METHODOLOGICAL ISSUES IN POVERTY RESEARCH

IMPACT OF CHOICE OF EQUIVALENCE SCALE ON INCOME INEQUALITY AND ON POVERTY MEASURES*

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Abstract: The authors present the theoretical bases and the results of an equivalence scale developed recently in the HSO. The paper shows how the income distribution and various measures of income inequality are affected by the choice of the equivalence scale. The authors investigate the impact of this choice on the phenomenon of poverty. According to the authors' opinion no global, generally applicable equivalence scale can be constructed because an appropriate scale is largely determined by the country's special circumstances. In order to change the present Hungarian practice they suggest not only professional, but also political consensus, because the choice of the equivalence scale can be advantageous for certain social groups, while disadvantageous for others.

Keywords: poverty, equivalence scale, income quality

INTRODUCTION

It is widely recognized that the welfare, the real income position of an individual depends on the income positions of other persons living in the same household. Thus the household is the relevant unit when investigating welfare issues. However, the welfare position of households with different size and composition can realistically be compared only if the differences in their needs are taken into account. This can be achieved by using some kind of *equivalence scale* which indicates how much expenditure an individual with given demographic characteristics and household status or a household with a given demographic composition needs to reach the same welfare level as the reference person or the reference household (Charlier 2002). Thus

the equivalence scale expresses the relation between the income-consumption needs of a given individual or household and those of the reference person or household.

Quite a number of equivalence scales have been constructed in the past decades as adult or household equivalence scales. There are model based, subjective and expert based scales. Buhmann et al. (1988) give a survey of equivalence scales used in ten countries, and report 34 different scales. The simplest one takes into account the size of the household only, disregarding its composition, and expresses the equivalence value of a given household as some power of the household size, i.e.

$E = n^s$

with s expressing the sensitivity of E to household size. According to this scale the fixed expenditures of households increase with increasing size, while personal expenditures decrease. This type of scale is rather widespread in international comparisons. The UN Statistical Office also uses it with $s = 0.55$. The former OECD scale applied a parameter value of $s = 0.73$.

Subjective equivalence scales are generally based on responses given by a sample of households to questions such as the amount of income (or expenditure) they would deem necessary to cover their needs, or to cover the minimal needs of a household of their size (see e.g. Charlier 2002). To elaborate an actual equivalence scale generally some model is used.

According to the authors' opinion no global, generally applicable equivalence scale can be constructed because an appropriate scale is largely determined by the country's special circumstances, e.g. its level of development or whether expenditures connected to individual needs such as food, clothing etc. represent a dominant or a small portion in the total expenditure of households. In the former case the household size and especially the number of children of various age should play a more dominant role in the equivalence scale than in the latter case. That is why we consider the so-called OECD2 equivalence scale inappropriate for Hungary, where food and clothing expenditures represent a decreasing but still considerable part in households' total expenditure. Our empirical results shown in Sections 3 and 4 unambiguously support this opinion.

The paper is organized as follows. In Section 2 the theoretical bases and the results of an equivalence scale developed recently in the HCSO are presented. Section 3 is intended to show how the income distribution and various measures of income inequality are affected by the choice of the equivalence scale, while Section 4 investigates the impact of this choice on the phenomenon of poverty. Section 5 contains some conclusions.

DEVELOPING A HUNGARIAN EQUIVALENCE SCALE

We looked for an *adult equivalence* scale where the scale values of various individuals are given as proportions of 1, the value given to the first adult of the household. Most equivalence scales do not differentiate among children, although the needs of and expenditures on a child aged 14 are clearly different from those of a child of age 2. Notwithstanding some studies consider the differentiation important as e.g. Lyssiotou (1997) or Charlier (2002).

When developing our equivalence scale we made use of a model proposed in Poverty Reduction in Estonia, but modified it somewhat. Namely we looked for a scale consisting of four values as follows:

1 for the first adult

$\lambda_1 \leq 1$ for the second and further adults

$\lambda_2 \leq \lambda_1$ for children aged 8–14

$\lambda_3 \leq \lambda_2$ for children aged 0–7.

