INCOME INEQUALITY IN THE VISEGRAD GROUP COUNTRIES. DECOMPOSITION OF GENERALIZED ENTROPY MEASURES

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Abstract

The paper aims at assessing and comparing the level of income inequalities in the Visegrad Group countries and at analysing how different social and demographic factors are associated with the extent of income inequality. The contribution of our article consists in the decomposition of income inequality by subgroups of household classified by characteristics such as the type and size of the household, the socio-economic group of the household, the educational level of the household head and the place of residence. The analysis on income inequality is based on microdata obtained from the Eurostat (EU-SILC). To assess the overall income inequality the measures of Generalized Entropy were used. The study shows that in the V4 group the lowest level of income inequality is observed in Slovakia and Czech Republic. Our findings suggest that education and prevailing source of income are among the main determinants of income inequality. In all V4 countries, the difference in the level of education is the most crucial driver of income inequality.

Key words: income inequality; generalized entropy measures; decomposition

JEL Code: D63, D31, C10

Introduction

In every society, we can observe different forms of inequality. The concept of social inequality implies the uneven distribution of resources, life conditions, opportunities, or other outcomes across individuals, groups, or social classes (Roberto, 2015, p. 2). The existence of social inequality is to some extent natural due to differences between individuals.

Economic inequalities can be conceived of as inequalities with an economic effect or an economic origin, being as much an outcome of the underlying economic process as an input into these processes (Salverda, Nolan, & Smeeding, 2009, p. 7). Most often, economic inequality indicates that economic resources are not shared equally between individuals. Analysis of economic inequality can be based on wealth, income, expenditure or utility distribution. The two variables most commonly studied are incomes and consumption

expenditures, however, inequality in the distribution of income (among households and / or individuals) seems to be a key aspect of overall economic inequality.

In our study we analyse the household income inequalities in the Visegrad Group (V4) countries. The aim of the research is to assess and compare the level of income inequalities in the V4 group and analyse how different social and demographic factors are associated with the extent of income inequality. We also aim at the decomposition of income inequality by subgroups of household classified by characteristics such as the type and size of the household, the socio-economic group of the household, the educational level of the household head and the place of residence.

Our analysis is based on microdata obtained from the Eurostat (EU-SILC 2016). The measurement of inequalities covers two concepts of income: equivalised disposable household income before social transfers (except old-age and survivors' benefits) and equivalised disposable household income after social transfers. In order to assess the overall income inequality, we use inequality indices belonging to the measures of Generalized Entropy and then decompose them into two components: within group and between group inequality.

1 Inequality of household incomes and their decomposition

Household disposable income is generated in a two-stage process: distribution and redistribution of income. At the first stage, as a result of combining all incomes of all household members a market income is created. It covers all labour market earnings from employment or self-employment, income from savings and investments and incoming private transfers such as pensions from individual private plans, alimony or receipts of gifts.

At the stage of income redistribution, household market income is subject to modification. Alterations can occur both in the public and private sector. In the public sector taxes and social transfers are the main sources of the modification. In the private sector alteration takes place through income transfers between the households. Household disposable income (net income) is a market income of a household, increased by public transfers such as social insurance or social assistance benefits and reduced by income taxes, social insurance contributions and outgoing private transfers, e.g. payments for child support.

Depending on the stage of household income generation process different sources of income inequality can be indicated. The inequalities arising at the distribution stage are primarily determined by market mechanisms related to the labour market and the capital market. They may result, among others, from differences in the ownerships of physical and

human capital, the level and structure of employment, labour market flexibility or productivity of production factors. The tax system and public transfers of a social character are responsible for the level of inequality, shaped at the stage of income redistribution. It is worth to notice that public transfers play a crucial role in reducing the level of income inequalities and their extent depends on the social policy of the state. Additional inequalities in the distribution of net income may occur, having other sources than those indicated above. They can result from the composition of the household and the relationship between its members.

