incomes around the poverty line, using the different equivalence scales, is impacted by the household structure, possibly leading to a lower poverty rate. The impact of applying the estimated SES thus ranges from -0.5 pp in France to 6.3 pp in the Netherlands. In particular, countries in which the equivalence scale has a considerable impact on AROP rates should consider applying a country-specific equivalence scale.

Figure 3 shows in detail how the AROP lines change with the estimated SES. The AROP line is defined as 60% of the equivalised income which means that the line can be directly compared to actual total income of single-person households (1+0) only. If we want to compare total household income of households with more members, we multiply the line by the corresponding adult and child weights. For instance, the monthly AROP line (which applies to singles) in Czechia is about 500 EUR while the poverty line equivalent for two-adult households with two children (2+2) is 1,050 EUR. With the estimated subjective weights (0.309 and 0.100 in Czechia), equivalised income increases in all households except singles, so does the national median, and poverty line increases to 637 EUR. The poverty line equivalent for (2+2) is 961 EUR.

FIGURE 3 over here

It should be noted that the poverty line for singles (black parts of the columns) increases in all countries (except EE, where the estimated adult weight is higher than 0.5). In contrast to this, the poverty lines for large households decrease; the poverty lines for typical households with two

children (2+2; total columns) are substantially lower when the estimated subjective equivalence scale is used. In other words, the poverty lines are less differentiated by household structure when the SES is used. While some households and their members enter the pool of income-poor when the SES is used, others get above the new poverty line. The left panel of Table 4 shows the share of the population which is no longer (col. (2))/newly (col. (3)) classified as income-poor when the SES is used. As the AROP rate increases when SES is used (with the exception of FR and LU, see Figure 2), more people enter the pool of income-poor than leave it.

Thus, the moderate changes in the ranking of overall income poverty rates are not the end of the story. More substantial changes may be determined by taking a closer look at the composition of the poor (De Vos and Zaidi 1997; Bishop et al. 2017; Morawski and Domitrz 2017). As lower weights favour equivalised incomes in larger households, the poverty rates of singles are likely to increase. In particular, the potentially higher poverty rate of single pensioners could be of interest to social policy. Table 4 shows the impact of the equivalence scale on the income poverty rates of selected household types, including households presumably at the highest risk such as singles 65+ and single parents.

The AROP rates of all singles inevitably increase with lower SES. While their equivalised income remains the same with any OECD-type equivalence scale, the AROP line is higher when the SES is used. With the OECD-modified scale, singles 65+ (col. (5) in Table 4) represent the group at the highest risk of income poverty in Eastern Europe (with the exception of HU and SK). In Western Europe, singles younger than 65 (col. (6)) are usually at a higher risk of income poverty than singles 65+. However, the ranking of countries substantially changes when the SES is used. The Netherlands, with the lowest original AROP rate of singles 65+, is ranked 15th when the SES is

TABLE 4

Relative income poverty rates based on the OECD-modified and subjective equivalence scales – by household type (%, 2019)

