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Household Income Inequality in Poland from 2005 to 2013 – A Decomposition of the Gini Coefficient by Socio-Economic Groups

INTRODUCTION

The decomposition of income inequality by population subgroups is a very important and popular tool of inequality analysis. It allows to investigate the structure of income disparities, showing – among other things – the contribution of individual subgroups into overall inequality. Together with the decomposition of inequality by income sources the decomposition of income inequality by population subgroups may be helpful in exploring the determinants of income disparities.

Although according to the data from Poland's Central Statistical Office (CSO) income inequality hasn't shown significant changes in recent years it would be interesting to analyze whether there occurred any changes in the structure of income disparities and to what extent.

The aim of this study is the empirical analysis of the Gini coefficient decomposition by socio-economic groups in Poland from 2005 to 2013 based on non-identifiable, individual data from Poland's CSO household budget surveys (HBS). The paper is divided as follows. The first part presents the decomposition method of income inequality applied in the empirical analysis. The second part contains a description of the HBS data used in this study. The third part includes an overview of overall income inequality in Poland during the analyzed period as well as the results of the Gini decomposition by socio-economic groups in Poland from 2005 to 2013. The fourth part concludes.

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ANALYTICAL FRAMEWORK

In order to decompose the Gini coefficient by socio-economic groups, the following decomposition method was applied. A general decomposition of income inequality by subgroups – commonly found in the literature (e.g. [Deutsch, Silber, 1999; Bellú, Liberati, 2006; Lambert, Aronson, 1993]) – may be presented as

$$I_0 = I_W + I_B + I_R, \quad [1]$$

where I_0 is overall income inequality, I_W denotes the contribution of the variability of income within individual groups to total income inequality (within-inequality), I_B refers to the contribution of the variability of income across the groups considered to I_0 (between-inequality) and I_R is a residual term – sometimes called the interaction term or re-ranking effect – measuring the extent to which overall inequality is attributable to overlapping income distributions of individual groups.

The within-inequality component is presented by the following formula

$$I_W = \sum_{k=1}^K P_k S_k G_k, \quad [2]$$

where K is the number of groups considered ($k=1, \dots, K$), P_k denotes the population share of group k , S_k refers to the income share of group k and G_k is income inequality in group k measured by the Gini coefficient.

The between-inequality element of the Gini decomposition by groups is calculated as the Gini coefficient of a fictitious income distribution in which the incomes of individuals are replaced by the mean of the group to which they belong. There are numerous ways to express the Gini coefficient. To illustrate the between-inequality component of the Gini decomposition we can use as an example the following Gini coefficient formula

$$G_0 = \frac{2 \operatorname{cov}[y_0, F(y_0)]}{\mu_0}, \quad [3]$$

where y_0 represents income, μ_0 denotes mean income and $F(y_0)$ is the cumulative distribution of total income. Replacing y_0 in [3] with the appropriate mean income of each group (μ_k) – as explained above – yields the between-inequality element of the Gini coefficient decomposition:

$$I_B = \frac{2 \operatorname{cov}[\mu_k, F(\mu_k)]}{\mu_0}. \quad [4]$$

The residual term of the decomposition [1] is then simply the difference between the Gini coefficient for overall income and the sum of the within- and between-inequality components of the decomposition:

$$I_R = (G_0 - [I_W + I_B]). \quad [5]$$

According to some of the studies on the Gini decomposition by groups, the between-inequality element, I_B , is treated as the net between-inequality component of the decomposition and the sum of the between-inequality component and the residual term, $(I_B + I_R)$, is called the gross between-inequality element of the decomposition.

The interpretation of the residual term requires a more detailed explanation. Since I_R measures the extent to which overall inequality is attributable to overlapping income distributions of individual groups, I_R is equal 0, if the income distributions of the groups considered do not overlap. In turn, I_R takes on a positive value, if the income distributions overlap, i.e. if “the rank by subgroup incomes overlap with the rank of the total income distribution” [Bellú, Liberati, 2006, p. 16]. In fact, when calculating within-inequality we take into account the ranking of individuals within individual groups, which is different – if the income distributions of those groups overlap – from the ranking of individuals in the distribution of overall income. In this sense, there occurs a re-ranking effect when we move from the within distribution to the distribution of overall income.

DATA

The empirical analysis was based on non-identifiable, individual data from Poland’s CSO (GUS) HBS data². The HBS are one of the main sources of information on Poles’ expenditures, living conditions and incomes. Poland’s CSO collects the HBS every year and the surveys are based on the representative method, of monthly rotation. In 2005 the HBS covered slightly less than 35 thousand households and from 2006 to 2013 the survey covered about 37.5 thousand households, which is equivalent to quite 110 thousand persons.