We estimated the adult equivalence values by means of a linear regression model separately on the database of three years (1998, 1999 and 2000) of the continuous Hungarian Household Budget Survey (HBS) the sample of which covers almost 11 thousand households annually. The dependent variable of the regression model was the current consumption expenditure, that is investment expenditures were not taken into account. Moreover, the estimation procedure each year was carried out not only for the total population, but for various sub-populations as well, always leaving out, however, the bottom and top deciles of the population in question, because the consumer behavior of the extreme deciles may differ markedly from that of the rest of the society. In most cases the linear regression model fitted rather well the data, better than the logistic regression models we also experimented with. After averaging and rounding off the reasonable estimates we finally obtained the following equivalence scale:

First adult (1)	Further adults (λ_1)	Child aged 8–14 (λ_2)	Child aged 0–7 (λ_3)
1	0.7	0.6	0.5

It should be noted that our equivalence scale is very similar to the OECD1 scale with the exception that we differentiated between children by age. It is remarkable furthermore, that we noticed a slight decrease in time in the equivalence value of further adults without any appreciable change in the equivalence values referring to children. This may indicate that with the increase of fixed expenditures (those e.g. connected with the maintenance of dwelling) in total expenditure of households the significance of further adults will probably decrease and therefore the scale has to be re-estimated from time to time.

As the results shown in the following sections will expressly indicate, our equivalence scale proves very useful for characterizing income distribution and poverty in Hungary.

IMPACT OF THE CHOICE OF EQUIVALENCE SCALE ON INCOME INEQUALITY

In this section we investigate how the choice of the equivalence scale applied affects income distribution and various inequality measures. By income *disposable income* of the households is to be understood. Four equivalence scales are considered:

– the special case when all persons have the same equivalence value 1/n (n being the size of the household), i.e. the distribution of per capita incomes is considered;

- the Hungarian equivalence scale introduced in Section 2;
- OECD1 scale, where the value 1 is given to the first adult, 0.7 to further adults and 0.5 to children (aged 0–14);
- OECD2 scale with value 1 given to the first adult, 0.5 to further adults and 0.3 to children.

To characterize the inequality of income distributions the value of five inequality measures was calculated. These inequality indicators are the following

- D_{10}/D_1, the ratio of mean income in the top income decile to that in the bottom decile;
- Q_5/Q_1, the ratio of mean income in the fifth income quintile to that in the first quintile;
- v, the Éltető–Frigyes index, introduced in Éltető and Frigyes (1968) and defined as the ratio of mean income of those above the population income to those below the mean;
- E, the Robin–Hood index or the one called alternatively as maximum equalization percentage, defined as the sum of percentages above 10 per cent of deciles with shares exceeding 10 per cent;
- G, the Gini coefficient.

Now let us see how the choice among the scales affects income distribution and the income position of various population groups. First, it is clear from the data of *Table 1* below that the per capita income overstates both the disadvantage of those in the bottom decile and the advantage of persons in the top decile. Income distribution seems least unequal when persons are ranked according to their income equalized by the OECD2 scale.

Table 1. Share of population quintiles and extreme deciles from total disposable income calculated on the basis of different equivalence scales

Scales	Bottom decile	1st	2nd	3rd	4th	5th	Top decile
		quintile					
Per capita	3.9	9.7	14.5	18.0	22.1	35.8	22.1
Hungarian	4.3	10.4	14.8	18.0	21.8	35.0	21.5
OECD1	4.1	10.1	14.7	17.9	21.9	35.3	21.8
OECD2	4.5	10.9	15.2	17.9	21.5	34.7	21.4

Source: Hungarian HBS, 2000.

The values of the various inequality measures shown in *Table 2* below support what was said above.

Table 2. Inequality measures calculated on the
basis of different equivalence scales

Scales	D10/D1	Q5/Q1	v	E	G
Per capita	5.6	2.0	2.06	17.9	0.252
Hungarian	5.0	1.9	1.98	16.8	0.237
OECD1	5.4	1.9	1.97	17.2	0.244
OECD2	4.8	1.8	1.97	16.2	0.229

Source: Hungarian HBS, 2000.

