IMPACT OF EQUIVALENCE SCALES ON POVERTY MEASURES IN THE EU MEMBER STATES

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Abstract

The goal of this paper is to analyse the influence of equivalence scales on poverty rates across EU countries. The previous studies suggest a question whether a single equivalence scale should be used for all EU member states, or different methodologies should be applied across different countries. In this paper a number of combinations of adult/child household members' weights to a linear type equivalence scale is simulated to 2005, 2008 and 2011 EU SILC microdata. According to the results, relative impact of adults' weights is stronger than relative impact of children's weights in most of the EU countries. The results further indicate that the shape of poverty rate distribution depends on structure of households in the economy. Different shapes of poverty rates distribution across the EU countries might be an indication of reconsidering common equivalence scales for all EU countries, and possibly substituting them by country-specific equivalence scales.

Key words: equivalence scales, EU SILC, monetary poverty

JEL Code: I32, I33

Introduction

Several papers dealing with poverty phenomena have been published in recent years. Several concepts of poverty, such as monetary poverty (Stankovičová, 2009; Bartošová and Forbelská, 2010; Tartaľová and Sovičová, 2013), material deprivation (Želinský, 2010; Želinský, 2012), objective and subjective poverty (Labudová, 2008; Stankovičová and Pastorek, 2009). Poverty is analysed in association to labour market (Loster and Langhamrová, 2011), inequality (Labudová, 2012; Pacáková, 2012), and many other aspects.

In terms of monetary poverty equivalisation of income is necessary in order to obtain comparable data, which is performed using equivalence scales.

The goal of this paper is to analyse distribution of at-risk-of-poverty rates in the EU countries considering linear type of equivalence scale, and its association to the structure of household. In the paper we also analyse shift in distribution between 2005 and 2011.

1 Equivalence scales

The logic behind equivalence scales is based on economies of scales in the households. Household consumption can be divided into collective consumption (e.g. housing expenditures) and individual, which is person-specific (Želinský and Tartaľová, 2012). It is obvious that a household with two children requires higher income than a household without children, in order to enjoy the same standard of living (Tartaľová and Želinský, 2012).

OECD equivalence scale is one of the best known, and it assigns a value of 1 to the first household member, of 0.7 to each additional adult and of 0.5 to each child. Hagenaars, De Vos and Zaidi (1994) argued that OECD equivalence scale overvalued weights of additional adults, and they proposed OECD modified scale, which was adopted by Eurostat in the late 1990's. The modified scale assigns a value of 1 to the household head, of 0.5 to each additional adult member and of 0.3 to each child. The authors further argue that more research efforts should be devoted to the choice of equivalence scales in cross-country comparisons. They discuss whether a single equivalence scale should be used for all EU member states, or different methodologies should be applied across different countries (Hagenaars, De Vos and Zaidi, 1994, p. 194).

There are numerous types of equivalence scales applied (for details see e. g. Buhmann et al., 1988; Bartošová and Bína, 2012), in this paper we focus on a linear type of equivalence scale.

2 Methods

Equivalence scale of household i (Si) using linear equivalence scale (Sipkova, 2009) is given by the following equation:.

$$S_i = 1 + \alpha(A_i - 1) + \beta K_i \qquad (1)$$

where

A_i is the number of adults in household i;

K_i is the number of children in household i;

α is the parameter reflecting the proportion (weight) of additional adults' expenditures in household i, $\alpha \in (0, 1)$;

β is the parameter reflecting the proportion (weight) of children's expenditures in household i, $\beta \in (0, 1)$.

Equivalence scale is a parameter necessary for estimating equivalised disposable income of household. The equivalised disposable income is defined as the total income of a household, after tax and other deductions, that is available for spending or saving, divided by the equivalised household size.

A simple simulation is performed in this study, where all possible equivalised household sizes are considered for each household (i.e. α_i, β_i = {0.00, 0.05, 0.10, 0.15, ... 1}). Then, for each possible equivalised household size the corresponding level of quivalised disposable household income is estimated and the value is assigned to each household member (which is in accordance with Eurostat methodology).

The study is based on EU SILC 2011 microdata (with reference period 2010) provided by the Eurostat. The poverty line is defined as 60 percent of median national equivalised disposable income. Estimation of at-risk-of-poverty rate is based on Eurostat methodology:

$$AROP = \frac{\sum_{i=1}^{q} w_i}{\sum_{j=1}^{n} w_j} \tag{2}$$

where

w_i is the personal cross-sectional weight of person i for which equivalised disposable income is lower than at-risk-of-poverty threshold; 1, 2, ..., $q \leq n$;

w_j is the personal cross-sectional weight of each person in the sample.

