Radosław Jeż

THE ROLE OF EQUIVALENCE SCALES IN SHAPING THE LEVEL OF INCOME INEQUALITY IN POLAND – THEORETICAL AND EMPIRICAL APPROACH

Introduction

The economic and constitutional changes in Poland of the nineties exerted a significant influence over the financial situation of all sectors of the economy and were connected with a serious decrease in the production output as well as a decline in the social welfare. This phenomenon was accompanied by a dramatic increase in the level of income inequalities. The process of transformation of Polish economy was tightly connected with the changes in consumption, embracing the level and structure of consumers' preferences. The question about an ideal equality, or on the contrary, about a certain permissible level of inequality in a society, is still vital and timely. Economics, analyzing the phenomenon of welfare, assumes that the level of wealth is denoted by the income vector. H. Dalton in his pioneering work referred to the measurement of inequality in terms of reducing social welfare. Those assumptions allowed to state that achieving the maximum level of welfare is possible in a situation where all citizens hold the same income. Such a distribution, which should be characterized by an ideal equality, has been called an egalitarian distribution in the literature on the subject. The existing inequality means the deviation of incomes distribution from an egalitarian distribution. After several years of socio-economic transformation a debate over the scale of incomes diversification in the context of the cause-and-effect analysis has intensified. The selection of appropriate tools used in the incomes inequality analysis has become a vital aspect, as these tools allow describing the actual level of unequal incomes distribution in the national economy.

1. Equivalence scales – basic issues

When assessing the welfare of households, an attention should be paid to the fact that their needs (especially of the various units within the household) are varied. The level of satisfied needs and the structure of expenditure are largely dependent not only upon income, but also upon socio-demographic characteristics[1]. Hence arises a question about income, which should a household of up *n* people have to achieve the standard of living which is a reference point, which is determined by an appropriate level of income or expenditure. The answer to this question will allow proportional distribution of income and identify these households who face, or may in the future encounter, the phenomenon of poverty. The

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[1] Socio-demographic characteristics taken into consideration are the number of persons in household, number of children, the age structure of household members, age and education of the household head, place of residence.

measurement of the utility function of income is primarily to create a theoretical basis for comparisons of welfare of households with different demographic structure. These comparisons can be made using the equivalence scales. The variety of equivalence scales and the problem associated with the choice of an appropriate scale are widely and carefully analyzed and described in the literature of statistics. B. Buhmann examines 35 different equivalence scales used in studies in various countries of the European Union[2]. In addition to the scales set by the experts, the so-called normative scales, which are used in their studies, e.g. GUS, are used quasi-accurate scales and subjective scales. Equivalence scales are the parameters for determining what is the impact of the demographic composition of the cost of living (consumption) of the household, and so, as its needs are shaped under the influence of specific characteristics. An equivalence scale for household of a given demographic composition informs how many times its income must change (increase or decrease) in order it reached the same level of consumption as a household, which constitutes the reference point (with scale equal to 1)[3]. Equivalence scales are used among others to determine the equivalent income. The equivalent income is a measure comparable between households, regardless of their demographic composition. Income divided by the appropriate equivalence scale is of fundamental importance for all social research, as it takes into account the location of households on a scale of wealth (for research include poverty, living costs, diversification of revenue, income mobility, etc.). A special case involves studies, in which the scale relates to certain specific individuals, such as children (the cost of child study). A. Deaton and J. Muellbauer in 1980 proposed a general equivalence scale:

$$SE(p, u, A, A_0) = \frac{c(p, u, A)}{c(p, u, A_0)} \qquad (1)$$

where:
c − a function of costs or expenses,
p − a vector of prices,
u − a fixed level of utility,
A − a vector of demographic characteristics of household surveyed,
A_0 − a vector of demographic characteristics of household reference.

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[2] B. Buhmann, L. Rainwater, G. Schmaus, T. Smeeding: *Equivalence Scales, Well-Being, Inequality and Poverty: Sensitivity Estimates Across Ten Countries Using the Luxembourg Income Study (LIS) Database*. "Review of Income and Wealth" 1988, No. 34, pp. 115-142.

[3] For example, it can be assumed that if the general expenses of the household consisting of two adults are 70 percent higher than the expenditure of one single person, the scale of the equivalence of two-person household will be equal to 1.7, assuming that for a single person household that is the reference point scale will be 1.

