# **HOUSEHOLDS IN BIG CITIES – ARE THEY RICH?**

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**Abstract:** The aim of the paper was to identify the extent of richness in Polish big cities. Basic characteristics, inequality and polarization measures, and richness measures were used to characterize income distribution of the total sample. There were calculated measures of richness (richness headcount ratios and income share of the top 10%), selected inequality (the Gini coefficient) and polarization (the Wolfson polarization index) measures for all households in the sample and for selected large sized towns in Poland. There were evaluated relationships between richness rates and the Gini coefficient as well as between richness rates the Wolfson polarization index. Correlation between top incomes and measures of inequality and polarization was also calculated. R software was used in all analyses. The study was conducted basing on data from Social Diagnosis project. The analyse showed that Polish big cities were differentiated due to income received by households living there. There was strong relationship between the inequality measures and the richness measures.

Key words: income, richness measures, Gini coefficient, Wolfson polarization index

**JEL codes:** D31, D63, R13

## 1. Introduction

Poverty phenomenon is studied all over the world. The poor (households are most often analysed) have not enough money to meet their needs. The poverty can be considered in different ways – through the prism of income, of expenditure, in the short term and in the long term, and so on. In this paper economic situation through the prism of income was considered. The poor are at the one end of income distribution and the rich are at the other end. Rich households are satisfying their needs, because they have enough money to do that. The question is which household groups are rich and where the rich live. The aim of the paper was to identify the extent of richness in Polish big cities (or large sized towns). In the previous studies (e.g. Brzeziński, 2010; Peichl et al., 2010) the attention was mostly paid to richness at the country level, without detailed analysis among women and men, among living in rural and urban areas, among living in large, middle and small sized towns, and so on. To achieve the goal basic characteristics, inequality and polarization measures, and richness measures were used to characterize the total sample income distribution. There were calculated measures of richness (richness headcount ratio and income share of the top 10%), selected inequality (the Gini coefficient) and polarization (the Wolfson polarization index) measures for all households in the sample and for selected large sized towns in Poland. There was evaluated relationship between richness rates and the Gini coefficient as well as between richness rates the Wolfson polarization index.

It was hypothesised that big cities are differentiated due to income received by households living there. It was also supposed that cities from Poland B (the eastern part of the country) are characterized by low share of rich households. It was also expected that richness measures are correlated with inequality measures and polarization measures (Leigh, 2009).

## 2. Methodology and Data

Income distribution can be described by different kinds of measures. The mean and the median are the basic statistics. The income distribution can be also characterized by the Gini coefficient and the Wolfson polarization index. The most popular measure of income inequality is Gini coefficient defined as the relationship of cumulative shares of the population arranged according to the level of income, to the cumulative share of the total income received by them. In alternative approach Gini coefficient is defined as half of the relative mean absolute difference which can be expressed by the formula (Sen, 1997):

$$G = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j|}{2n^2 \mu},$$
(1)

where  $x_i$  is income of individual *i* and there are *n* individuals,  $\mu$  is the mean income. The Gini coefficient ranges between 0 (perfect equality) to 1 (perfect inequality). It is popular to express the Gini coefficient in percentages.

Standard inequality measures do not give any information about polarization. A more polarized income distribution is one that has relatively fewer middle income class and more low- and/or high income households (Alichi et al., 2016). Low income class is very often identified with poverty and high-income class with richness. One of the measures of polarization is the Wolfson polarization index given by (Wolfson, 1994):

$$P = 2(2T - G)\frac{\mu}{Me},$$
(2)

where T is the difference between 0.5 and the income share of the bottom half of the population, G – Gini coefficient,  $\mu$  is the mean income, Me is the median income. Index lies between 0 and 1. The higher values of index, the greater is polarization. Wolfson index is commonly expressed in percentages.