It is important to emphasize, that the methodological issues of HBS have almost not changed since 2005. The most significant discontinuity in the data refers to the change of weights applied for making the data representative. Since a part of households selected for the survey by GUS refuse to participate in the study, the structure of the selected and the surveyed sample differ in regard of

² The results of the empirical analysis presented in this study are the author’s own calculations based on data made available by GUS. GUS is not responsible for the conclusions contained in this paper.

socio-economic traits. In order to allow for the generalization of the surveyed sample to the whole population of households, the results have to be weighted with the National Census data broken by the number of persons living in urban and rural areas [GUS, 2014, p. 31]. In the case of the years 2005-2012 the data used in this study were adjusted with weights based on the 2002 National Census and the 2013 data were adjusted with weights based on the 2011 National Census. Thus, the results of this empirical study are almost fully comparable throughout the entire period of analysis, with certain attention on 2013.

For the purpose of this study income was defined as equivalized household disposable income, i.e. the unit of analysis is a household and household disposable income was adjusted using the OECD modified equivalence scale. This type of scale assigns a weight of 1 to the household head, 0.5 to each person aged 14 and above and 0.3 to each child.

GUS classifies households according to five basic socio-economic groups: employees' households, farmers' households, households of the self-employed, households of old-age and disability pensioners and households supporting themselves from non-earned sources. In this study the incomes of six socio-economic groups were analyzed, i.e. the group of old-age and disability pensioners was divided into two separate subgroups.

The calculations were performed using Excel 2013 and DAD 4.6. – a software for distributive analysis (Jean-Yves Duclos, Abdelkrim Araar and Carl Fortin, "DAD: A Software for Distributive Analysis/Analyse Distributive," MIMAP programme, International Development Research Centre, Government of Canada, and CIRPÉE, Université Laval).

EMPIRICAL RESULTS

As specified in the previous sections, for the purpose of this study income inequality was defined as inequality measured by the Gini coefficient for equivalized household disposable income. It is very important to specify 1) the unit of analysis, 2) the definition of income, 3) the equivalence scale used and – of course – 4) the measure of inequality, since every individual specification determines the income distribution considered and may yield different results.

Figure 1 shows income inequality trends for three specifications of income inequality. It can be clearly seen, that the interpretation of individual time-series data may lead to different conclusions³.

³ Another important reason explaining the difference in the income inequality trend between Eurostat and GUS/PGG data is the data source (different for Eurostat and GUS/PGG, although both data are collected by Poland's Central Statistical Office). Such a difference is also clearly visible when comparing Household Budget Survey data with EU-SILC data for most EU-countries [Eurostat, 2015, p. 42].

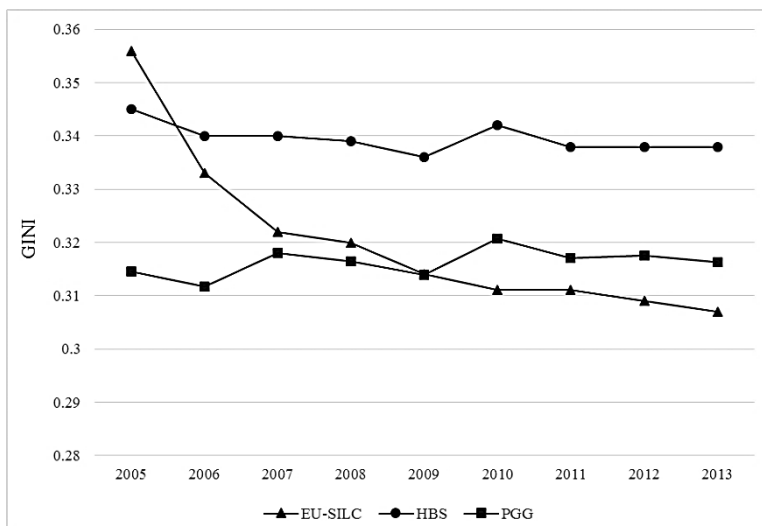


Figure 1. Income inequality* in Poland – 2005-2013

Note: * EU-SILC (European Union Statistics on Income and Living Conditions data collected by GUS) – unit of analysis: person, income definition: disposable income, equivalence scale: OECD modified equivalence scale; HBS (Household Budget Survey data collected by GUS) – unit of analysis: household, income definition: available income, equivalence scale: per capita; PGG (author's own calculation based on HBS data) – unit of analysis: household, income definition: disposable income, equivalence scale: OECD modified equivalence scale.