	Population identified as poor:				AROP rate using OECD-modified equivalence scale				AROP rate using estimated subjective equivalence scale			
	in both cases	only if OECD-mod. used	only if SES used	non-poor	singles 65+	singles <65	1 adult with child/ren	2 adults with child/ren	singles 65+	singles <65	1 adult with child/ren	2 adults with child/ren
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Eastern Europe												
BG	21.8	0.8	1.2	76.2	57.7	26.2	50.4	19.0	60.3	27.5	42.4	16.3
CZ	9.1	1.1	4.8	85.1	42.7	17.3	31.5	7.8	79.5	32.1	34.0	5.1
EE	20.4	1.3	2.1	76.2	79.0	30.8	27.1	13.5	78.9	30.8	16.3	10.4
HU	11.6	0.8	3.8	83.7	17.8	27.2	12.8	9.8	41.8	39.3	9.9	8.6
LT	18.7	1.9	2.7	76.8	59.5	35.4	43.3	19.3	70.6	41.9	35.9	13.8
LV	22.2	1.0	1.5	75.2	75.4	32.2	24.9	13.4	79.1	35.3	17.0	11.3
PL	14.1	1.4	2.8	81.7	34.9	31.2	18.9	8.9	57.1	41.5	16.9	6.7
RO	21.4	2.5	4.1	72.0	43.6	26.9	25.0	22.0	77.1	46.1	33.2	21.0
SI	10.8	1.0	3.5	84.6	45.0	32.5	26.4	9.0	64.1	45.6	26.0	6.3
SK	10.6	1.3	2.9	85.3	20.5	22.4	44.3	13.6	59.8	34.7	45.9	10.0
Western Europe												
AT	11.8	1.7	2.2	84.3	26.4	23.3	35.7	14.3	34.6	29.3	24.3	8.8
BE	12.0	2.9	4.4	80.7	17.9	23.4	35.5	12.2	52.3	36.7	24.7	7.2
DE	13.9	1.2	2.7	82.2	31.6	32.4	28.6	8.6	45.3	40.0	29.8	5.6
DK	10.8	1.9	5.5	81.9	17.8	33.5	22.6	6.9	48.0	43.5	20.0	2.5
EL	16.0	1.7	1.9	80.3	16.9	22.0	26.3	17.0	33.3	29.8	24.8	12.6
ES	17.9	2.6	3.2	76.3	14.5	25.9	40.6	21.2	49.6	37.2	44.1	18.3
FI	10.3	1.3	6.1	82.3	31.1	27.0	17.2	5.2	63.4	44.9	17.6	2.7
FR	10.7	2.6	2.1	84.7	14.8	20.4	29.8	12.2	23.6	27.1	18.1	6.8
IE	11.4	1.9	4.3	82.3	42.9	32.5	28.6	10.5	67.9	48.4	32.8	8.7
IT	17.5	2.5	2.8	77.2	24.3	25.5	33.9	19.7	43.0	35.5	36.2	16.3
LU	14.9	2.2	2.0	80.9	18.6	21.0	43.9	19.0	28.1	31.8	40.7	15.3
NL	11.4	1.7	8.0	78.8	11.8	30.3	27.3	9.4	63.3	56.5	31.8	7.1
PT	15.7	1.5	2.9	79.9	27.3	26.0	26.7	12.1	47.6	38.5	32.4	10.3
SE	14.5	2.8	5.7	77.0	30.2	29.5	32.8	15.2	70.7	42.6	34.6	10.2

Source: EU-SILC 2019. Authors' computations.
Notes: Adults defined as households members 16+ (the AROP rates may differ from official statistics).

used, and the AROP rate increases by 51.6 pp (compare cols. (5) and (9)). On the other hand, Bulgaria with a relatively moderate increase of the AROP rate of singles 65+ (by 2.6 pp) moves from 21st position to 14th. The AROP rates of singles 65+ are much more sensitive to the choice of equivalence scale than the overall national rates. This is particularly the case of countries where the income of many pensioners is very close to the poverty line. This makes their situation very similar to those officially classified as income-poor and should be of great interest to policymakers.

The impact of using SES on AROP rates of larger families is less presumable. Lower SES increases their equivalised income although the income poverty line increases at the same time. Members of larger families thus can move in both directions around the new poverty line. In Austria, which originally ranks 19th in the AROP rate of single parents (col. (7) in Table 4), there is no household newly identified as poor when the SES is used. The rate decreases by 11.4 pp and Austria ranks 8th (col. (11)). In contrast, Romania moves from 6th to 16th position, where using the SES adds 8.2% of population from single parent families into the pool of the poor, while no one leaves it. This means that the poverty line increases more than the equivalised income of single parent households in Romania. In most countries, a share of single parent families leaves the pool of the poor while another share enters it.