For years, income inequalities as well as their sources have been the subject of numerous studies. Within the literature in this field, we can find a large number of decomposition methodologies, each with their own advantages and limitations. According to Cowell and Fiorio (2011, p. 510), two main categories of decomposition approach can be distinguished: 'a priori' approaches and 'regression models'.

In a priori approach decomposition is based on theoretical axioms. This category includes decompositions by factors components and by population subgroups, developed by Shorrocks (1982, 1984) as well as the Shapley-value decomposition (Chantreuil & Trannoy, 2013). Each of the above-mentioned decomposition methods provides us with a different insight into what drives inequality. Decomposition by factor components identifies the contribution of each factor sources to total inequality, while decomposition by population subgroups allows the disaggregation of overall inequality into the contribution arising from the inequality within each of the group and the contribution from inequality between the groups. The Shapley-value decomposition defines an inequality measure as an aggregation (ideally a sum) of a set of contributory factors, whose marginal effects are accounted eliminating each of them in sequence and computing the average of the marginal contributions in all possible elimination sequences (Cowell & Fiorio, 2011, p. 511).

The second type of decomposition approach, based on multivariate regression models, derives from a mainstream econometric tradition in applied economics. It covers all types of econometric models from a simple regression model as in Fields (2003) to the structural model of inequalities decomposition developed by Bourguignon, Ferreira and Leite (2008).

2 Methodology

The empirical strategy applied in this article pertains to the Generalised Entropy (GE) class of inequality indices decomposed by various individual attributes. The GE measures belong to the group of measures based on information theory (Cowell & Kuga, 1981) and are given by:

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

where y_i is the equivalised disposable income of an individual i, $\bar{y}$ is the population mean income, and n is the number of individuals in the population. Parameter $\alpha \epsilon (-\infty, +\infty)$ summarises the sensitivity of $GE(\alpha)$ to income differences in different parts of the income distribution. For α large and positive $GE(\alpha)$ is sensitive to changes in the distribution that affect the upper tail; with α small and positive the measure will be more sensitive to what happens at the bottom tail of the income distribution. For $\alpha \leq 0$ the measure is sensitive to changes in the distribution that affect the lower tail (Cowell, 2006, p. 5). Nonetheless in empirical work, values of parameter α is typically limited to $[-1,2]$ because, otherwise, estimates may be unduly influenced by a small number of very small incomes or very high incomes (Jenkins, 2009, p. 394).

It is worth noting that expression (1) is not defined for $\alpha = 0$ and $\alpha = 1$, because the denominator $n(\alpha^2 - \alpha) = 0$ in both cases. With this in mind, two specific cases are obtained using the *de l'Hôpital* rule:

- for $\alpha = 0$ (mean logarithmic deviation – MLD)**:**

$$\mathrm{L} = GE(0) = -\frac{1}{n} \sum_{i=1}^{n} \ln \left(\frac{y_i}{\bar{y}} \right) \quad (2)$$

- for $\alpha = 1$ (the Theil index):

$$\mathrm{T}=\mathrm{GE}(1) = \frac{1}{n} \sum_{i=1}^{n} \frac{y_i}{\bar{y}} ln \frac{y_i}{\bar{y}}. \quad (3)$$

Measures belonging to the class (1) include several indices such as the variance, measures of industrial concentration, and the Atkinson class of inequality indices (Cowell, 2006, p. 8)

The GE inequality indices have played a special role because they are fully decomposable by population subgroup. Early publications in the field present theoretical and empirical results on income inequality decomposition by population subgroups and by income sources (Bourguignon, 1979; Shorrocks, 1980, 1982, 1984). The decomposable inequality measure is defined as a measure such that the total inequality of a population can be broken down into a weighted average of the inequality existing within subgroups of the population and the inequality existing between them (Bourguignon, 1979).