Source: Own calculation based on HBS data; Eurostat database; [GUS, 2014, table 5, p. 287].

Income inequality in Poland from 2005 to 2013 calculated from HBS data and used for the decomposition procedure in this study (PGG) was rather stable, with slight variability and ranged between 0.31 and 0.32 measured by the Gini coefficient. However, that does not necessarily imply a invariable structure of income inequality throughout the analyzed period.

Figure 2 shows that the general structure of income inequality was subject to some changes between 2005 and 2013⁴. The component of within-inequality was increasing continuously till 2011 and then decreased slightly over the next two years. An almost contrary change is visible in the case of the residual term. The element of between-inequality changed from year to year but without any clear direction. Both within- and between-inequality were explaining overall income inequality to a similar extent of about 0.08-0.1 in absolute terms (i.e. of the Gini coefficient that ranged between 0.31 and 0.32) during the analyzed period, however, the within-inequality component was slightly higher during most of the time. Most of total income inequality in Poland was attributable to overlapping

⁴ Note that the scales in the figures presented in this study may be different. The calculations of the Gini coefficient decomposition by socio-economic groups are presented in the Appendix.

income distributions of individual socio-economic groups (between 0.115 and 0.134 in absolute terms).

The decrease of the residual term indicates that overlapping distributions of the income groups considered explained to a lesser extent income disparities in Poland – at least till 2009 or 2011. The drop in I_R may be caused by two factors (equation [5]), *ceteris paribus* (income inequality remained more or less the same throughout the entire period): 1) an increase in the between-inequality component, I_B , which would indicate rising disparities between the mean incomes of the income groups taken into consideration or/and 2) an increase in the within-inequality component, I_W , which results either from a rise in the Gini coefficient for some or all individual groups, G_k , or/and an appropriate change in the inequality weights, $P_k S_k$, of income groups.

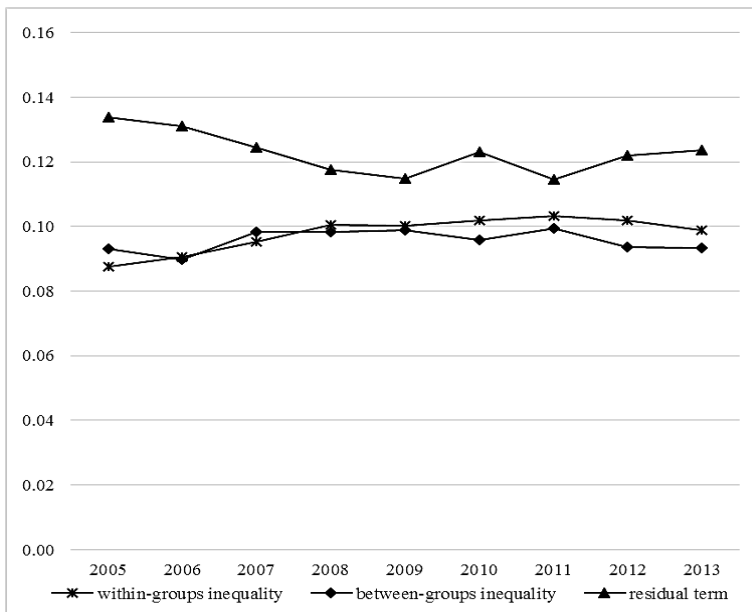


Figure 2. Decomposition elements of the Gini coefficient, absolute terms

Source: Own calculation based on HBS data.

Figure 2 indicates that the decrease in the residual term was accompanied by the rising within-inequality component, while the between-inequality component was not exhibiting a clear trend. As the more in-depth analysis of the inequality structure will show, the increase in the within-inequality component was caused mainly by changes in the inequality weights, $P_k S_k$, favorable for employees' households, while income inequality in this group remained stable throughout the entire period.

Among all individual socio-economic groups the employed constituted the group that contributed to the largest extent to overall income inequality in Poland in regard to within-inequality (Figure 3). Moreover, this contribution was increasing almost continuously throughout the analyzed period, with a slight decrease visible in the last two years. The weighted variability of income among employees' households explained almost 21% of total inequality in 2005 and almost 25% in 2013 (reaching its peak in 2011 at over 26%). The second most important socio-economic group contributing to overall income inequality were old-age pensioners with a stable weighted variability of income at about 5% during the analyzed period. Weighted income disparities in the rest of socio-economic groups explained only a marginal part of total income inequality (overall, 1.4-2.1% of total income inequality).

