MEASURING SOCIAL INEQUALITY

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Abstract: *The measurement of social inequality is a timely and important topic. Income inequality measure or income distribution measures are used to measure the distribution of income and economic inequality among the participants in a particular economy. Among the most common metrics used to measure inequality are the Lorenz curve and the Gini index (Gini coefficient). Theil's index is part of a special class of inequality measures known as Generalised Entropy measures. An important property of Theil's index is the additive decomposability characteristic, which implies that the aggregate inequality measure can be decomposed into inequality within and between any arbitrarily defined population subgroups. This paper aims to investigate the expenditure inequality in Slovakia. Total expenditure inequality is decomposed into the within-groups and between-groups components using Theil's inequality decomposition technique. The analysis is based on individual data derived from the Household budget survey conducted by the Central Statistical Office in Slovakia.*

Key words: *Generalised entropy measures, inequality, Theil T index, decomposition*

1. INTRODUCTION

Inequality is the difference in the capacity of individuals to follow lives of their choosing [1]. The concept of inequality is quite broad. Inequality can be linked to inequality in opportunities, education, skills, happiness, health, life expectancy, welfare, assets and social mobility. Economists are especially interested in a monetarily measurable dimension of inequality related to individual household income and consumption.

Many researchers study macroeconomic effects and their relationship with inequality [2], [3], [4], [5], [6]. The second framework for the analysis of inequality is the relationship between inequality and microeconomic factors. The aim of their studies is to assess the effect of household and individual characteristics on inequality (income and expenditure inequality).

2. METHODOLOGY

The measurement of income inequality is a timely and important topic. According to [1] inequality measures can be classified into two broad types, the objective and the normative. The normative measures usually deal with inequality from a view of its effect on a social welfare assignation. The objective measures are characterized by the use of statistical and mathematical tools for the estimation of income dispersion among a set of individuals.

There are many ways of measuring inequality. The most commonly used measuring methods in empirical studies include the Gini coefficient, the decile ratio, the variance, the standard deviation of logarithms, the coefficient of variation, the Robin Hood index, The Generalized Entropy Indexes and the Atkinson index [7]. In this paper we used The Generalized Entropy Indexes.

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2.1 THE GENERALIZED ENTROPY INDEXES

The Generalized Entropy Indexes are based on the concept of entropy. In thermodynamics, entropy is a measure of disorder [8]. When applied to income or expenditure distributions, entropy has the meaning of deviations from perfect equality. The formula of a Generalised Entropy Indexes $GE(\alpha)$ is the following [8]:

$$GE(\alpha)=\frac{1}{\alpha^2-\alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha}-1\right] \tag{1}$$

where α represents the weight given to distances between incomes at different parts of the income distribution, n is the number of individuals in the sample, y_i is the income of individual i, $i \in (1,2,...,n)$ and $\bar{y}$is the mean income of the sample. The value of $GE(\alpha)$ ranges from 0 to ∞, with zero representing an equal distribution (all incomes identical) and higher values representing higher levels of inequality.

The index $GE(\alpha)$ assumes different forms depending on the value assigned to α. A positive α captures the sensitivity of the $GE(\alpha)$ index to a specific part of the income distribution. With positive and large α, the index $GE(\alpha)$ will be more sensitive to what happens in the upper tail of the income distribution. With positive and small α, the index $GE(\alpha)$ will be more sensitive to what happens at the bottom tail of the income distribution.

The commonest values of α are 0 and 1. $GE(0)$, also known as Theil's L, and it is called mean log deviation measure:

$$Theil\ L=GE(0)=\lim_{\alpha\to 0}\frac{1}{\alpha^2-\alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha}-1\right]=\frac{1}{n}\sum_{i=1}^{n}\log\frac{\bar{y}}{y_i} \tag{2}$$

$GE(1)$ is known as Theil's T index and has been calculated using the formula:

$$Theil\ T=GE(1)=\lim_{\alpha\to 1}\frac{1}{\alpha^2-\alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha}-1\right]=\frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{\bar{y}}\log\frac{y_i}{\bar{y}} \tag{3}$$

2.2 DECOMPOSITION OF INCOME INEQUALITY

Many empirical analyses of income inequality rely on measures of inequality which are decomposable in the sense that, if the population of income earners is broken down into a certain number of subgroups, the inequality measure for the total population I can be expressed as a sum of the weighted average of the inequality existing within subgroups of the population I_W and of the inequality I_B existing between them [9]:

$$I=I_W+I_B \tag{4}$$

Thus, decomposable measures differ only by the weights given to the inequality within the subgroups of the population. It is proven [10], [11] that the only zero-homogeneous "income-

weighted" decomposable measure is Theil's T index and that the only zero-homogeneous "population-weighted" decomposable measure is the Theil's L index.