Analysis of the influence of equivalence scales across the EU countries is based on the following procedure. The distribution of poverty levels with respect to the weight of adult/child household members is approximated by a paraboloid function considering the following regression function:

$$z_i = \beta_0 + \beta_1 x_i + \beta_2 y_i + \beta_3 x_i^2 + \beta_4 y_i^2 + \varepsilon_i \tag{3}$$

where

x is the weight of further adult members;

y is the weight of children members;

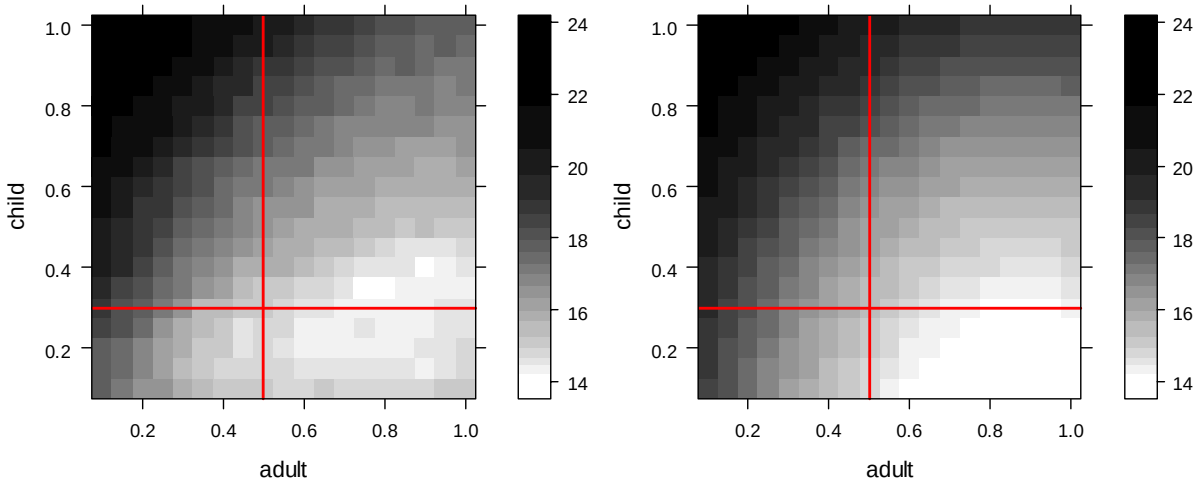
z is the corresponding poverty level;

β_k are parameters to be estimated, k = 0, 1, ..., 4;

ε is the random term.

The graphical representation is presented in the following figure:

Fig. 1: Example of at-risk-of-poverty rate distribution approximated by a paraboloid

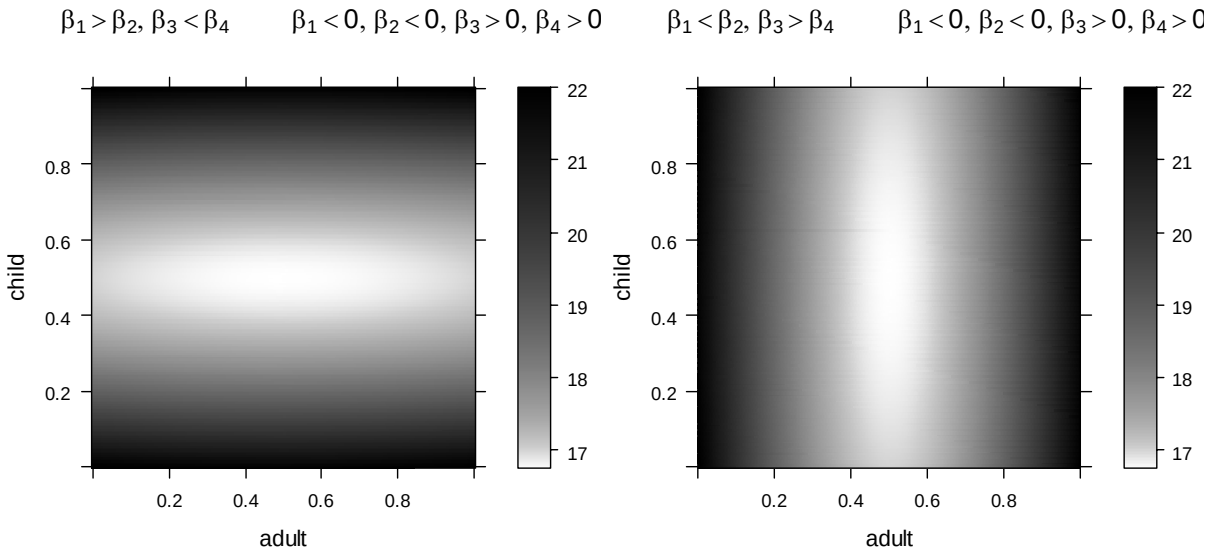


Notes: left figure: original distribution, right figure: approximated distribution; horizontal and vertical red lines represent equivalence scale weights in accordance with Eurostat methodology.