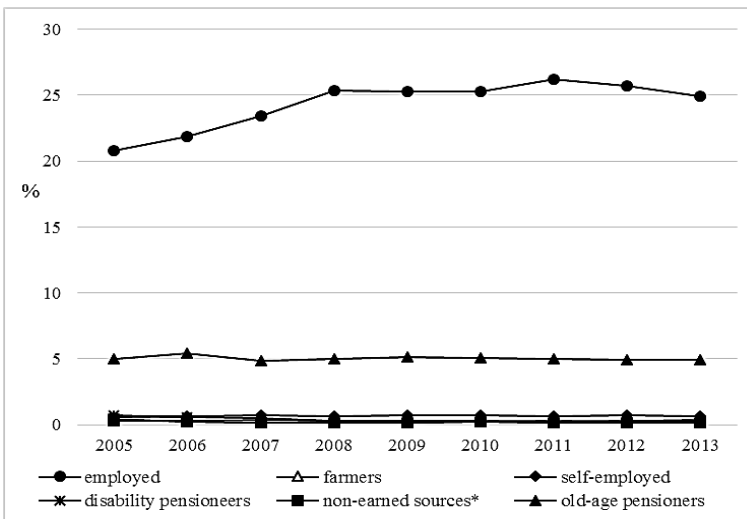


Figure 3. Relative contribution of individual socio-economic groups to overall income inequality

Note: * Supporting themselves from non-earned sources.

Source: Own calculation based on HBS data.

That means that the rise in the within-inequality element of the decomposition was only due to the weighted dispersion of income among employees' households. However, that does not mean that income inequality in the group of the employed increased as well. As can be seen in Figure 4, the increasing within-inequality component for employees' households can be explained by the rising population and income shares of this group. Note, that income disparities among the employed were relatively stable throughout 2005-2013 at about 0.3 measured by the Gini coefficient.

Figure 5 shows the decomposition components of the within-inequality element for households of old-age pensioners. The population and income shares as well as the Gini coefficient for this group were not revealing any significant changes during the analyzed period, with the exception of a slight drop in the income share in the first two-three years. It is worth noticing that income disparities among old-age pensioners were the lowest among all socio-economic groups between 2005 and 2013.

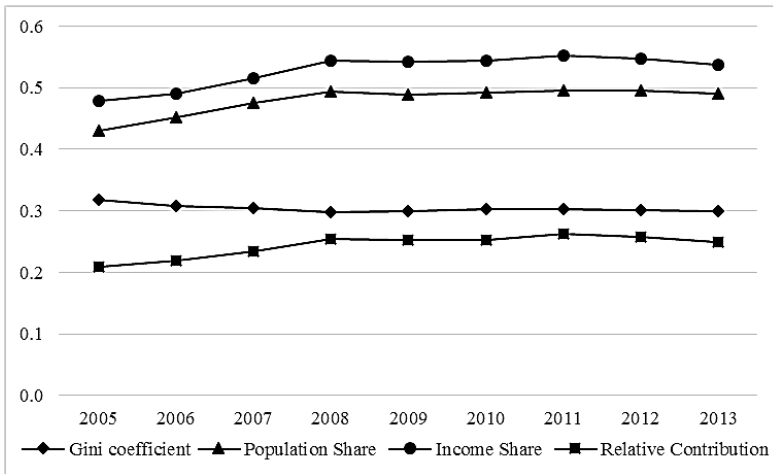


Figure 4. Decomposition of income inequality – employees' households

Source: Own calculation based on HBS data.

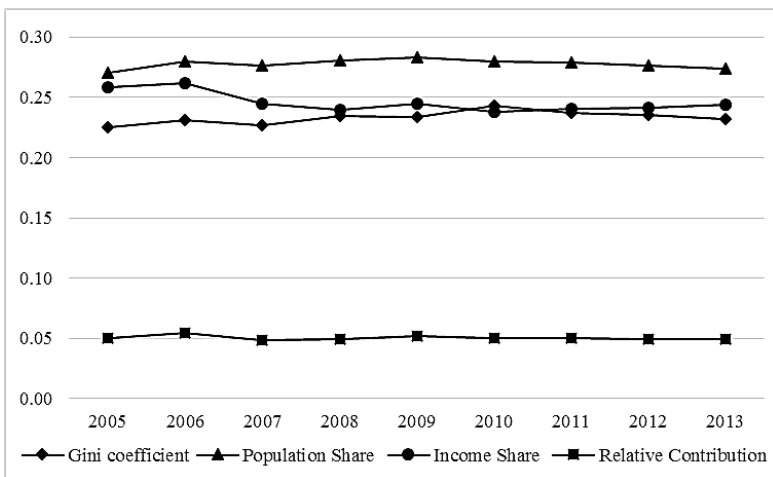


Figure 5. Decomposition of income inequality – households of old-age pensioners

Source: Own calculation based on HBS data.