If now we look at households with different demographic composition it is clear from the data of *Tables 3* and *4* that all real adult equivalence scales tend to depreciate increasing household size and especially the role of children as compared to per capita incomes. For instance, in the lowest decile the average household size is 3.8 on the basis of per capita income, 3.3 according to the Hungarian scale, 3.2 with OECD1 scale, and 2.4 only if the OECD2 scale is applied. For the same reason the risk of persons falling into different income quintiles widely varies if different scales are used *(Table 3).*

Table 3. Risk of persons in households of different size of falling into various income
quintiles calculated on the basis of the equivalence scales considered

Scales	Quintiles	Number of household members						
		1	2	3	4	5	6	7 and more
Per capita	1st	0.2	0.3	0.7	1.1	2.0	2.6	2.7
	2nd	0.5	0.7	1.0	1.1	1.4	1.3	1.2
	3rd	1.0	1.0	1.1	1.1	0.7	0.6	0.5
	4th	1.4	1.3	1.1	0.9	0.5	0.3	0.3
	5th	1.7	1.6	1.1	0.8	0.4	0.2	0.2
Hungarian	1st	0.2	0.4	0.8	1.1	2.0	2.7	2.8
	2nd	0.6	0.7	1.0	1.1	1.4	1.2	1.2
	3rd	1.0	1.0	1.1	1.1	0.8	0.6	0.5
	4th	1.4	1.3	1.1	0.9	0.5	0.3	0.3
	5th	1.7	1.5	1.0	0.8	0.4	0.2	0.2
OECD1	1st	1.1	0.7	0.9	1.0	1.7	2.1	2.4
	2nd	1.2	0.9	0.9	0.8	1.2	1.3	1.0
	3rd	1.1	1.0	0.9	1.0	0.9	0.8	0.8
	4th	0.8	1.2	1.1	1.1	0.8	0.5	0.7
	5th	0.9	1.2	1.1	1.0	0.6	0.3	0.2
OECD2	1st	2.0	0.8	0.8	0.8	1.2	1.3	2.0
	2nd	1.3	1.0	1.0	0.9	1.0	1.6	0.4
	3rd	0.7	1.1	1.0	0.9	1.3	0.9	1.2
	4th	0.5	1.0	1.1	1.2	0.7	0.8	1.0
	5th	0.5	1.0	1.1	1.2	0.8	0.4	0.4

Source: Hungarian HBS, 2000.

There are even much more marked differences between the impacts of the various
equivalence scales on the income inequality if we consider households with different
number of children. Per capita incomes enhance mostly the income disadvantage of
households with several children, while the OECD2 scale differentiates least between
the households with various number of children *(Table 4)* by their income.

Table 4. Risk of the persons in households with different number of children
of falling into various income quintiles calculated on the basis of the equivalence
scales considered

Scales	Quintiles	Number of children under 15			
		None	1	2	3 and more
Per capita	1st	0.3	1.0	1.5	2.9
	2nd	0.7	1.1	1.4	1.2
	3th	1.1	1.1	1.0	0.5
	4th	1.3	1.0	0.6	0.3
	5th	1.5	0.9	0.5	0.2
Hungarian	1st	0.4	1.3	1.7	3.2
	2nd	0.8	1.3	1.4	1.0
	3th	1.1	1.1	0.9	0.4
	4th	1.3	0.8	0.6	0.1
	5th	1.4	0.6	0.4	0.2
OECD1	1st	0.7	1.1	1.3	2.2
	2nd	0.9	1.0	1.1	1.2
	3th	1.0	1.0	1.1	1.0
	4th	1.0	1.2	1.1	0.8
	5th	1.2	0.8	0.8	0.3
OECD2	1st	0.9	0.9	1.0	1.7
	2nd	1.0	1.0	0.9	1.1
	3th	1.0	1.0	1.1	0.9
	4th	1.0	1.1	1.0	0.7
	5th	1.1	1.0	1.0	0.5

Source: Hungarian HBS, 2000.

It is important to note that both household size and the number of children in the
household are in inverse relationship with shares of the income deciles, except in the
case of the OECD2 scale, where the relation is positive. As shown in *Table 5* below,
the negative correlation is rather strong when using per capita incomes. It is looser on
the bases of the Hungarian and OECD1 scales and the relation turns to positive when
using the OECD2 scale.

Table 5. Correlation of household size and the number of children with shares
of income deciles using various equivalence scales

Equivalence scale	Household size		Number of children	
	Gamma	Spearman	Gamma	Spearman
Per capita	-0.321	-0.347	-0.480	-0.375
Hungarian	-0.060	-0.067	-0.216	-0.168
OECD1	-0.040	-0.045	-0.174	-0.135
OECD2	+0.164	+0.179	+0.027	+0.021

Source: Hungarian HBS, 2000.

