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INCOME STRATIFICATION IN POLAND

Summary: Income stratification is one of direct ways of social structure analysis. This stratification is one-dimensional graduation scheme on the "low income – high income" scale. This method allows to assess the share of affluent and poor groups in the whole society and to assess the changes in the structure of society through the prism of income. In this study, the division of households into seven income groups, according to relative approach was used. To divide the studied period 2000-2015 into sub-periods with similar income structures the taxonomic algorithm was used. According to this algorithm, the studied period was divided into four sub-periods.

Keywords: income stratification, poverty, affluence, richness, income inequality.

JEL Classification: D31, I31.

Introduction

Social structure may be studied by analyzing income stratification which is one-dimensional graduation scheme on the "low income – high income" scale. It is obvious that this kind of analysis does not contain every component of life, but it allows to get a certain picture of social structure in a relatively easy way because the data about income are commonly available in different databases. Income studies mostly focus on inequalities in income distribution, on the share of the poor, in recent studies also on the share of the rich. Analysis of income structure allows to get a wider picture, because it focuses on all income groups, i.e. on the whole society.

Issues of income stratification are studied by Russian authors, e.g. V.A. Anikin and N. Tikhonova. Anikin et al. [2016] discuss different approaches to the problem of income stratification and focus on income stratification in Russia. The authors conclude that income stratification model in Russia is quite stable even

during the economic crisis. Tikhonova [2018] focuses on comparison income stratification in Russia with other countries. The author concludes that the Russian income stratification model is typical for Europe. It should be mentioned that Tikhonova used the data from International Social Survey Programme (ISSP) which is "a cross-national collaboration programme conducting annual surveys on diverse topics relevant to social sciences" [www 1]. One of the modules – The Social Inequality – allows to get information about income stratification models in dozens of countries. This specific module is only collected approximately every ten years, for the last time in 2009, which is undoubtedly a disadvantage of this module. Information about income stratification in many countries from all over the world can be also taken from the "Compare your income" web tool created by Organisation for Economic Co-operation and Development (OECD). This tool allows, inter alia, to compare perceived and real income structures in particular countries participating in the survey.

The aim of the paper is to get a knowledge about income stratification in Poland. In this study, the data from "Social Diagnosis" project were used which allowed to fill the information gap about income stratification models before 2009 (before the last wave of ISSP) and also between 2009 and 2017 (the data from OECD web tool). The second aim was to show the changes in income structure in Poland from 2000 to 2015 using the division into seven income groups. To find groups of years with similar structures the index of dissimilarity of structures was used. The important problem was also to answer the question about the association between the changes in income structure and changes in the economic and political situation in Poland. Based on the studied literature the following hypotheses were tested:

Hypothesis 1: A mass of households in Poland achieve low or average income.

Hypothesis 2: Share of the most affluent households in Poland is decreasing.

Hypothesis 3: Changes in income structures are related to income inequality changes; the economic changes (Poland's accession to the European Union, global economic crisis) have a little, but visible impact on income stratification models as well on income inequality in Poland.

1. Materials and methods

Income stratification models may be created based on absolute and relative approaches. The main methodological issue is to select one of the approaches that apply different criteria for defining income groups and their boundaries: absolute income thresholds (the absolute approach), which distinguishes income groups in relation to a clearly defined amount of income, and relative income thresholds (the relative approach) – based on the median income, mean income or income distribution by percentile groups [Anikin et al., 2016]. The most popular solution is based on median income. This kind of method was also used in this study.

There are many possibilities to divide income distribution into groups using the median income. One of the choices was used in OECD's "Compare your income" web tool. The households were divided into seven income classes. The principle of the division was as follows [OECD, 2018]:

a) the lower-income class – households with a net income below 50% of the median income;

b) the average-income class – households with a net income between 50% and 150%; three bars of the income diagrams:
   – from 50% to 80% of the median income,
   – from 80% to 110% of the median income,
   – from 110% to 150% of the median income;

c) the higher-income class – households with a net income above 150% of the median; three bars of the income diagrams:
   – from 150% to 200% of the median income,
   – from 200% to 250% of the median income,
   – above 250% of the median income.