Source: own

Analyses of equivalence scales performed in this paper are based on inspection of parameters of the estimated paraboloid regression function. As obvious from Fig. 2 (left), if $\beta_3 < \beta_4; \beta_3, \beta_4 > 0$, impact of adults' weights on poverty rate is very weak, i.e. poverty rates strongly depend on children's weight parameters, and are almost independent of adults' weight parameters.

Fig. 2: Inspection of paraboloid parameters



Source: own

It is also obvious (Fig. 2 right) that $\beta_3 > \beta_4; \beta_3, \beta_4 > 0$ result in strong impact of adults' weight parameters on the poverty rates, and very weak impact of children's weights. Further, if $\beta_3 = \beta_4; \beta_3, \beta_4 > 0$, adults' and children's weight parameters have the same impact on poverty rates.

Of course, different combinations of $\beta_1, ..., \beta_4$ values result in different shapes of poverty rate distribution. Values of β_3 and β_4 coefficients will be of our central interest, as our goal is to inspect influence of adults' and children's weight parameters on poverty rates.

All calculations and estimations are performed in R environment (R Development Core Team, 2012).

3 Results and Discussion

As described above our analyses are focused on comparing estimated coefficients β_3 and β_4. The following three cases can be considered:

- $\frac{\beta_3}{\beta_4} > 1$: adults' weight has stronger relative impact on poverty rates than children's weight,
- $\frac{\beta_3}{\beta_4} < 1$: children's weight has stronger relative impact on poverty rates than adults' weight,
- $\frac{\beta_3}{\beta_4} = 1$: adults' and children's weights have the same relative impact on poverty rates.

According to the results in Tab. 1 it is obvious that in most cases adult's weights have stronger relative impact on poverty rates than children's weights. In few cases the fractions are around one which indicates (nearly) the same relative impact of weights on poverty rates. In very few cases the fractions are lower than one, indicating stronger relative impact of children's weight, but on the other hand the values are not significantly lower than one.

The results indicate that in the most cases adults' weights have stronger relative impact on poverty rates than children's weights.

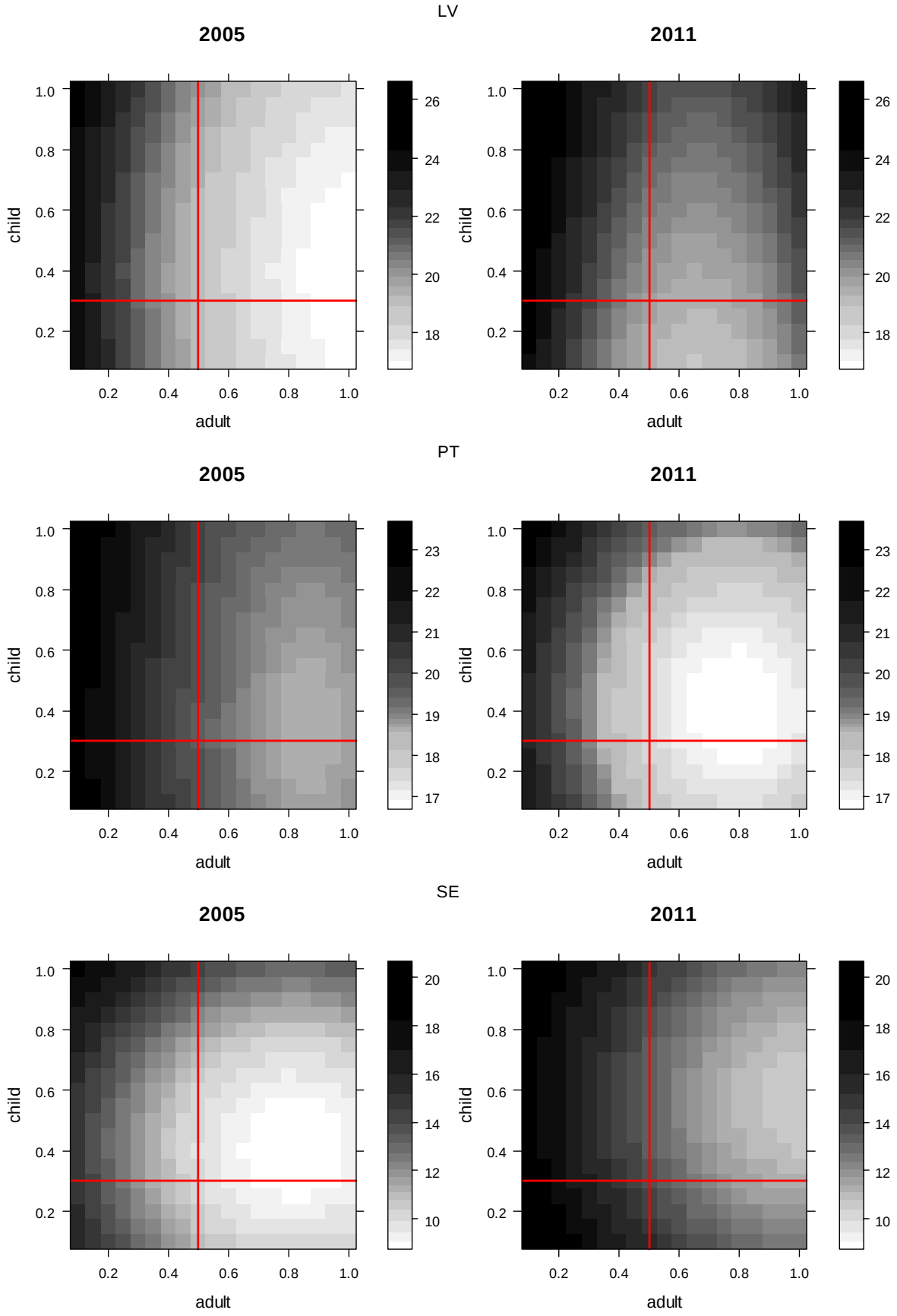
Tab. 1: Ratio of parameters β_3 / β_4, 2005-2008