The scale recorded by the above formula is defined as the ratio of cost function of two households with different demographic characteristics. The value of the scale described is equal to the minimum cost of household demographic characteristics of A, which is desirable to achieve a level of utility by holding a reference to the demographic characteristics of A_0. Studies show that it is not possible to build scale equivalence solely on the basis of household spending and prices of goods. Equivalence scales, defined as the ratio of cost functions of households with different demographic characteristics cannot be derived from observations on market behaviour of households[4]. Therefore, there is not an unambiguous answer to the question, which an income should a household of demographic characteristics of the A have, to achieve prosperity for the reference household of a demographic characteristics A_0 and income x_0. The literature proposes two ways to resolve this problem[5]. The first is the introduction of arbitrary assumptions, which allow estimating the scale with econometric methods. This approach leads to an arbitrary scale (e.g. quasi-exact scale)[6]. The other way − the use of appropriate non-market data, which are mostly subjective assessment of the level of prosperity achieved by the survey[7].

Determination of equivalence scales is based on several basic assumptions. One of them concerns the standard of living of the household, which is measured by the size of income. An alternative to this measurement is an assumption that uses the number of persons in the household. It suggests that with an increase in the number of persons in the household its income and expenditure should also be increased in order to maintain its current standard of living[8]. It is assumed that equivalence scales are growing more slowly than in proportion with the increasing number of people in the household. Moreover, it varies with the reference to the particular goods purchased in the basket mix, which makes the scales determined for the goods and households different. This follows from the evaluation, suggesting that economies of scale are larger in the case of the dwelling than for food, and the set scales should increase more slowly for the dwelling than for expenditures incurred for food. The main difficulty arising in the deter-

[4] S.M. Kot: *Ekonometryczne modele dobrobytu.* Wydawnictwo Naukowe PWN, Warszawa – Kraków 2000, pp. 176-177.
[5] Ibid.
[6] A. Szulc: *Quasi-exact Equivalence Scales Estimation*. "Przegląd Statystyczny" 1994, No. 3-4, pp. 302-307.
[7] J. Podgórski: *Wyznaczenie subiektywnych linii ubóstwa*. "Wiadomości Statystyczne" 2003, No. 12, pp. 12-19.
[8] Significantly different point of view is presented in the study: R.W. Blundell, A. Lewbel: *The Information Content of Equivalent Scales*. "Journal of Econometrics" 1991, No. 50, pp. 49-68.

mination of specific equivalence scales comes from the budgetary strategy of households. This strategy – is a two-step process, where the basic assumption is weak separability. This means that the marginal rate of substitution between two goods belonging to one class of goods does not depend on consumption of different groups of goods. The household income is first divided between the main groups of goods (e.g. maintenance, food, clothing), then the amount is distributed within the appropriate category and provided for the purchase of goods according to preferences and liking. The disaggregation of income between various goods is associated with the estimate of a large number of equations and parameters, which turns out to be impossible in the absence of such statistics.

The major problems that occur in the process of estimating equivalence scales and cause disputes and discussions include[9]:

1. Selection of the utility function is necessary for the scale traceability, which stems from the fact that two completely different cost functions, describing the different preferences of individuals, and related rules of consumption of goods, may generate the same demand functions describing the individual consumption behaviour of households. If still the data on the observed consumer behaviour are available, according to which demand functions can be determined, it is not possible to clearly designate the cost function and the corresponding equivalence scale. An arbitrary selection of a specific utility function means that the scale resulting from this function is of similar character.

2. The specification of the demand function depending on demographic variables, which is to decide on the existence of economies of scale, or its absence, non-linear demand function and determines the flexibility of arbitrary scales for selected goods[10].

3. How to introduce the system demographic variables in demand functions − a direct way is very common, which is bases on the fact that there are demographic variables in the model as additional explanatory variables. These are the procedures for placing explanatory variables. This involves the direct introduction into the cost function of demographic variables, prices and house-

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[9] The literature referring to the equivalence scales is very rich. The work in this field is of methodological and applied approach. See: C. Blackorby, D. Donaldson: *Household Equivalence Scales and Welfare Comparisons: A Comment.* "Journal Public Economics" 1993, No. 50, p. 143 and the following; A. Szulc: *Almost Ideal Demand System with Demographic Variables: Estimates for Poland with Applications to Welfare Measurement.* "Research Bulletin" 1999, No. 8, pp. 61-80; Idem: *Is it Possible to Estimate Reliable Household Equivalence Scales?* "Statistics in Transition" 2003, No. 4, pp. 589-611.

[10] The solution is to adopt such flexibility equal to 0 for spending on clothing for adults, or alcohol and tobacco or equal to 1 − for total spending on clothing.

hold spending[11]. An indirect way is based on the fact that demographic variables constitute modified, in an appropriate way, the parameters of the model.

4. Redistribution of income and consumption between social units within the household − consumption in the first stage takes place between individual units belonging to the household. The remaining part is regarded as a common property. This division, due to the specific characteristics of households, demographic composition, maintenance costs and economies of scale[12], is very difficult to estimate.