The intention of the definition of these income classes is basically the graphical illustration of the density function of incomes – perceived and actual. Answering the questions in "Compare your income tool", we can choose one of the four income stratification models:

– Type 1 – a small wealthy elite, a few people with an average income, and a mass of people with low income,

– Type 2 – a small wealthy elite, some people with an average income, and most people with a low income,

– Type 3 – most people with an average income,

– Type 4 – a large wealthy elite, some people with an average income, and a few people with a low income.

These types of income stratification models may be illustrated in income diagrams. In a few questions from "Compare your income" web tool, there are presented four income diagrams. One of these questions is presented in Figure 1.
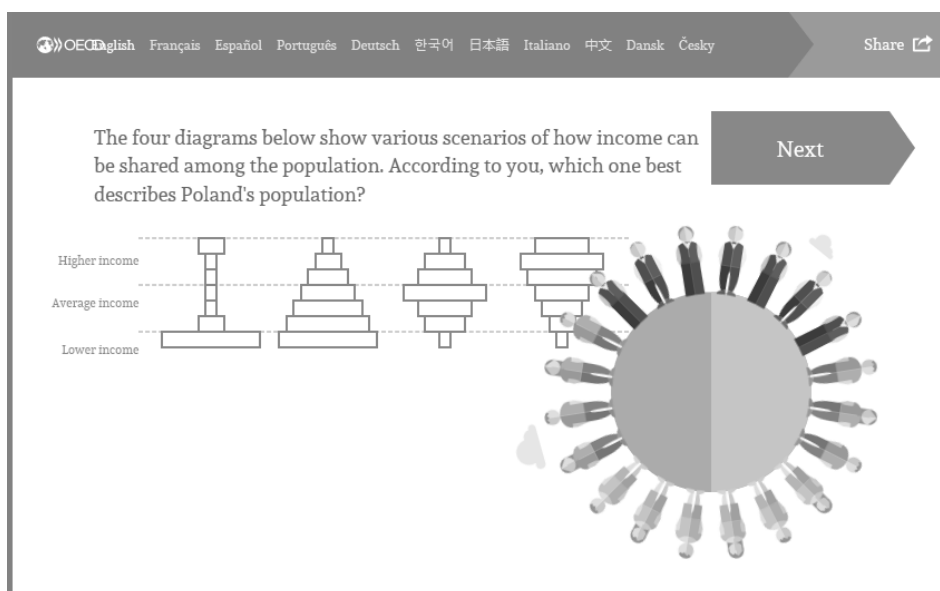

Figure 1. Screenshot from "Compare your income" web tool

Source: [www 2].

The division into seven income classes was proposed earlier, in ISSP. The specific module of ISSP – The Social Inequality – took place in 1987, 1992, 1999, 2009. Next survey will take place in 2019. Authors of this module did not show precisely the boundaries between income classes. They propose to consider five types of society [ISSP, 2018]:

− Type A – a small elite at the top, very few people in the middle and the great mass of people at the bottom,
− Type B – a society like a pyramid with a small elite at the top, more people in the middle, and the most at the bottom,
− Type C – a pyramid except that just a few people are at the bottom,
− Type D – a society with most people in the middle,
− Type E – many people near the top, and only a few near the bottom.

   The types of society in ISSP planned in 2019 are presented in Figure 2.
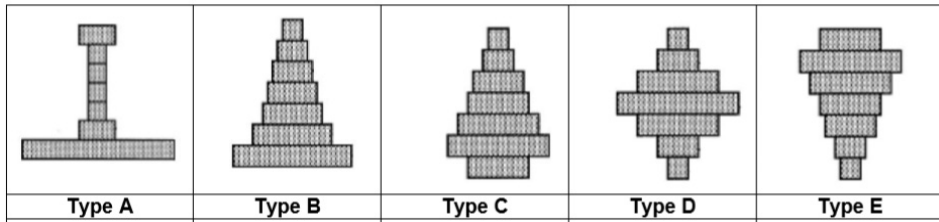
Figure 2. Types of society in ISSP planned in 2019

Source: [www 2].

The boundaries between income classes tried to set J. Niehues [2014]. She proposed seven classes very similar to classes from OECD's "Compare your income". The difference concerns the first border – Niehues decided to take 60% of median income instead of 50% of median income. This 60% threshold is equal to the standard definition of the relative poverty risk rate.

In our study, the identical division into income classes was adopted as in the "Compare your income" web tool. The adoption of this solution will allow to compare the results of our study with the newest results of OECD's study. It should be noted that in OECD's study the data from 2015 or 2016 were used and these data were adjusted by authors with the changes in the consumer price index for all goods up to 2017.