We can investigate, furthermore, how the risk indicators behave for households with heads of different *age* using the various equivalence scales. Data show that when using the Hungarian scale the risk of getting into the bottom deciles decreases with the increasing age of the household head, while the probability of getting into the 4th quintile increases for households with the increasing age of the head. As to the risk of getting into the first quintile the same holds true in the case of the OECD1 scale, but the tendency is not so clear as in the case of the Hungarian scale. OECD1 scale prefers households with older heads in the second and third quintiles. Finally, using OECD2 scale the risk of getting into the bottom three quintiles is increasing with increasing age of the household head, while it tends to decrease in the top two quintiles showing again that the demographic structure of the various income deciles and quintiles is quite different when using the OECD2 scale from that using the other three equivalence scales.

SENSITIVITY ANALYSES OF VARIOUS POVERTY MEASURES USING DIFFERENT SCALES

Data of the Hungarian HBS indicate that poverty and various characterizations of poverty are even more sensitive to the choice of equivalence scale than income inequality. To be able to analyze poverty issues first the poverty threshold has to be defined. In what follows a household or person living below *60 per cent of the median income* is regarded as poor. Data of *Table 6* below clearly demonstrate this sensitivity.

Table 6. Number and proportion of poor households and persons and the normative
poverty gap using various equivalence scales

Equivalence scale	Number	Proportion, %	Number	Proportion, %	Poverty gap, %
	Households		Persons		
Per capita	310 495	8.3	1 117 229	11.8	23.1
Hungarian	290 900	7.8	929 435	9.3	22.2
OECD1	290 718	7.8	923 215	9.3	21.6
OECD2	369 877	9.9	903 689	9.1	20.8

Source: Hungarian HBS, 2000.

If we measure the extent of poverty by the proportion of *poor households,* we get the highest extent by using the OECD2 scale, according to which almost every tenth household is poor. If, on the other hand, the proportion of *poor persons* is considered as a measure of the extent of poverty, then per capita income produces the highest rate, nearly 12 per cent, while according to the other three scales somewhat more than 9 per cent of the population belongs to the poor.

Poor households differ not only in their proportion, but also in their characteristics, when using different scales. The average size of poor households according to per capita income amounts to 3.8, far exceeding the national average. Applying the Hungarian scale the average size is 3.3, and using the OECD1 scale it is 3.2. The OECD2 scale produces an average size of 2.4, below the national average. Thus following the sequence of equivalence scales considered the size of poor households becomes more and more smaller. With some simplification we can assess that counting by their per capita income poor households are large families with several children, while applying the OECD2 scale - preferred in the practice of the EU – poor households are mostly elderly pensioner and single person households.

No matter which equivalence scale we use the poverty risk of young households with children is high, but while on the basis of per capita income it is double of their population weight, it is only 1.2 times higher than that when the OECD2 scale is used. The poverty risk of households consisting of old people exceeds their population weight on the basis of the OECD2 scale only. It is worth mentioning, furthermore, that the poverty risk of young and middle-aged people with children is very high on the basis of their per capita income, is still considerable using the Hungarian or OECD1 scales, while it is lower than their population weight when applying the OECD2 scale.

Seeing how the various scales affect the proportion and demographic composition of the poor the question arises which of the scales catches best the phenomenon of poverty. To be able to answer the question we extend somewhat the concept of poverty introducing a number of observed variables to characterize the poor. It is supposed that the delineation of those living in income poverty can be regarded more successful, if the relation between the many-sided characterization of the poor and income poverty is closer. For this reason the following 15 variables are introduced to characterize generally the living conditions of households:

x_1 = average size of the households;

x_2 = number of children below school age in 100 households;

x_3 = number of pupils in elementary school in 100 households;

x_4 = number of students in 100 households;

x_5 = number of unemployed persons in 100 households;

x_6 = average age of household heads;

x_7 = rate of household heads completing at most elementary school, %;

x_8 = rate of household heads with third level educational attainment, %;

x_9 = rate of unemployed household heads, %;

x_{10} = rate of households having person(s) with lasting disease or in need of nursing, %;

x_{11} = rate of households experiencing difficulties paying the bills of public electricity, gas, water, etc. works, %;

x_{12} = rate of households considering themselves rather poor, %;

x_{13} = rate of households regarding themselves being well off, %;

x_{14} = rate of households without flush toilet and/or bathroom within the dwelling, %;

x_{15} = share of food expenditures in total expenditure, %.