Decompositions by population subgroups begin with a partition of the population Π into Π_j $(j = 1,2,\ldots,k)$ distinct non-overlapping groups of individuals, defined by different characteristics (type of household, age, household size, region, household members occupation, education (Jenkins & Van Kerm, 2009)). In particular, total inequality can be

written as the sum of the inequality within groups $GE_W(\alpha)$ and the inequality between groups $GE_B(\alpha)$, where the first is the weighted sum of the inequalities within each subgroup:

$$GE(\alpha) = GE_W(\alpha) + GE_B(\alpha). \quad (4)$$

The GE measures are decomposed as follows (Elbers, Lanjouw, Mistiaen & Özler, 2008, p. 234):

- $GE(\alpha) = \sum_{j=1}^{k} GE_j(\alpha) g_j \left(\frac{\bar{y_j}}{\bar{y}}\right)^{\alpha} + \frac{1}{\alpha^2-\alpha}\left[\sum_{j=1}^{k} g_j \left(\frac{\bar{y_j}}{\bar{y}}\right)^{\alpha} - 1\right]$, for $\alpha \neq 0, 1$ (5)
- $GE(0) = \sum_{j=1}^{k} GE_j(0) g_j + \left[\sum_{j=1}^{k} g_j \ln\left(\frac{\bar{y}}{\bar{y_j}}\right)\right]$ (6)
- $GE(1) = \sum_{j=1}^{k} GE_j(1) g_j \left(\frac{\bar{y_j}}{\bar{y}}\right) + \sum_{j=1}^{k} g_j \left(\frac{\bar{y_j}}{\bar{y}}\right) \ln\left(\frac{\bar{y_j}}{\bar{y}}\right)$, (7)

where *j* refers to the sub-group, the GE_j refers to inequality in subgroup *j* and g_j refers to population share of subgroup *j*.

3 Empirical analysis

The methods discussed above were applied to the analysis of income inequality in the V4 countries. In the study we consider the following attributes of the household:

- degree of urbanisation (densely-populated area, intermediate area, thinly-populated area),
- household size (number of current household members: 1, 2, 3, 4, 5, 6 or more),
- education level (highest ISCED level attained of head of the household – 6 categories),
- household type (a one-person household, households without dependent children, a single parent household, 2 adults with one dependent child, 2 adults with two dependent children, 2 adults with three or more dependent children, other households),
- socio-economic type (classified by income category of head of household: 1-employee cash or near cash income, 2-cash benefits or losses from self-employment, 3-unemployment benefits, 4-old-age benefits, 5-survivor' and sickness benefits, 6-disability benefits).

Our analysis is based on the individual-level income data for the household members and the measures are estimated with the use of cross-personal weights. In order to measure the inequality of income distribution, we calculated the GE measures for $\alpha = -1, 0, 1$. The results are presented in tables 1 – 4.

In the first step of our discussion of the results we focus on two questions: what is the level of income inequalities among V4 countries and what is the role of social policy in reducing inequalities? All the measures indicate, that the highest total inequality of income before social transfers is in Hungary ($GE(-1) = 1{,}605$, $GE(0) = 0{,}246$,

$GE(1) = 0{,}195$) while the smallest one is in Slovakia ($GE(-1) = 0{,}435$, $GE(0) = 0{,}135$, $GE(1) = 0{,}122$). As we expected, indices based on incomes after social transfers are smaller than those calculated for incomes before them. In the case of incomes after social transfers, the highest overall inequality of income is observed in Poland ($GE(-1) = 0{,}242$, $GE(0) = 0{,}157$, $GE(1) = 0{,}151$) while the smallest in Slovakia ($GE(-1) = 0{,}190$, $GE(0) = 0{,}113$, $GE(1) = 0{,}106$) and Czech Republic $GE(-1) = 0{,}122$, $GE(0) = 0{,}107$, $GE(1) = 0{,}119$). The differences between the value of the measures for incomes before and after transfers present the influence of the social system. As we can observe, the level of changes is different in each of the countries. Our study shows that opposite to Poland, Hungarian social policy seems to be the most effective one. Interestingly, under the influence of social transfers, the high values of $GE(-1)$ have decreased the most. This reveals the very important role of social transfers for the poorest households.