In practice of social research, there are many types of equivalent scales, but none of them has become a widely accepted standard. Among the equivalence scales should be highlighted so called general scales and specific scales. The general equivalence scales are developed on the basis of the overall level of consumption in households with precisely defined demographic characteristics. Specific scales in turn refer to the consumption of households at the lower level of aggregation. These cater for groups of goods (or the individual consumer goods) consumed by households. Equivalence scales can be divided into normative and empirical, and subjective, relating to their own assessment of different income levels[13]. Different methods of estimation will result in the formation of differences in size scales.

2. The influence of some equivalence scales in shaping the level of income inequality – own research

The analyzed category of income is the income per capita and equivalent income (adjusted), obtained after the application of appropriate equivalence scales: OECD 70/50 and OECD 50/30 scales and power scales of values 0.72 and 0.43. The OECD scale values were determined directly from the definition, rather than using the power function approximations, which guarantees the authenticity of the results obtained. The distribution of the household income values, as well as information about sample sizes and the average values of income categories in question are those reported in Table 1.

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[11] R.A. Pollak, T.J. Wales: *Demographic Variables in Demand Analysis*. "Econometrica" 1981, No. 49, pp. 1533-1550.

[12] For example, the relatively low price of common property used by everyone in the household, causes increased consumption of that good. At the same time, this process reduces the size of individual consumption of goods by adults and children, thus reducing children's the cost of living.

[13] A. Szulc: *Skale ekwiwalentności w pomiarze dobrobytu gospodarstw domowych*. "Polityka Społeczna" 1995, No. 22, pp. 37-42.

Table 1

Average and median equivalent income in Poland in 1998-2005

Year	A type of equivalence scales				
	E = 1	OECD 70/50	LIS E = 0,72	OECD 50/30	S.M. Kot E = 0,43
	Average				
1998	514,9	674,4	716,6	826,2	1027,2
1999	557,8	729,1	776,2	892,5	1112,6
2000	606,4	791,7	842,6	968,5	1206,1
2001	651,6	845,8	899,5	1030,9	1280,2
2002	675,8	873,2	929,4	1061,5	1317,5
2003	696,1	898,5	956,1	1091,4	1353,6
2004	721,9	933,1	992,4	1134,2	1405,7
2005	769,1	956,2	999,1	1397,8	1474,6
2006	772,4	961,8	1000,5	1406,6	1483,4
2007	780,2	969,4	1005,9	1420,1	1495,5
2008	785,9	974,2	1010,4	1438,9	1510,4
	Median				
1998	440,9	588,1	628,0	724,9	903,8
1999	475,5	633,6	678,2	781,1	980,3
2000	511,6	680,4	725,4	835,9	1041,4
2001	547,0	727,7	777,9	891,7	1117,2
2002	558,6	740,2	793,8	910,1	1140,2
2003	574,9	756,9	810,8	927,5	1158,0
2004	593,3	781,4	838,9	955,6	1200,0
2005	621,1	792,9	867,7	972,6	1242,0
2006	634,5	798,9	877,8	980,6	1268,9
2007	645,7	805,8	890,4	1005,3	1302,5
2008	658,9	817,8	910,5	1023,8	1332,3

Source: Based on: *Roczniki Statystyczne Głównego Urzędu Statystycznego w Polsce 1998–2008*. GUS, Warszawa 1999-2009; *Warunki życia ludności w Polsce w latach 1998–2008*. GUS, Warszawa 1999-2009.

In each of the samples obtained measuring the concentration of income in households has been conducted. In the analysis of the concentration of income two commonly used indices were applied: Gini index *(G)* and the mean relative deviation *(R)*. Indices values *(G)* and *(R),* given in Table 2, were compared to five equivalence scales of investigated categories of income.

Table 2

The values of the concentration of income equivalent to Gini index *(G)*
and the average relative deviation *(R)* in Poland in 1998-2005

Year	A type of equivalence scales				
	E = 1	OECD 70/50	LIS E = 0,72	OECD 50/30	S.M. Kot E = 0,43
	Gini index *(G)*				
1998	0,321	0,299	0,296	0,290	0,287
1999	0,327	0,305	0,302	0,296	0,292
2000	0,338	0,318	0,314	0,309	0,305
2001	0,338	0,316	0,311	0,306	0,299
2002	0,347	0,324	0,318	0,313	0,305
2003	0,350	0,328	0,322	0,318	0,309
2004	0,356	0,335	0,329	0,325	0,317
2005	0,364	0,348	0,335	0,332	0,329
2006	0,366	0,349	0,337	0,333	0,330
2007	0,367	0,348	0,338	0,335	0,332
2008	0,377	0,350	0,338	0,336	0,333
	the average relative deviation *(R)*				
1998	0,225	0,209	0,206	0,202	0,200
1999	0,229	0,212	0,210	0,205	0,203
2000	0,237	0,221	0,219	0,215	0,212
2001	0,237	0,221	0,217	0,214	0,209
2002	0,245	0,227	0,223	0,219	0,213
2003	0,248	0,231	0,226	0,223	0,217
2004	0,252	0,235	0,231	0,228	0,221
2005	0,258	0,239	0,237	0,232	0,228
2006	0,259	0,241	0,237	0,233	0,229
2007	0,262	0,244	0,238	0,235	0,233
2008	0,264	0,245	0,235	0,240	0,235