If we define that the overall inequality can be completely and perfectly decomposed into a between-group component T_B and a within-group component T_W, then equation (4) can be decomposed such that [10], [12]

$$TheilL = TheilL_W + TheilL_B \tag{5 a}$$

$$Theil\ L = \sum_{j=1}^{k}\left(\frac{n_j}{n}\right)L_j + \sum_{j=1}^{k}\frac{n_j}{n}\log\frac{n_j/n}{y_j/y} \tag{5 b}$$

Equation (3) can be decomposed into:

$$TheilT = TheilT_W + TheilT_B \tag{6 a}$$

$$Theil\ T = \sum_{j=1}^{k}\left(\frac{y_j}{y}\right)T_j + \sum_{j=1}^{k}\left(\frac{y_j}{y}\right)\log\frac{y_j/y}{n_j/n} \tag{6 b}$$

where j indexes a group, n_j representing the population in group (subgroups) j, and y_j representing the total income in group j (subgroups). The Theil's L (Theil's T) index for each group, L_j (T_j), corresponds to the inequality only between those individuals that are members of group.

The first term (5 b, 6 b) describes inequality within each of the j population subgroups, the second term measures inequality between these subgroups.

The Household budget survey micro data on family characteristics and expenditures (HBS) was used as a data source for this paper. The data were collected in 4 704 randomly selected households from the whole Slovak Republic. International classification of individual consumption by purpose (COICOP – HBS) was applied to the HBS and was published in "Household Budget Surveys in EU: Methodology and recommendations for harmonisation, 2003". The COICOP – HBS classification has 12 divisions: Foodstuffs and non-alcoholic beverages; Alcoholic beverages and tobacco; Garments and shoes; Housing, water, electricity, gas and other fuels; Furniture, dwelling equipment and current maintenance of house; Health; Transport; Communications; Recreation and culture;

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2014 – associate professor - Faculty of Economic Informatics, University of Economics in Bratislava (Quantitative Methods in Economics)
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The aim of the analysis presented in this paper is to assess the socioeconomic factors in terms of their impact on inequality in the distribution of consumption expenditures among the households in Slovakia. We take into account the differences between regions of Slovakia and characteristics of the heads of households, which could have an impact on the behaviour of households in consumption.

3. EMPIRICAL RESULTS

Looking at the composition household expenditure by consumption purpose by the 10 COICOP categories figures (see Figure 1), almost a quarter of household expenditure (24.9 % of total) was devoted to Food and non-alcoholic beverages. Other large shares are observed for Housing, water, electricity, gas and other fuels (22.7 % of total). Transport (9.0 % of total), Recreation and culture (8.5 % of total) and Miscellaneous goods and services (7.0 % of total) followed.

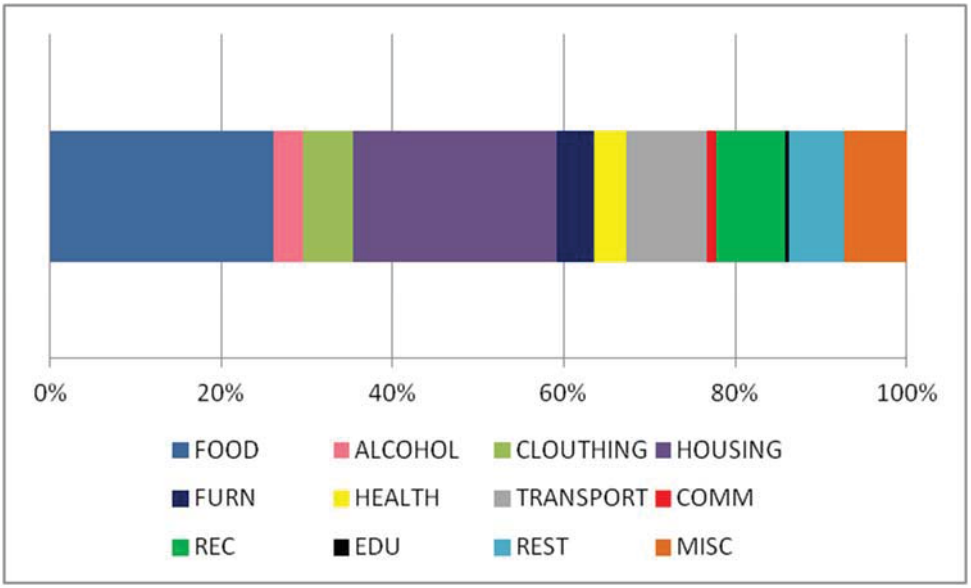

Figure 1: Household expenditure by consumption purpose – COICOP, share of total
Source: Household budget survey, authors' own elaboration

FOOD – Foodstuffs and non-alcoholic beverages, ALCOHOL – Alcoholic beverages and tobacco, OO- Garments and shoes, HOUSING – Housing, wate, electricity, gas and other fuels, FURN – Furniture, dwelling equipment and current maintenance of house, HEALTH – Health, TRANSPORT – Transport, COMM – Communications, REK- Recreation and culture, VZD-Education, REST- Hotels, cafés and restaurants, RTS- Miscellaneous goods and services.