Similar effects can be found for households of two adults with children although AROP rates of their members are substantially lower than the rates of single parents irrespective of the applied scale (Table 4). While the overall national AROP rate is less sensitive to the scale, especially to the weights of children, subpopulations classified as poor varies with different scales. An inappropriate equivalence scale can misclassify the most vulnerable subpopulations such as single pensioners and members of single parent households.

VI CONCLUSION

The relative income poverty rate is highly dependent on various steps taken in its construction, including the scale used to equivalise the total income of households of different sizes to comparable units. This study questions the use of the current official OECD-modified equivalence scale which has been used since the 1990s, prior to the Eastern European countries joining the EU. The justification for using a single scale is to provide uniformity across European countries. From a transnational perspective, such an approach assures that poverty rate estimations are harmonised and the results comparable across all EU countries. However, social policy measures are adopted at the national level. Consequently, national social policies would benefit from using equivalence scales that fit local conditions rather than from international uniformity.

In this paper, we have challenged the international uniformity and country-level specificity of equivalence scales in the EU. We have focused on the difference between Eastern European (EE) countries – post-communist countries which have undergone three decades of economic transition – and Western European (WE) countries – "old EU member" states – and argue that the uniformity of this equivalence scale may not be ideal. Our estimations confirm that subjective economies of scale are lower in the EE region than in the WE region, meaning that the weights in term of those assigned by the OECD-type scale to second and subsequent adult household members and to children are higher in EE than in WE.

The main contribution of this study is the proposal of a method that results in a two-parameter scale – a single weight for the second and each additional adult and a single weight for each child household member – consistent with the current OECD-modified equivalence scale used in the EU, followed by its empirical application. Our approach allows us to estimate these weights for each individual country, considering country specificities, yet maintaining the same construction

method for the equivalence scales. Our estimated subjective equivalence scales show generally higher economies of scale (lower weights) than the OECD-modified scale for both WE and EE, with two exceptions for adult weights in EE. Although we do not provide an analysis on comparable data from the 1980s/1990s for WE countries, our results indicate that economies of scale may have increased since that time. Further, we show that the subjective equivalence scales generally differ between EE and WE with EE countries generally exhibiting lower subjective economies of scale than WE countries. However, this mainly concerns the adult weights while the child weights are similar across the two regions. As shown by the previous literature, the AROP rate is substantially more sensitive to the adult than to the child weight (Želinský and Mysíková 2021).

In order to demonstrate the relevance of our scales, we compared the original AROP rates with AROP rates if the subjective equivalence scales derived by this analysis were used instead of the country-uniform OECD-modified scale. The impact on the AROP rate not only depends on the degree of change of the national scale, but also on the sensitivity of the AROP rate to the equivalence scale in the individual countries. The changes in the AROP rates range up to six percentage points in our study which is an amount of considerable interest. Furthermore, the changes in the overall AROP rates hide the impacts on the composition of the income-poor. The effects on the AROP rates of subpopulations at the highest risk of income poverty – households of singles aged 65 and over and single parents – are substantially more pronounced. If the AROP rate of any subpopulation substantially increases with a change of the equivalence scale, it means that their income may be located very close to the poverty line. This makes their situation very similar to those officially classified as income-poor and should be of great interest to policymakers.

We hesitate to conclude this study by speculating whether subjective equivalence scales are "better" than the OECD-modified scale. However, we believe we provide sufficient information to

suggest reconsideration of the current scale and to spur the process of either updating the common scale to be more suitable for current EU countries, or to evoke a debate on a single methodology to derive country-specific equivalence scales (to respond to this unanswered question from the 1990s). We would also like to emphasise that country-specific equivalence scales, especially in countries where the AROP rate is substantially affected by the estimated scale, would be more appropriate for national purposes. This is particularly the case in informing effective social policies and tracking poverty alleviation progress. In addition, our results suggest that equivalence scales are not necessarily fixed but can change over time as a result of the economic development of a society. While we are aware that statistical institutions and policy makers are reluctant to accept subjective approaches, we hope we have supported the idea that it is useful to re-assess equivalence scales over time.

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FIGURES