In the next step we investigate how different social and demographic factors are associated with the extent of income inequality. The decomposition of the GE measures allows us to have a better understanding of factors determining inequality. Base on the results of our study we report the significance in contribution of each of components (within and between) to the total inequality in terms of the GE measures. The between-group component can be conventionally interpreted as income inequality between groups that constitute the total inequality. It thus put a characteristic of the contributions of the causes to income inequality. For this purpose, just like many experts, we use the GE measures for $\alpha = 0{,}1$.

Tab. 1: Decomposition of income inequality in Poland by group

		Income before social transfers					Income after social transfers				
		Total	Between	(%)	Within	(%)	Total	Between	(%)	Within	(%)
Degree of urbanisation	GE(-1)	0,626	0,012	1,9%	0,614	98,1%	0,242	0,010	4,3%	0,232	95,7%
	GE(0)	0,202	0,012	6,0%	0,190	94,1%	0,157	0,010	6,6%	0,147	93,4%
	GE(1)	0,175	0,012	6,8%	0,163	93,2%	0,151	0,010	6,8%	0,141	93,2%
Household size	GE(-1)	0,626	0,008	1,3%	0,618	98,7%	0,242	0,007	2,8%	0,235	97,2%
	GE(0)	0,202	0,008	4,0%	0,194	96,0%	0,157	0,007	4,3%	0,151	95,7%
	GE(1)	0,175	0,008	4,4%	0,167	95,5%	0,151	0,007	4,3%	0,144	95,7%
Education	GE(-1)	0,626	0,038	6,0%	0,623	99,6%	0,242	0,034	14,1%	0,218	90,0%
	GE(0)	0,202	0,038	18,7%	0,169	84,1%	0,157	0,034	21,8%	0,128	81,2%
	GE(1)	0,175	0,038	22,0%	0,141	80,9%	0,151	0,035	23,3%	0,121	80,3%
Household type	GE(-1)	0,626	0,008	1,2%	0,618	98,8%	0,242	0,007	2,7%	0,235	97,3%
	GE(0)	0,202	0,008	3,7%	0,194	96,3%	0,157	0,007	4,1%	0,151	95,9%
	GE(1)	0,175	0,007	4,2%	0,167	95,8%	0,151	0,006	4,2%	0,144	95,7%
Socio-economic	GE(-1)	0,626	0,031	5,0%	0,595	95,0%	0,242	0,013	5,30%	0,229	94,7%
	GE(0)	0,202	0,018	8,9%	0,184	91,1%	0,157	0,011	6,85%	0,146	93,1%

type	GE(1)	0,175	0,013	7,2%	0,162	92,8%	0,151	0,009	6,22%	0,141	93,8%

Source: Authors' own calculations.

Between-group inequality depends on three factors: differences among groups in mean incomes, the number of the groups, and their relative sizes. The importance of a variable in explaining income inequality is denoted as a ratio of the inequality between subgroups to overall inequality. According to the table 1, in Poland, the main source of income inequality, both before and after social transfers, concerns the education level of the head of the household that characterizes the formal side of human capital. The share of the inequality between subgroups in total inequality equals to 18,7% - 22,0% (before social transfers) and 21,8% - 23,3% (after social transfers). These values are the highest of all obtained in our investigation. The between-group component reflects the polarization of the subgroups, which results from significant differences in average income. The household type and the household size are the least significant in explaining income inequality.