Richness headcount ratio is a proportion of the population with incomes above the affluence line (Brzeziński, 2010; Sączewska-Piotrowska, 2015):

$$R^{HC}(\mathbf{x},\rho) = \frac{1}{n} \sum_{i=1}^{n} \mathbf{1}_{x_i > \rho} = \frac{r}{n},$$
(3)

where  $x_i$  is an income of individual i, n is the number of individuals,  $\rho$  is the richness line, r is the number of rich and  $\mathbf{1}_{x_i > \rho}$  denotes the indicator function, which is equal to 1 when its argument is true and 0 otherwise. The richness line is often defined as 200% of the median, 300% of the median or 400% of the median. Some authors defined (based on the median) three categories: affluent (300% of the median), rich (500%) and superrich (1000%). Relative thresholds of richness were used by Brzeziński (2010), Peichl et al. (2010), Sączewska-Piotrowska (2015), Franzini et al. (2016).

One of the most popular measure of richness – income share of the top p% of the population – takes a form (Brzeziński, 2010):

$$R^{IS}(\mathbf{x},\rho) = \frac{\sum_{i=1}^{n} x_i \mathbf{1}_{x_i > q_{1-p}}}{\sum_{i=1}^{n} x_i},$$
(4)

where  $x_i$  is an income of individual i, n is the number of individuals,  $q_{1-p}$  is the (1-p) quantile of the population and  $\mathbf{1}_{x_i > q_{1-p}}$  denotes the indicator function, which is equal to 1 when its argument is true and 0 otherwise.

The study was conducted based on data from Social Diagnosis project (Council for Social Monitoring, 2016). There was analysed household income in Poland in March/June 2015. There was calculated equivalised income in order to take account of the differences in a household's size and its composition. The modified OECD (Organisation for Economic Co-operation and Development) equivalence scale was used. This scale assigns 1 to the first adult of the household, 0,5 to each subsequent adult aged 14 or more and 0,3 to children (each person under 14). Median income was calculated based on all households from the study sample (more than 10 thousand households). Further analysis focused on 13 big cities (large sized towns). Study sample consists of almost 2400 households living in large sized towns. According to the Central Statistical Office (2014) large sized towns – 100 thousand people and more, medium sized towns – from 20 thousand to 100 thousand people, and small sized towns – lower than 20 thousand inhabitants.

The basic characteristics of selected cities shows table 1. Additionally, table 1 includes information about location in Poland A or B. Poland A (west of the Vistula river) is more economically developed and is growing faster than Poland B.

City	Population*	ation* Voivodship		
Białystok	2	Podlaskie	В	
Gdańsk	2	Pomorskie	Α	
Katowice	2	Śląskie	Α	
Kielce	1	Świętokrzyskie	В	
Kraków	3	Małopolskie	Α	
Łódź	3	Łódzkie	Α	
Lublin	2	Lubelskie	В	
Olsztyn	1	Warmińsko-mazurskie	В	
Poznań	3	Wielkopolskie	Α	
Radom	2	Mazowieckie	Α	
Szczecin	2	Zachodniopomorskie	Α	
Warszawa	3	Mazowieckie	А	
Wrocław	3	Dolnośląskie	Α	

Tab. 1 The basic characteristics of selected cities in Poland, 2015

\* 1 – 100-200 thousand, 2 -200-500 thousand, 3 – 500 thousand and more \*\* refers to the historical, political and cultural distinction between the western (Poland A) and the eastern (Poland B) part of the country.

Source: The authors' work based on Council for Social Monitoring (2016).

Two large sized towns have population from 100 thousand to 200 thousand people, six towns from 200 thousand to 500 thousand people and five towns – 500 thousand people and more. Two big cities (Warszawa and Radom) are located in the same voivodship – in Mazowieckie voivodship. Most cities are from Poland A and only four cities are from Poland B.

All statistical analyses and charts were performed using R software (R Core Team, 2015) with affluenceIndex (Wolny Dominiak and Sączewska-Piotrowska, 2017) package.