Although the rest of socio-economic groups – i.e. their within-inequality components – contributed to income inequality only to a marginal extent it is worth showing what happened to income inequality in those groups. Income disparities in the group of farmers' households were markedly the highest and the most variable⁵ among all socio-economic groups and ranged between 0.482 and 0.576 measured by the Gini coefficient. However, both population and income shares were relatively low (stable and about the same), which explains the small impact of the within-inequality component of this socio-economic group on overall income inequality.

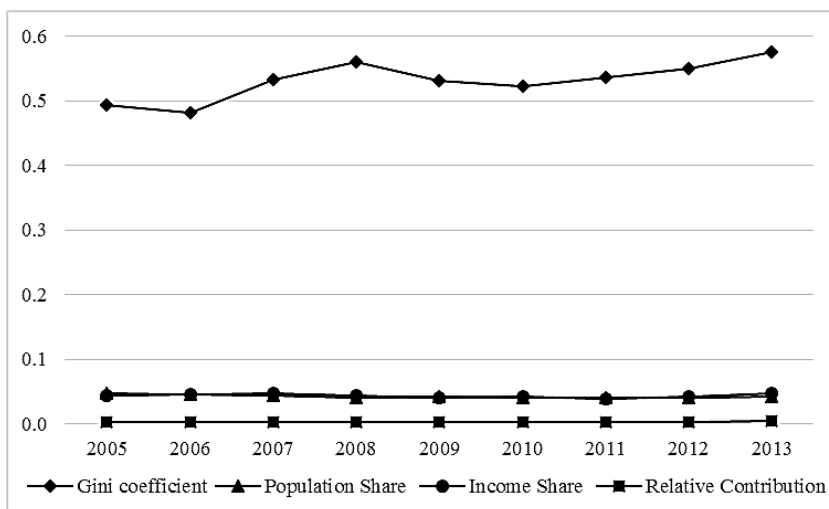


Figure 6. Decomposition of income inequality – farmers' households

Source: Own calculation based on HBS data.

Income disparities among households of the self-employed were the second and, after three years, the third largest among all groups considered. Income inequality in this group decreased almost continuously during the analyzed period. On the other hand, households of persons supporting themselves from non-earned sources recorded the second highest income inequality after 2007. Income disparities and the population and income shares changed in opposite di-

⁵ A similar variability can be seen in the case of households of persons supporting themselves from non-earned sources (Figure 9). However, when we look at the individual HBS data, we can see that both the 2010 as well as the 2012 increase in the Gini coefficient in this group was due to the inclusion of single extraordinary high incomes (a multiple of the second highest income) in those years (the main source of maintenance of these households are not only unemployment or family benefits but also e.g. donations). Those cases could be treated as outliers, however, the author decided to include all incomes for the sake of consistency with the GUS calculations of the Gini coefficient.

rections for both groups. In both cases the contribution of the weighted income dispersion was due to low population and income shares. The same occurred for households of disability pensioners. Moreover, this group experienced a relatively considerable decrease in the population and income shares.

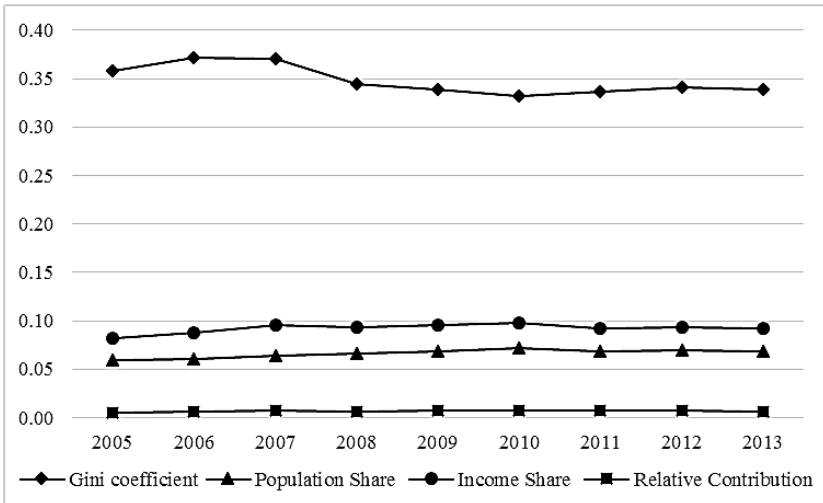


Figure 7. Decomposition of income inequality – households of the self-employed

Source: Own calculation based on HBS data.