The structures including income structures are changing over time. Index of similarity of structures allows to compare the similarity of structures of two or more collectivity. The index is constructed on the basis of structural indicators. The value of the similarity index of structures is in the range [0; 1]. The value is closer to unity, the similarity of the structures of compared sub-populations is higher. A value of 0 indicates a lack of similarity and a value of 1 total similarity of the structures of the compared sub-populations [www 3]. The index of similarity of structure is expressed by the formula [Chomątowski, Sokołowski, 1978; Sojka, 2011]:

$$P_{ij}^* = \sum_{k=1}^{r} \min(p_{ik}, p_{jk}) \tag{1}$$

where:

i, j – numbers of objects or moments,

k – number of component of the structure,

p_{ik} – share of component k in the structure of the object,

p_{jk} – share of component j in the structure of object.

Often more comfortable is to use the index of dissimilarity of structure expressed by the formula:

$$P_{ij} = 1 - \sum_{k=1}^{r} \min(p_{ik}, p_{jk}) = 1 - P_{ij}^* \qquad (2)$$

The starting point in the division of n-element set of objects or units of time is a determination of symmetric square matrix:

$$P = \begin{bmatrix} P_{11} & P_{12} & \cdots & P_{1n} \\ P_{21} & P_{22} & \cdots & P_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ P_{n1} & P_{n2} & \cdots & P_{nn} \end{bmatrix}$$

where: $0 \leq P_{ij} \leq 1, P_{ii} = 0, P_{ij} = P_{ji}$.

The taxonomic algorithm allowing to divide the period of time into sub-periods with similar structures of objects consists of seven stages. In the first step critic level of similarity α is set, which is a starting point for further matrix transformations. The detailed description of the algorithm is included in Chomą-towski and Sokołowski [1978].

In the analysis of income stratification, the data from Social Diagnosis project [Council for Social Monitoring, 2016] were used. Generally, Social Diagnosis project is based on panel research. The first sample was taken in 2000. The next sample took place three years later and since then measurement has been repeated every two years (eight waves in 2000-2015). The household was the study unit. Table 1 contains information on the number of households surveyed in subsequent waves of the panel.

**Table 1.** Number on households in the database of Social Diagnosis project

Year	2000	2003	2005	2007	2009	2011	2013	2015
Wave	I	II	III	IV	V	VI	VII	VIII
Number of households	3005	3962	3881	5532	12 380	12 359	12 343	11 738

Source: Based on data from Council for Social Monitoring [2016].

The basic variable is net income per household in Poland in March/June in subsequent waves of the panel. In order to take account the differences in a household's size and its composition an equivalised income was calculated by dividing the household's income by its equivalent size. There was used the modified OECD scale, which assigns a weight 1 to the head of household, 0.5 to every other adult person in the household and 0.3 to each child (person aged less than fourteen). The income calculating in such a way was the basis of division into seven income classes according to OECD's method mentioned above.

2. Results

In the first step the graphical illustrations of the density functions for all studied years were plotted. Income diagrams for Poland in 2000-2015 are presented in Figure 3.
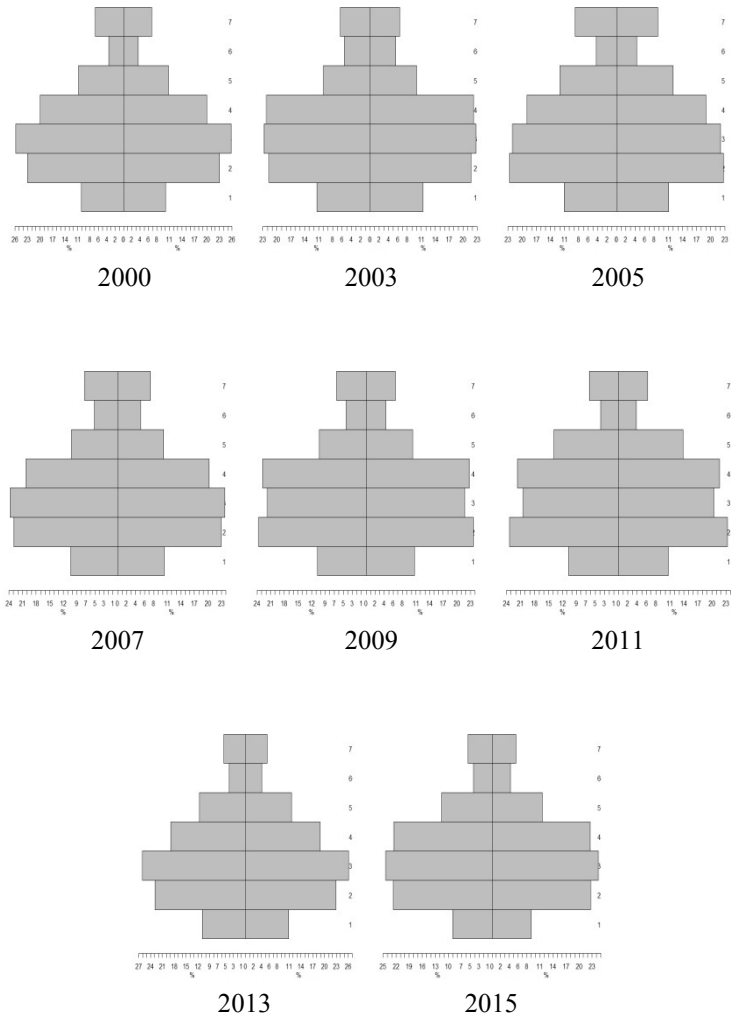
Figure 3. Income diagrams for Poland in 2000-2015