### 3. Results and Discussion

In the first step income distribution characteristics and richness measures for all households were calculated (table 2).

**Tab. 2** Income\* distribution characteristics and richness measures in Poland, 2015

Income distribution							
Mean (PLN)	Median (PLN)	Gini (%)	Wolfson (%)				
2136	1750	32.01	24.87				
Richness measures (%)							
$R_{2xMe}^{HC}$	$R^{HC}_{3xMe}$	$R_{10}^{IS}$	$R_5^{IS}$				
9.77	3.37	25.88	16.82				

\* income is adjusted according to OECD modified equivalence scale

Source: The authors' work based on Council for Social Monitoring (2016).

The mean income is higher than the median income – income distribution is rightskewed. It means that most households receive income lower than the mean income, in other words a larger share of income is located on the lower tail. Right-skewness of distribution is shown on histogram (figure 1). Figure 1 also shows the richness lines taking into account in the analysis: two times median and three times median richness lines.



Fig. 1 Histogram\* of household income in Poland, 2015

\* for ease of viewership, there were excluded top 1% observations (the 99<sup>th</sup> percentile cut-off point)

Source: The authors' work based on Council for Social Monitoring (2016).

Gini coefficient equals to 32,01% and means that the average absolute difference in incomes between any two randomly selected households is 64,02% of mean income (table 2). The quite low value of Wolfson polarization index does not indicate the disappearance of the middle class. The share of households living over the richness line defined as two times median is 9,77% and defined as three times median is 3,37%. The

share of the total income received by the top 10% households is 25,88% and by the top 5% is 16,82%.

The results are similar to data of World Bank (Poverty and Equity, 2017). The Gini coefficient in our study is 32,01% and according to World Bank (in 2014) is 32,1%. The values of income share of the top 10% of the population are also very close – our study 25,88% and World Bank 25,18%. The study covering the earlier period (1998-2007) gave also the similar results – Gini in 2007 is 31,1%, the value of income share of the top 10% is 25,35% and the top 5% is 16,23%. Richness headcount ratios in 2007 were 9,20% (richness line calculated as two times median) and 2,80% (richness line calculated as three times median) (Brzeziński, 2010). The latest study on income polarization (Panek, 2017) showed that value of the Wolfson polarization index in 2014 was 24,15% (in our study 24,87%). It must be noted that the results of previous studies are relatively similar, although they were conducted according to different methodology (e.g. using different equivalence scales) and they cover different period.

Richness, inequality and polarization measures were calculated for selected big cities in Poland (table 3). Richness measures are visualised on the map (figure 2).

City	$R_{2xMe}^{HC}$	$R^{HC}_{3xMe}$	$R_{10}^{IS}$	Gini	Wolfson
Białystok	11.20	3.20	23.24	27.11	23.65
Gdańsk	18.71	5.76	20.41	26.33	22.19
Katowice	13.64	4.55	24.73	30.42	20.88
Kielce	7.50	5.00	23.81	29.46	18.96
Kraków	20.37	3.70	21.40	28.20	22.89
Łódź	11.88	4.95	24.68	29.99	23.76
Lublin	10.47	2.33	21.82	27.06	23.46
Olsztyn	14.29	3.90	24.05	29.99	27.80
Poznań	16.46	6.33	25.39	29.65	19.19
Radom	5.33	0.00	20.02	24.05	20.93
Szczecin	18.60	5.81	23.26	26.79	20.85
Warszawa	33.82	16.18	26.91	34.82	28.86
Wrocław	22.22	5.56	27.58	32.72	24.54

**Tab. 3** Richness, inequality and polarization measures\*, selected big cities in Poland,2015

\* all values expressed in %

Source: The authors' work based on Council for Social Monitoring (2016).