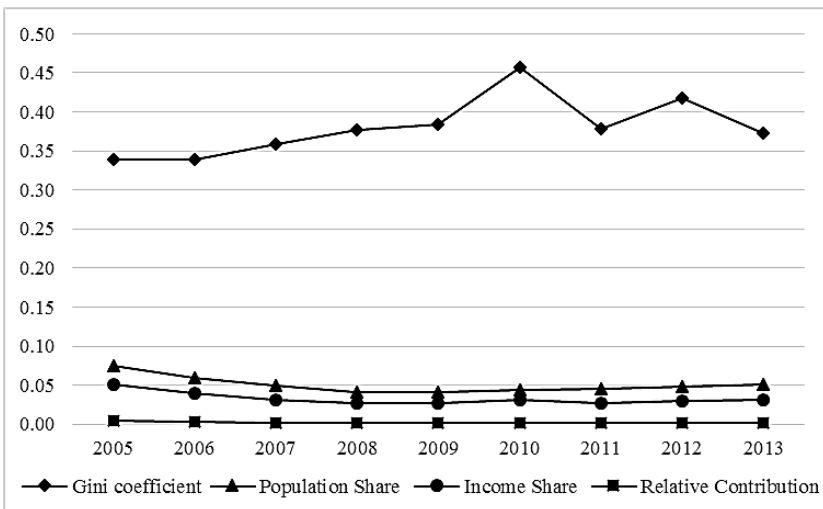


Figure 8. Decomposition of income inequality – households of supporting themselves from non-earned sources

Source: Own calculation based on HBS data.

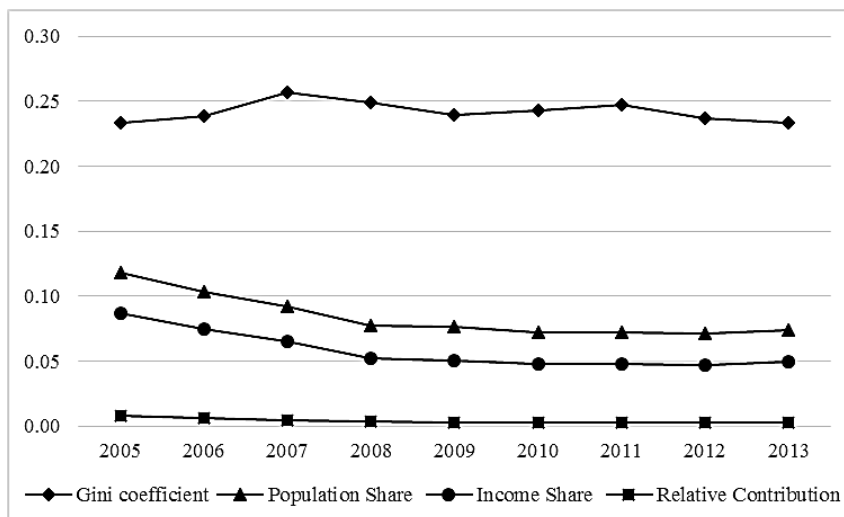


Figure 9. Decomposition of income inequality – households of disability pensioners

Source: Own calculation based on HBS data.

CONCLUSIONS

The results obtained from the Gini decomposition by socio-economic groups allowed to shed some light on the structure of income inequality in Poland and its changes from 2005 to 2013. The study showed that overall income inequality was mainly explained by the residual term of the decomposition, which means that a huge part of the income distributions of socio-economic groups overlapped and that the income gap between the groups considered was not very large. However, the residual term varied throughout the analyzed period and ranged between 36.1% and 42.5% of total income inequality. The residual term – rising in the first years, then stabilizing and rising again over the last years – was almost offset by the within-inequality element of the decomposition that moved in a contrary direction, although this component was relatively more stable than the residual term. The joint weighted inequality of income within socio-economic groups was rising almost continuously throughout the entire period of analysis and explained between almost 28% and slightly above 32.5% of total income inequality in Poland. Among all socio-economic groups considered in this study employees' households (its weighted income inequality) contributed to the largest extent to the within-inequality component of the decomposition.

As mentioned at the beginning of this study, the decomposition of income inequality by socio-economic groups may serve as one of the elements for the

analysis of income inequality determinants. A broader picture of the determinants of income disparities could be obtained by extending the analysis by the decomposition of income inequality by income sources and other subgroups (regions, age, family composition, occupation, skills, education, etc.) and a regression-based decomposition.

An important problem is the large discrepancy on income inequality trends between the HBS and the EU-SILC data. There are inherent methodological differences between these two surveys and it is very important to evaluate precisely the usefulness of both data sources for the analysis of income inequality determinants.