Source: Own work based on Council for Social Monitoring [2016].

It can be seen that the lowest class was decreasing in the last years of the observation period. The highest share of the lowest class was in 2003 and 2005, definitely the lowest share in 2015. From 2000 to 2005 the share of the highest class was increasing and in the next years this share was systematically decreasing.

The shape of actual distribution taken from OECD's "Compare your income" tool (from 2017) is visible in Figure 4. It is clear that the shape of income diagram in 2017 is similar to the shape in 2015 obtained in this study. It is also evident that in 2017 the share of the highest class is even smaller than in 2015 which indicates that the downward trend is continued.

In reality, in Poland there
is a considerable wealthy
elite and a mass of people
with either an average or
a low income.

Figure 4. Actual distribution of income − results for Poland from
"Compare your income" web tool

Source: [www 2].

In the next step matrix with values of income structure dissimilarity index was calculated (Table 2). This matrix was a base of the division of the observation period to sub-periods with similar income structures.

Table 2. Matrix with values of income structure dissimilarity index

Year	2000	2003	2005	2007	2009	2011	2013	2015
2000	0.000	0.057	0.050	0.028	0.049	0.059	0.025	0.042
2003		0.000	0.055	0.034	0.030	0.054	0.061	0.045
2005			0.000	0.041	0.048	0.051	0.041	0.059
2007				0.000	0.036	0.056	0.043	0.043
2009					0.000	0.035	0.059	0.039
2011						0.000	0.062	0.053
2013							0.000	0.038
2015								0.000

Source: Own work based on Council for Social Monitoring [2016].

The most dissimilar income structures were in 2011 and 2013 ($p_{ij} =$ $= 0.062$), and in 2003 and 2013 ($p_{ij} = 0.061$), the least dissimilar – structures in 2000 and 2013 ($p_{ij} = 0.025$), and in 2000 and 2007 ($p_{ij} = 0.028$).

Based on the taxonomic algorithm (with $\alpha = 0.05$), homogeneous sub-periods were distinguished:

I.   2000, 2007, 2013, 2015,
II. 2003,
III. 2005,
IV. 2009, 2011.

There were calculated the average structures in sub-periods (Table 3) and the values of income structure (Table 4). It should be mentioned that sub-periods II and III are one-element groups which means that average structures are really the structures in 2003 and 2005, respectively.

Table 3. Income structure in sub-periods

Income class	I	II	III	IV
<0.5 Me	0.063	0.063	0.088	0.064
0.5 – 0.8 Me	0.043	0.056	0.043	0.041
0.8 – 1.1 Me	0.110	0.100	0.120	0.121
1.1 – 1.5 Me	0.204	0.222	0.190	0.222
1.5 – 2.0 Me	0.250	0.227	0.221	0.211
2.0 – 2.5 Me	0.229	0.217	0.227	0.235
>2.5 Me	0.101	0.114	0.111	0.107

Source: Own work based on Council for Social Monitoring [2016].