Warszawa was characterized by the highest share of rich households and Radom by the lowest share of rich households. Generally, these two cities are on the two poles -Warszawa had the highest values of almost all measures and Radom had the lowest values of almost all measures. In Radom there was no (!) household receiving income above three times median (median calculated for all households in the sample - national richness line). The differentiation due to economic situation is visible not only in the case of these two cities. The attention should be also paid to Kielce, Lublin and Wrocław. Kielce was characterized by low (lower than for whole Poland) share of rich households for twice median richness line, Lublin by the very low share of rich households for three times median line and Wrocław by the highest income share of the top 10%. It must be also noted that richness headcount ratios for large sized towns in Poland B were lower than in Poland A and there was no difference between cities with different population. The large sized towns are differentiated due to values of Gini coefficient and Wolfson polarization index. Warszawa and Wrocław were the least equal towns, Radom was the most equal. Warszawa and Olsztyn were the most polarized cities, Kielce and Poznań the least polarized. Generally, the values of these two measures are lower in cities than

in whole Poland. Warszawa was the exception – the values of Gini coefficient and Wolfson polarization index was higher than for Poland.





\* R\_HC2 and R\_HC3 are richness headcount ratios (two times median and three times median, respectively), R\_IS10 is income share of the top 10% blue-coloured background – Poland A, pink-coloured background – Poland B Source: The authors' work based on Council for Social Monitoring (2016).

There was identified correlation between richness headcount ratios (two and three times median) and the Gini coefficient, and correlation between richness headcount ratios and Wolfson polarization index. Inequality and polarization measures were positively and significantly associated with the richness headcount ratios (figure 3 and figure 4).



Fig. 4 Relationship between richness headcount ratio and Wolfson polarization index in big cities in Poland, 2015



Source: The authors' work based on Council for Social Monitoring (2016).

It is clear that cities from Poland B are located on the left side of scatter plots, which means that these cities are characterized by the low shares of rich households. Warszawa was the outlier – the highest share of rich households and the highest values of Gini coefficient and Wolfson polarization index.

Figure 5 plots the relationship between the income share of the top 10% and the Gini coefficient, and the relationship between the share of the top 10% and the Wolfson polarization index.





Source: The authors' work based on Council for Social Monitoring (2016).

There was strong correlation between  $R_{10}^{IS}$  and the Gini coefficient, that may suggest the same factors which affect inequality at the top of the income distribution also affect the Gini coefficient. Similar conclusions were drown by Leigh (2009). Many authors, e.g. Saez and Veall (2005), Roine et al. (2007), Atkinson and Piketty (2010) consider possible factors affecting top income shares. The analyses are mostly conducted at the country level. For example, Roine et al. (2007) based on data from 16 developed and developing countries found that higher growth, lower income taxes, financial development, and international trade (for the Anglo-Saxon) were associated with higher top income shares.

## 4. Conclusions

Generally, in most big cities the share of rich households is higher than in Poland. It can be also noted that income inequality and polarization is lower in selected cities than in whole Poland. Performed analysis showed that definitely the highest share of rich households is in Warszawa. The capital is the richest city and also the most differentiated due to household income. Among the cities included in analysis, at the other end is the second town from Mazowieckie voivodeship, i.e. Radom. This city is characterized by the lowest share of rich households and by the least differentiated income.

This is a preliminary study concerning the richness in Poland. It is clear that large sized towns are differentiated due to economic situation. Therefore, it is not obvious that place of residence influences the economic situation. There are other factors influencing the material situation. The further research will focus on determining those factors. The further research will also focus on dynamics of the richness in big cities as well in voivodships, among living rural and urban areas, and take into account different kinds of household division. There will be also estimated different richness measures to evaluate the intensity of richness<sup>1</sup>. The measurement of the extent and intensity of richness as well as income inequality and polarization will allow to get a fuller picture of income richness in Poland.

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<sup>&</sup>lt;sup>1</sup> These indicators are based on poverty measures: Foster et al. (1984) indices and Chakravarty (1983) index. They are characterized by Peichl et al. (2010).

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