Decomposition of the consumption expenditure on Food and non-alcoholic beverages and on Housing, water, electricity, gas and other fuels was performed according to population subgroups, which are based on the categories of variables that describe the characteristics of households: *Administrative region* (8 categories), *Urbanisation degree* (3 categories), *Type of household* (8 categories) and variables that characterize the household heads: *Gender of the head of household* (2 categories), *Highest completed education of the head of household* (15 categories), *Current activity of the head of household* (9 categories).

Results of decompositions of consumption expenditure of Food and non-alcoholic beverages and of Housing, water, electricity, gas and other fuels are shown in Table 1.

Decomposition of the Theil-T index shows that the most important determinant of inequality of consumption expenditure on Food and non-alcoholic beverages and on Housing, water, electricity, gas and other fuels is a type of households and current activity of head of household. Between-group inequality component for Food and non-alcoholic beverages represents 25.94 percent of total inequality (12.67 percent) and for Housing, water, electricity, gas and other fuels represents 42.07 percent of total inequality (11.66 percent) (Table 1).

Variable	**T index**	**Theil Value (%)**	**Value**	**Value (%)**
	Component	Food and non-alcoholic beverages	Housing, water, electricity, gas and other fuels	Total
Gender	T_B	4.31%	10.58%	1.79%
	T_W	95.69%	89.42%	98.21%
Urbanisation degree	T_B	0.87%	4.37%	3.86%
	T_W	99.13%	95.63%	96.14%
Current activity of head of household	T_B	**12.67%**	**11.66%**	3.87%
	T_W	87.33%	88.34%	96.13%
Administrative region	T_B	2.53%	2.90%	4.85%
	T_W	97.47%	97.10%	95.15%
Education level of head of household	T_B	0.69%	1.87%	5.36%
	T_W	99.31%	98.13%	94.64%
Type of household	T_B	**25.94%**	**42.07%**	22.18%
	T_W	74.06%	57.93%	77.82%

Table 1: Decomposition of the Theil T index (net expenditures (EUR per person per month)) by household characteristics
Source: Household budget survey, authors' own elaboration

4. CONCLUSION

In this paper, we used the method of Generalized Entropy Indexes decomposition to measure the impact of characteristics of households and their members (the type of household, the urbanisation degree, the administrative region, the current activity of head of household, the education level of head of household and gender of head of household) on inequality of

consumption expenditure on "Food and non-alcoholic beverages" and on "Housing, water, electricity, gas and other fuels". Among our findings is that the most important determinant on inequality of consumption expenditure on "Food and non-alcoholic beverages" and on "Housing, water, electricity, gas and other fuels" is the type of household and current activity of head of household.

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REFERENCES

[1] Sen, A. K. (1997). *On Economic Inequality*. Oxford: Oxford University Press, 1997. 260 p. ISBN 0-19828193-5.
[2] Kuznets, S. (1955). The American Economic Growth and Income Inequality. *The American Economic Review*, 45 (1), pp. 1 – 28.
[3] Bourguignon, F., Morrisson, Ch. (2002). Inequality among World Citizens: 1820 – 1992. *The American Economic Review*, 92 (4), pp.727 – 744.
[4] Milanovic, B. (2006). *Global Income Inequality: What it is and why it matters*. The World Bank.
[5] Sala-i-Martin, X. (2002). *The Distributing „Rise" of Global Income Inequality. NBER Working Paper No. 8904*. Cambridge: National Bureau of Economic Research.
[6] Forbes, K. J. (2000). A Reassessment of the Relationship between Inequality and Growth. *American Economic Review*, 90 (4), pp.869 – 887.
[7] Schutz, R. R. (1951). On the measurement of income inequality. *American Economic Review*. 41, pp.07 – 122.
[8] Frenken, K. (2007). Entropy statistics and information theory. *Elgar Companion to Neo-Schumpeterian Economics*. Cheltenham: Edward Elgar, pp.544 – 555.
[9] Cowell, F. A., Jenkins, S. P. (1995). How Much Inequality can we Explain? A Methodology and an Application to the USA. *The Economic Journal,*105 (429), pp.421 – 430.
[10] Bourguignon, F. (1979). Decomposable Income Inequality Measures. *Econometrica.* (47), 4, pp.901 – 920.
[11] Shorrocks, A. F. (1980). The class of additively decomposable inequality measures. *Econometrica*. 48, (3), pp.613 – 625.
[12] Cowell, F. A. (1980). On the Structure of Additive Inequality Measures. *Review of Economic Studies.* (47) 3, pp.521 – 531.