Tab. 2: Decomposition of income inequality in Czech Republic by group

		Income before social transfers					Income after social transfers				
		Total	Between	(%)	Within	(%)	Total	Between	(%)	Within	(%)
Degree of urbanisation	GE(-1)	0,928	0,002	0,2%	0,926	99,8%	0,122	0,002	1,3%	0,121	98,7%
	GE(0)	0,170	0,002	1,3%	0,168	98,7%	0,107	0,002	1,5%	0,106	98,5%
	GE(1)	0,150	0,002	1,5%	0,148	98,5%	0,119	0,002	1,4%	0,117	98,6%
Household size	GE(-1)	0,928	0,004	0,5%	0,924	99,5%	0,122	0,005	4,0%	0,117	96,0%
	GE(0)	0,170	0,004	2,4%	0,166	97,6%	0,107	0,005	4,3%	0,103	95,7%
	GE(1)	0,150	0,004	2,6%	0,146	97,4%	0,119	0,004	3,7%	0,115	96,3%
Education	GE(-1)	0,928	0,025	2,7%	0,904	97,3%	0,122	0,019	15,3%	0,104	84,7%
	GE(0)	0,170	0,023	13,5%	0,147	86,5%	0,107	0,018	16,9%	0,089	83,1%
	GE(1)	0,150	0,022	14,8%	0,128	85,2%	0,119	0,018	15,1%	0,101	84,9%
Household type	GE(-1)	0,928	0,010	1,1%	0,918	98,9%	0,122	0,009	7,1%	0,114	92,9%
	GE(0)	0,170	0,009	5,4%	0,161	94,6%	0,107	0,008	7,5%	0,099	92,5%
	GE(1)	0,150	0,008	5,5%	0,142	94,5%	0,119	0,007	6,3%	0,111	93,7%
Socio-economic type	GE(-1)	0,928	0,035	3,8%	0,894	96,2%	0,122	0,016	13,2%	0,106	86,8%
	GE(0)	0,170	0,025	14,6%	0,145	85,4%	0,107	0,015	13,9%	0,092	86,1%
	GE(1)	0,150	0,020	13,2%	0,130	86,8%	0,119	0,014	11,8%	0,105	88,3%

Source: Authors' own calculations.

In Czech Republic, the between-group components of inequality of both incomes are generally low. As mentioned by Elbers, Lanjouw, Mistiaen & Özler (2008, p. 233) it is not so surprising that one rarely observes a high share of between-group inequality. This would appear to indicate that, there are not strong differences in income between social subgroups. The between-group inequality is the highest when the breakdown by the socio-economic group as well as the education level of head of the household are considered. The rest of the

variables, such as the degree of urbanisation, the household size and its type have only marginal importance.

Tab. 3: Decomposition of income inequality in Hungary by group

		Income before social transfers					Income after social transfers				
		Total	Between	(%)	Within	(%)	Total	Between	(%)	Within	(%)
Degree of urbanisation	GE(-1)	1,605	0,012	0,8%	1,592	99,2%	0,241	0,009	3,9%	0,232	96,1%
	GE(0)	0,246	0,013	5,1%	0,234	94,9%	0,142	0,010	6,8%	0,132	93,3%
	GE(1)	0,195	0,013	6,6%	0,182	93,4%	0,139	0,010	7,0%	0,130	93,0%
Household size	GE(-1)	1,605	0,012	0,7%	1,593	99,3%	0,241	0,004	1,8%	0,237	98,2%
	GE(0)	0,246	0,011	4,4%	0,235	95,6%	0,142	0,004	2,9%	0,137	97,1%
	GE(1)	0,195	0,010	5,3%	0,185	94,7%	0,139	0,004	2,9%	0,135	97,1%
Education	GE(-1)	1,605	0,043	2,7%	1,561	97,3%	0,241	0,031	12,7%	0,211	87,3%
	GE(0)	0,246	0,042	16,9%	0,205	83,3%	0,142	0,030	21,2%	0,112	78,8%
	GE(1)	0,195	0,040	20,6%	0,155	79,4%	0,139	0,030	21,5%	0,109	78,5%
Household type	GE(-1)	1,605	0,021	1,3%	1,584	98,7%	0,241	0,009	3,6%	0,233	96,4%
	GE(0)	0,246	0,019	7,7%	0,227	92,3%	0,142	0,008	5,9%	0,133	94,1%
	GE(1)	0,195	0,018	9,2%	0,177	90,8%	0,139	0,008	5,7%	0,131	94,3%
Socio-economic type	GE(-1)	1,605	0,069	4,3%	1,536	95,7%	0,241	0,014	5,7%	0,228	94,3%
	GE(0)	0,246	0,033	13,6%	0,213	86,4%	0,142	0,011	8,1%	0,130	91,9%
	GE(1)	0,195	0,021	10,8%	0,174	89,2%	0,139	0,010	7,3%	0,129	92,7%

Source: Authors' own calculations.