Source: Ibid.

Changes in indices, over a time period, are shown in the Figures 1 and 2. The highest concentration of income values is noticeable for the per capita income. Along with the decreasing elasticity scale also the value of indices decreases. These figures may appear to be shifted along the vertical axis. In fact, the change in the equivalence scale implies an approximately proportional change in the value of concentration index (except the scale with the lowest elasticity). The type of scale used does not affect the direction of changes in the concentration.
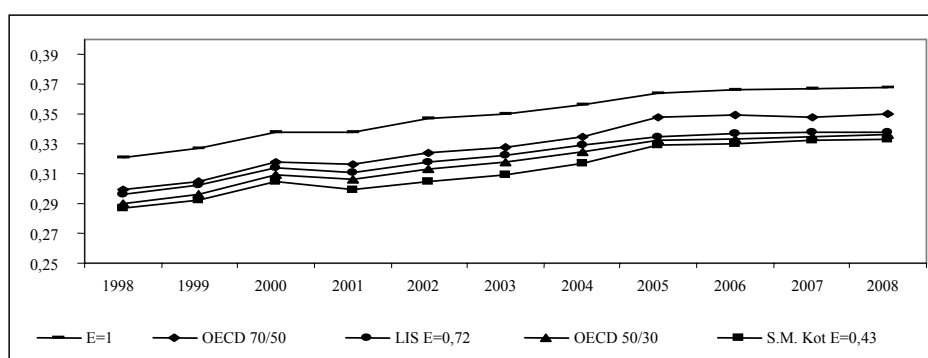
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Figure 1. The dynamics of changes in Gini index *(G)* for the five categories of equivalent income in Poland in 1998-2008

Source: Based on: *Roczniki Statystyczne Głównego Urzędu Statystycznego…*, op. cit.; *Warunki życia ludności…*, op. cit.

The highest level of income concentration was reported for the per capita income. Along with the decrease of the elasticity of the equivalence scale the values of the concentration indices decrease also, namely, Gini index *(G)* and the average relative deviation *(R)*. The use of different equivalence scales causes an approximately proportional change in the value of concentration index. So, these changes do not affect the direction of the changes of the level of income concentration.
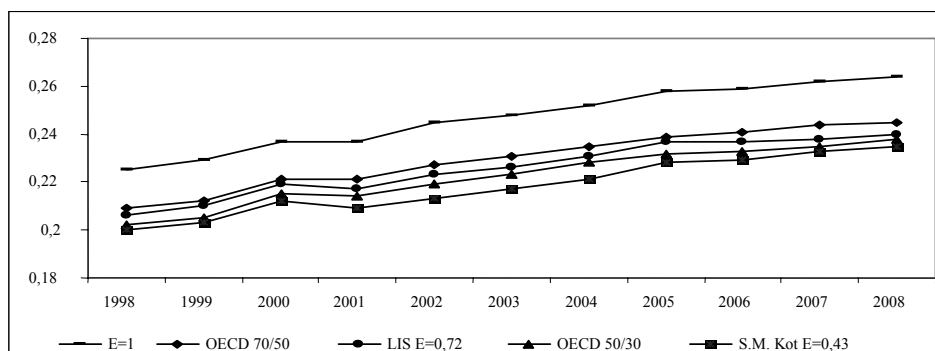

Figure 2. The dynamics of changes in the average relative deviation *(R)* for the five categories of equivalent income in Poland in 1998-2008

Source: Ibid.

Conclusions

Income inequalities in Poland, shape many negative effects of economic and social development. The stratification of income in Poland, since the beginning of the economic transformation process – as it is clear from the empirical

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research – has been showing an upward trend. Through the use of specific equivalence scales it has been indicated that the increase in income inequality in Poland – despite the relatively rapid economic growth – caused that a small proportion of the population has benefited from this growth. Salaries of some social groups are growing only slightly in relation to the increase in the overall level of income. This situation makes that much of the population is excluded from the possibility of investing in intellectual development, which would impact adversely on the potential development of Polish economy.

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