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Summary

The aim of this study is the empirical analysis of the Gini coefficient decomposition by socio-economic groups in Poland from 2005 to 2013. The analysis was based on non-identifiable, individual household budget surveys data collected by Poland's Central Statistical Office. For the purpose of this study income was defined as equivalized household disposable income, i.e. the unit of analysis is a household and household disposable income was adjusted using the OECD modified equivalence scale.

The Gini coefficient decomposition by socio-economic groups revealed that the residual term measuring the extent to which overall inequality is attributable to overlapping income distributions of individual socio-economic groups contributed to the greatest extent to overall income inequality in Poland during the analyzed period. The second most important factor explaining income inequality was the component of inequality within socio-economic groups. Income inequality between socio-economic groups contributed about 28–30% to overall income inequality in Poland from 2015 to 2015.

The Gini decomposition results allow to conclude, that the structure of the contribution of individual socio-economic groups in Poland was the following. Employees' households were the group with the largest, increasing contribution of weighted income variability to overall income disparities. The second group that was explaining total income disparities to the greatest extent regarding within-inequality were old-age pensioners. The remaining socio-economic groups had only a marginal impact in this regard in Poland from 2005 to 2013.

Keywords: income inequality, Gini coefficient, decomposition

**Zróźnicowanie dochodów gospodarstw domowych
w Polsce w latach 2005–2013 – dekompozycja współczynnika Giniego
według grup społeczno-ekonomicznych**

Streszczenie

Celem pracy jest przeprowadzenie dekompozycji współczynnika Giniego ze względu na grupy społeczno-ekonomiczne w Polsce w latach 2005-2013. Badanie przeprowadzono na nieidentyfikowalnych, jednostkowych danych pochodzących z badań budżetów gospodarstw domowych GUS. W niniejszym studium przez pojęcie dochód należy rozumieć dochód do dyspozycji gospodarstw domowych na jednostkę ekwiwalentną, tj. za badaną jednostkę przyjęto gospodarstwo domowe, za dochód – dochód do dyspozycji, przy czym zastosowano zmodyfikowaną skalę ekwiwalentności OECD.

Dekompozycja współczynnika Giniego według grup społeczno-ekonomicznych pokazała, że największy wkład w kształtowanie się nierówności dochodów ogółem w Polsce w badanym okresie miał składnik resztkowy, czyli efekt wynikający z nakładania się dystrybucji dochodów poszczególnych grup społeczno-ekonomicznych. Drugim, co do istotności czynnikiem wyjaśniającym zróźnicowanie dochodów zgodnie z dekompozycją współczynnika Giniego według grup społeczno-ekonomicznych były nierówności wewnątrzgrupowe. Wkład nierówności międzygrupowych stanowił około 28-30% zróźnicowania dochodów ogółem w Polsce w badanym okresie.

Uzyskane wyniki pozwoliły stwierdzić, że w badanym okresie struktura wkładu poszczególnych grup społeczno-ekonomicznych w wyjaśnianiu nierówności dochodów ogółem w Polsce kształtowała się następująco. Do grupy o największym, rosnącym wkładzie nierówności dochodów ważonych udziałami w populacji i dochodzie ogółem należały gospodarstwa domowe pracowników. Ważone zróźnicowanie dochodów dla gospodarstw domowych emerytów wyjaśniało nierówności ogółem w drugiej kolejności spośród badanych grup ekonomiczno-społecznych, mimo że grupa ta charakteryzowała się najniższym zróźnicowaniem dochodów w badanym okresie. Ważone nierówności dochodów pozostałych grup społeczno-ekonomicznych miały bardzo niewielkie znaczenie, jeśli chodzi o wkład w zróźnicowanie dochodów ogółem w Polsce w latach 2005–2013.

Słowa kluczowe: nierówności dochodów, współczynnik Giniego, dekompozycja

JEL: D30, D31

APPENDIX

Table A1. Income inequality decomposition by socio-economic groups – Poland, 2005-2013