In Hungary, the highest inequality of incomes before social transfers relate to subgroups distinguished on the basis of the education level of the household head. The between-group term accounts for 16,9% - 20,6% of the overall indices. In the case of income after social transfers, this component equals to approx. 21%. As in the case of Poland, this is due to significant differences in average income of subgroups. Also, the socio-economic type, the household type and the degree of urbanisation are somewhat significant, while the household size has only marginal importance.

Tab. 4: Decomposition of income inequality in Slovakia by group

		Income before social transfers					Income after social transfers				
		Total	Between	(%)	Within	(%)	Total	Between	(%)	Within	(%)
Degree of urbanisation	GE(-1)	0,435	0,005	1,1%	0,430	98,9%	0,190	0,005	2,4%	0,186	97,6%
	GE(0)	0,135	0,005	3,8%	0,130	96,2%	0,113	0,005	4,1%	0,109	95,9%
	GE(1)	0,122	0,005	4,3%	0,116	95,7%	0,106	0,005	4,6%	0,101	95,4%
Household size	GE(-1)	0,435	0,005	1,2%	0,429	98,8%	0,190	0,005	2,5%	0,186	97,5%
	GE(0)	0,135	0,005	3,8%	0,130	96,2%	0,113	0,005	4,1%	0,109	95,9%
	GE(1)	0,122	0,005	4,1%	0,117	95,9%	0,106	0,005	4,3%	0,102	95,7%
Education	GE(-1)	0,435	0,014	3,2%	0,421	96,8%	0,190	0,014	7,5%	0,176	92,5%
	GE(0)	0,135	0,013	9,6%	0,122	90,4%	0,113	0,013	11,7%	0,100	88,3%

	GE(1)	0,122	0,012	10,2%	0,109	89,8%	0,106	0,013	11,9%	0,094	88,1%
Household type	GE(-1)	0,435	0,015	3,5%	0,419	96,5%	0,190	0,012	6,2%	0,179	93,8%
	GE(0)	0,135	0,014	10,6%	0,121	89,4%	0,113	0,011	10,0%	0,102	90,0%
	GE(1)	0,122	0,014	11,3%	0,108	88,7%	0,106	0,011	10,4%	0,095	89,6%
Socio-economic type	GE(-1)	0,435	0,016	3,6%	0,419	96,4%	0,190	0,007	3,6%	0,184	96,4%
	GE(0)	0,135	0,010	7,3%	0,125	92,7%	0,113	0,006	5,2%	0,107	94,8%
	GE(1)	0,122	0,007	5,9%	0,114	94,1%	0,106	0,005	4,9%	0,101	95,1%

Source: Authors' own calculations.

In Slovakia, similarly to Czech Republic, between-group contributions to inequality of both incomes are generally low. The type of household and the educational attainment seem to be the main sources of income inequality. The other features, such as the degree of urbanisation, the household socio-economic type and its size have only marginal importance. What's more, in Slovakia there are the smallest inequalities in both categories of income.

Conclusions

The results of this study show that in the V4 group the lowest level of inequality, for both types of income, is observed in Slovakia and in Czech Republic. Hungary experiences the highest variability of incomes before social transfers, but in the case of incomes after social transfers, the level of inequality in this country is similar to the level of income inequality in Poland.

Our study has confirmed that social transfers play a crucial role in the reduction of income inequality, especially in the case of the poorest households. The findings indicate that in the V4 countries, Hungarian social policy seems to be the most effective one.

The analysis of the factors accounting for income inequality has implied that in all the V4 countries, difference in the level of education, characterized the formal side of human capital, is the most crucial driver of income inequality. Our results suggest also that prevailing source of income (Czech Republic) and the household type (Slovakia) are among the main determinants of income inequality.

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