Country	2005	2008	2011
AT	1,52	2,33	2,06
BE	3,48	3,62	11,18
BG	--	4,03	5,69
CY	1,82	2,84	2,20
CZ	2,97	2,22	2,48
DE	0,84	0,84	1,30
DK	0,70	0,70	0,99
EE	3,59	0,12	2,92
EL	1,90	7,31	5,17
ES	10,57	2,31	4,43
FI	1,10	1,05	1,51
FR	1,91	1,78	1,70
HU	4,20	5,04	5,12
IE	2,16	2,31	--
IS	0,99	1,20	1,11
IT	2,14	3,38	–7,22
LT	4,05	2,42	4,73
LU	1,37	1,83	8,32
LV	2,79	–1,36	34,04
MT	--	--	7,62
NL	1,18	1,56	1,95
NO	0,77	0,84	0,81
PL	6,55	5,29	4,10
PT	5,74	3,65	1,45
RO	--	–112,96	2,32
SE	0,91	1,06	1,01
SI	1,32	1,71	1,92
SK	4,49	4,97	3,61
UK	2,23	19,12	1,20

Source: own calculations based on EU SILC microdata

Let us take a look at shift in poverty distributions for selected countries between 2005 and 2011 (Fig. 3). Three countries (LV: Latvia, PT: Portugal and SE: Sweden) are chosen to demonstrate changes in shape of poverty rate distribution. The β_3 / β_4 ratio increased considerably in Latvia between 2005 and 2011 (from 2.8 to 34), which can be seen in top-left and top-right figures of Fig. 3. The reverse change can be seen in Portugal – relative impact of adults' weights was significantly higher in 2005 (around 5.7) than in 2011 (around 1.5). Sweden represents relatively stable impacts of adults' and children's weights on poverty rates.

Fig. 3: Inspection of paraboloid parameters



Source: own

As the poverty rates depend on equivalised size of household, we will now analyse relationship between the household structure and β_3 / β_4 ratio. Ratio of child members to adult members in each country is used as a proxy for household structure. Relationship between the household structure and β_3 / β_4 ratio is evaluated by Spearman rank correlation and the corresponding test. As β_3 / β_4 ratio is a ratio of adult-to-child weights and household structure is proxied by child-to-adult members ratio, negative relationship between those two variables is expected.

The following correlation coefficients and p-values have been obtained:

Tab. 2: Spearman's rho

Year	Spearman's rho	p-value
2005	–0.5303	0.006
2008	–0.2961	0.126
2011	–0.4517	0.015

Source: own calculations

As expected, the results indicate that there is a negative relationship between the household structure and β_3 / β_4 ratio (statistically significant for 2005 and 2011 data). Thus we can assume that shape of poverty rate distribution for a certain country is determined by age structure of households in the country.

Conclusion

Poverty measures based on equivalised income data strongly depend on equivalence scales. Analyses performed in this paper focus on inspection of at-risk-of-poverty rates distribution with respect to equivalence scale.

According to the results, relative impact of adults' weights is stronger than relative impact of children's weights in most of the EU countries. The results further indicate that the shape of poverty rate distribution depends on structure of households in the economy.

Different shapes of poverty rates distribution across the EU countries might be an indication of reconsidering common equivalence scales for all EU countries, and possibly substituting them by country-specific equivalence scales.

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