Year	Socio-economic group*	Gini coefficient	Population Share	Income Share	Absolute Contribution	Relative Contribution
1	2	3	4	5	6	7
2005	EMP	0.318	0.431	0.478	0.066	0.208
	FAR	0.493	0.047	0.044	0.001	0.003
	S-EMP	0.358	0.060	0.082	0.002	0.006
	DP	0.234	0.118	0.087	0.002	0.008
	NES	0.338	0.075	0.050	0.001	0.004
	OAP	0.225	0.270	0.259	0.016	0.050
	WGI	-	-	-	0.088	0.279
	BGI	-	-	-	0.093	0.296
	RT	-	-	-	0.134	0.425
2006	EMP	0.308	0.451	0.491	0.068	0.219
	FAR	0.482	0.046	0.045	0.001	0.003
	S-EMP	0.371	0.061	0.087	0.002	0.006
	DP	0.238	0.103	0.075	0.002	0.006
	NES	0.339	0.060	0.040	0.001	0.003
	OAP	0.231	0.279	0.262	0.017	0.054
	WGI	-	-	-	0.091	0.291
	BGI	-	-	-	0.090	0.288
	RT	-	-	-	0.131	0.421
2007	EMP	0.304	0.475	0.515	0.074	0.234
	FAR	0.532	0.043	0.048	0.001	0.004
	S-EMP	0.371	0.064	0.096	0.002	0.007
	DP	0.256	0.092	0.065	0.002	0.005
	NES	0.358	0.049	0.032	0.001	0.002
	OAP	0.227	0.276	0.245	0.015	0.048
	WGI	-	-	-	0.095	0.300
	BGI	-	-	-	0.098	0.309
	RT	-	-	-	0.125	0.391
2008	EMP	0.299	0.494	0.545	0.080	0.254
	FAR	0.561	0.041	0.044	0.001	0.003
	S-EMP	0.344	0.066	0.093	0.002	0.007
	DP	0.249	0.078	0.052	0.001	0.003
	NES	0.377	0.041	0.027	0.000	0.001
	OAP	0.234	0.280	0.240	0.016	0.050
	WGI	-	-	-	0.101	0.318
	BGI	-	-	-	0.098	0.311
	RT	-	-	-	0.118	0.371
2009	EMP	0.300	0.489	0.542	0.080	0.253
	FAR	0.532	0.041	0.040	0.001	0.003
	S-EMP	0.339	0.069	0.095	0.002	0.007
	DP	0.240	0.076	0.051	0.001	0.003

1	2	3	4	5	6	7
	NES	0.384	0.042	0.027	0.000	0.001
	OAP	0.234	0.283	0.245	0.016	0.052
	WGI	-	-	-	0.100	0.319
	BGI	-	-	-	0.099	0.315
	RT	-	-	-	0.115	0.366
2010	EMP	0.303	0.492	0.544	0.081	0.253
	FAR	0.522	0.040	0.041	0.001	0.003
	S-EMP	0.333	0.072	0.098	0.002	0.007
	DP	0.243	0.072	0.048	0.001	0.003
	NES	0.457	0.044	0.032	0.001	0.002
	OAP	0.243	0.280	0.238	0.016	0.050
	WGI	-	-	-	0.102	0.318
	BGI	-	-	-	0.096	0.299
	RT	-	-	-	0.123	0.384
2011	EMP	0.303	0.495	0.553	0.083	0.262
	FAR	0.537	0.040	0.039	0.001	0.003
	S-EMP	0.337	0.069	0.093	0.002	0.007
	DP	0.248	0.072	0.048	0.001	0.003
	NES	0.379	0.045	0.028	0.001	0.002
	OAP	0.237	0.279	0.240	0.016	0.050
	WGI	-	-	-	0.103	0.326
	BGI	-	-	-	0.099	0.313
	RT	-	-	-	0.115	0.361
2012	EMP	0.302	0.495	0.547	0.082	0.257
	FAR	0.550	0.040	0.042	0.001	0.003
	S-EMP	0.341	0.070	0.093	0.002	0.007
	DP	0.237	0.071	0.047	0.001	0.003
	NES	0.418	0.048	0.030	0.001	0.002
	OAP	0.235	0.276	0.241	0.016	0.050
	WGI	-	-	-	0.102	0.321
	BGI	-	-	-	0.094	0.295
	RT	-	-	-	0.122	0.384
2013	EMP	0.299	0.490	0.537	0.079	0.249
	FAR	0.576	0.042	0.047	0.001	0.004
	S-EMP	0.339	0.069	0.092	0.002	0.007
	DP	0.234	0.074	0.049	0.001	0.003
	NES	0.372	0.051	0.031	0.001	0.002
	OAP	0.232	0.274	0.244	0.016	0.049
	WGI	-	-	-	0.099	0.313
	BGI	-	-	-	0.094	0.296
	RT	-	-	-	0.124	0.391

Note: * Households of: EMP – employees, FAR – farmers, S-EMP –self-employed, DP – disability pensioners, NES – supporting themselves from non-earned sources, OAP – old-age pensioners, WGI – within-groups inequality, BGI – between-groups inequality, RT – residual term.

Source: Own calculation based on HBS data.