Table 4. Matrix with values of income structure dissimilarity index – sub-periods

Sub-period	I	II	III	IV
I	0.000	0.045	0.045	0.041
II		0.000	0.055	0.039
III			0.000	0.041
IV				0.000

Source: Own work based on Council for Social Monitoring [2016].

The difference between the average structures for all sub-periods is mostly smaller than $\alpha = 0.05$. It means that structures in sub-periods are homogeneous, but they are not so different.

The changes in income stratification models can be compared with changes in income inequalities. All these changes are related to the economic situation. Income inequalities can be measured by many indices. In our study, three measures of income inequality are included: the D9/D1 ratio, the Gini coefficient and

Palma ratio. The D9/D1 ratio is the ratio of the upper bound value of the ninth decile to the upper bound value of the first decile [OECD, 2017]. This measure ranges from 1 to infinity. The higher values of the D9/D1 ratio, the higher income inequality. The Gini coefficient is defined as the relationship of cumulative shares of the population arranged, according to the level of equivalised disposable income, to the cumulative share of the equivalised total disposable income received by them [Sen, 1997]. The Gini coefficient ranges between 0 (perfect equality) to 1 (perfect inequality). It is popular to express the Gini coefficient in percentages. One of the newest measures of inequality is the Palma ratio. This measure was proposed by Alex Cobham and Andy Sumner, on the basis of the Palma proposition: an observation by Jose Gabriel Palma that currently changes in income or consumption inequality are almost exclusively due to changes in the share of the richest 10 per cent and poorest 40 per cent, because the 'middle' group between the richest and poorest always capture approximately 50 per cent of gross national income [Cobham, Sumner, 2013]. The values of income inequality measures in Poland are shown in Table 5.

Table 5. Values of selected inequality measures

Year	Gini (%)	D9/D1	Palma
2000	33.45	4.129	1.332
2003	35.14	4.637	1.262
2005	37.61	4.834	1.629
2007	35.51	4.480	1.490
2009	35.24	4.242	1.474
2011	34.69	4.074	1.395
2013	33.79	4.063	1.357
2015	32.01	3.850	1.168

Source: Own work based on Council for Social Monitoring [2016].

It is visible that in 2005 all presented inequality measures had the highest values, which means that households income was the most differentiated. It should be noted that 2005 is a year immediately after Poland's accession to the European Union. Analyzing the income structure, it is clear that 2005 was characterized by the highest share of the most affluent households (the highest income group). In 2009 and 2011 the dynamics of the decline of income inequality slowed down. Simultaneously, the share of households with income from 50% to 80% of the median income (the lowest part of the average-income class) was relatively high. This situation suggests that there is a relationship between income distribution and the global economic crisis.

Conclusions

The conducted study allowed to gain knowledge about income stratification in Poland. Analysis of the stratification in time (2000-2015) allowed to assess the changes in shares income classes.

Based on the conducted study, it can be concluded that:

– in all studied years definitely the highest share had a group of households with either an average or a low income,
– the most distinctive year (2005) was characterized by the highest values of inequality measures; this was shortly after Poland's accession to the European Union,
– it can be clear to see that the share of the most affluent households was decreasing in the studied period.

The further research will focus on comparisons of income stratification model in Poland with other countries from Europe and beyond. The aim of further studies will be also to indicate groups of countries with similar income structures and thanks to that it will be possible, inter alia, to answer the question about the similarity of contemporary income structures of countries from the former Eastern Bloc.

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STRATYFIKACJA DOCHODOWA W POLSCE

Streszczenie: Stratyfikacja dochodowa jest jednym z bezpośrednich sposobów analizowania struktury społeczeństwa. Ten rodzaj stratyfikacji to jednowymiarowy system oceniania na skali „niski dochód – wysoki dochód". Metoda ta pozwala ocenić udział zamożnych i biednych grup w ogóle społeczeństwa oraz zmiany zachodzące w strukturze społeczeństwa przez pryzmat dochodów. W przeprowadzonym badaniu zastosowano podział gospodarstw domowych na siedem grup dochodowych, stosując podejście relatywne. W celu podzielenia badanego okresu 2000-2015 na podokresy cechujące się podobnymi strukturami dochodów zastosowano algorytm taksonomiczny. Zgodnie z zastosowanym algorytmem badany okres podzielono na cztery podokresy.

Słowa kluczowe: stratyfikacja dochodowa, ubóstwo, zamożność, bogactwo, nierówność dochodowa.