It is instructive to see how the equivalence scales investigated affect the value of the above variables. This will be clear by showing the values of the poverty indicators above in the bottom and top income deciles formed on the basis of the various scales.

In accordance with what was observed before, the average age of the household head is lowest when the first decile is formed by per capita income and highest using the OECD2 scale, and the opposite is true in the case of the top decile. The looseness of the relation of the latter scale with poverty is clearly demonstrated by the fact that less than 4 per cent of the household heads is unemployed in the first income decile formed by using the OECD2 scale, while according to the rest of scales this proportion is more than 5 per cent. It is remarkable, furthermore, that subjective poverty (x12) is lowest in the first decile and highest in the top decile based on per capita income, and again the opposite trend prevails when using the OECD2 scale. This very probably is related by the phenomenon frequently experienced in household surveys that the presence of children in the household considerably decreases subjective poverty feeling in spite of the objective situation, while the presence of old people increases it. It is worth noting, finally, that the various equivalence scales seem not to influence to any appreciable extent the proportion of food expenditures in neither of the extreme deciles. More detailed data are shown in *Table 7* below.

Table 7. Some characteristics of households in the extreme income
deciles formed on the basis of various equivalence scales

	1st decile formed by				10th decile formed by			
	Per capita	Hungarian	OECD1	OECD2	Per capita	Hungarian	OECD1	OECD2
	Equivalence scales							
X_1	3.87	3.21	3.15	2.42	2.11	2.46	2.48	2.75
X_2	75	49	48	29	6	12	11	15
X_3	71	51	45	27	10	16	18	25
X_4	96	74	68	42	23	34	36	47
X_5	45	39	39	28	3	3	3	4
X_6	41.5	46.4	46.8	53.0	47.9	45.9	45.9	44.8
X_7	50.5	56.1	54.5	62.8	8.8	6.1	6.0	5.6
X_8	2.5	2.9	2.6	2.4	41.7	43.7	43.7	43.5
X_9	5.6	5.1	5.1	3.9	0.3	0.4	0.4	0.2
X_{10}	19.6	22.5	23.2	25.1	9.1	7.8	7.9	7.8
X_{11}	39.0	34.8	33.3	26.5	3.6	4.2	4.1	4.2
X_{12}	69.5	71.4	70.7	72.4	12.2	8.6	8.1	6.4
X_{13}	0.1	0.4	0.4	0.3	15.4	17.8	18.3	19.9
X_{14}	29.1	31.6	31.8	34.0	1.9	1.5	1.5	1.9
X_{15}	37.2	37.1	37.1	37.0	22.1	21.6	21.6	21.9

Source: Hungarian HBS, 2000.

CONCLUSIONS

The equivalence scale described in Section 2 is a result of quite a number of trials. The final version is based on a model the parameters of which were estimated by using the data set of three consecutive years of the Hungarian HBS. The scale is rather similar to the OECD1 scale with the essential difference that children are differentiated by age. It has to be noted that though the application of the OECD1 scale can be found in many researches and even in publications of the HCSO, in practice e.g. in official social politics the use of per capita income still prevails. Therefore in order to change this practice not only professional, but also political consensus is necessary, because the choice of the equivalence scale can be advantageous for certain social groups while disadvantageous for others.

For the time being there is no consensus on which equivalence scale is to be used either within the country or internationally. The latter can be considered quite natural, because – as it was stressed in the *Introduction* – for a fair comparison among countries instead of a general scale different scales suitable to reflect the development level and consumption patterns of the individual countries should be applied. International comparability, in contrast with the present practice, requires not the use of a common, supranational scale, but rather different scales that take into account and stress the national characteristics of the countries participating in the comparison.

Formerly the OECD1 scale was in general use while recently the application of the OECD2 scale has been forced, especially in the practice of the EU. The developed Hungarian scale is at present rather similar to the OECD1 one, while it is very far from the OECD2 scale. As our analysis revealed the latter scale is in very loose correlation only with income poverty as well as with multidimensional poverty indicators, at least under the present Hungarian circumstances. Therefore, we regard it unjustified to force its application for Hungary as required by Eurostat.

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