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MAŁGORZATA RACZKOWSKA, KINGA GRUZIEL

Warsaw University of Life Sciences – SGGW, Poland

INEQUALITIES IN THE DISTRIBUTION OF INCOME IN THE HOUSEHOLDS OF FARMERS IN POLAND

Key words: farm household, disposable income, income inequalities, Gini coefficient

ABSTRACT. The purpose of the study was to identify and assess the level of income inequality in farm households. The research methods applied were literature studies and analysis of statistical data provided by the Central Statistical Office for the period 2012-2017. The subject of the study was the disposable income of a farm household per capita. A research hypothesis was adopted whereby, over the years 2010-2017, a systematic increase in income inequality in farm households took place. It was found that during the analysed years, there was an increase in disposable income per capita in farm households. When assessing the level of income inequality in this group of households, a decrease in income stratification measured by the level of the Gini coefficient, by the Schutz-Pietra measure, was noticed, although these changes were very small. Comparing the level of the Gini coefficient among all groups of households distinguished with regard to the main source of income, it was the group of farms that was characterised by the highest level of income inequality. In addition, income inequalities among farmers were characterised by the highest variation compared to other professional groups. This situation may be caused by the nature of farm income, which is conditioned, among others, by the size and productivity of the farm, its degree of specialisation, as well as weather conditions.

INTRODUCTION

Income inequalities become a relevant issue in the situation whereby income obtained by individuals, households or social groups varies, i.e. certain individuals or groups have more income at their disposal than other ones.

Income inequalities, in Poland, occur in various cross-sections. This is particularly visible in the division into socio-professional groups. The highest level of income inequality being of significance is observed in farm households. This may be due to the specificity of farm income, which depends, among others, on farm size, productivity, degree of specialisation, weather conditions and the economic situation. Large income spreads in this group may also be caused by the diversity of life opportunities, lack of broad access to transport, technical and social infrastructure as well as access to enterprises and institutions offering well-paid employment.

A comprehensive analysis of inequality in a given society is, therefore, an important tool for socio-economic policy in each country. Understanding the size and distribution of inequalities is helpful in preventing and combating many social problems, as well as maintaining social harmony and prosperity.

MATERIAL AND RESEARCH METHODS

The aim of the study was to identify and assess the level of inequality in the distribution of income in farm households, in Poland, over the years 2012-2017, as well as compare income spreads between distinguished socio-professional groups[1]. Therefore, the general research hypothesis was: over the years 2010-2017,a systematic increase in income inequality in the households of farmers took place. Farm households are considered to be households whose only or main source of upkeep is the income from an individual farm used for farming and an additional source of income being a retirement pension, disability benefit or other non-profit source, hired labour, self-employment or freelance job [GUS 2018].

Table 1. Postulates of economic inequality measurements

Criterion	Description
Anonymity	Income inequality should be determined solely on the basis of income, with the issue of whom this income belongs to being of secondary importance
Continuity	Slight changes in income distribution should cause small changes in the level of inequality
Transfers according to Pigou-Dalton	Any transfer of income/goods from a richer person to a poorer one must cause inequality to decrease
Symmetry	The change of income between any pair of households should not cause changes in the index value
Independence from the measuring scale	The size of inequality should not change if the measuring scale (unit) of a given variable is changed, e.g. currency
Independence from the size of Dalton's population	Multiplication of the population does not affect inequality. This means that, when assessing inequality, the size of the community in which the inequality occurs is disregarded
Decomposability	Inequality in the whole society depends on inequalities within the sub-groups forming this society and their characteristics. Thus, the level of inequality in the entire population only depends on the level of inequality, number and average income of subgroups
Replication stability	The coefficient value will not change with any number of replications of the studied population.

Source: own elaboration based on [Jabkowski 2009, Jancewicz 2016, Sawiński 2012, Zwiech 2016]

[1] Income distribution in agriculture in recent years has been studied , among others, by Andrzej Wołoszyn and Feliks Wysocki [2014], Maria Grzelak [2016], Joanna Średzińska [2017], Alina Jędrzejczak and Dorota Pekasiewicz [2017].

Table 2. Selected measures of income inequality measurement

Measure	Definition	Interpretation	Formula
Gini coefficient	Half of the average absolute value between two randomly selected characteristic values from the population	The values of the Gini coefficient are within the range [0, 1] and the index from 0 to 100, where zero means full uniformity of distribution, while unity (or 100) means that only one household has income, and the rest do not have them at all	Assuming that income values are ordered in an ascending order, the Gini coefficient is determined by the formula: $G = \frac{\frac{1}{2n^2}\sum_{i=1}^{n}\sum_{j=1}^{n}\lvert x_i - x_j\rvert}{\bar{x}}$ where: G – Gini coefficient, x_i – value of the i-th variable for the household, x_i – value of the j-th variable for the household variable, $\overline{x}$ – average value of the characteristic, n – sample size, i – position of the observation in a series (in ascending order)
Schutz-Pietra measure (also called the Robin Hood index)	The percentage of the sum of income of all units divided into two parts (the richer and the poorer) that should be transferred from a group of richer farms to a group of poorer farms to completely eliminate income disparities in the studied group.	The Schutz inequality measure is in the range [0,1], where 0 is equal and 1 is the maximum inequality.	$S = \frac{D}{2\mu}$ where: S – measure of Schutz inequality, D – average deviation of the variable, $\frac{D}{\mu}$ – relative average deviation of the variable, μ – average value of the variable in the general population
Asymmetry coefficient	A measure that indicates whether the majority of the population is above or below the average level of the examined feature X.	A positive value of the coefficient indicates right-hand asymmetry, while a negative one indicates left-hand asymmetry. When the distribution is characterised by left- or right-hand asymmetry, at least 50% of the value is larger/smaller than the arithmetic mean. The greater the absolute value of the asymmetry coefficient, the greater the asymmetry of distribution	$A_s = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_1 - \bar{x})^3}{S(x)^3}$ where: A_s – asymmetry coefficient, $S^2(x)$ – variance, x_i – value of the variable for the i-th household, $\overline{x}$ – average value of the variable

Source: own elaboration based on [Kasprzyk 2014, Panek 2011, Kuszewski 2008, Ulman 2006, Zwiech 2016]

The measure of income in this study was disposable income per capita. According to the definition adopted by the Central Statistical Office: "Disposable income is the sum of current household income from all sources reduced by advances towards personal income tax deducted by the employer on behalf of the tax-payer (from income earned through hired labour and certain benefits from social insurance and a social welfare agency), by taxes paid from income and property paid by self-employed persons, including freelance professionals and persons using an individual farm for farming and by social security and health insurance premiums. Disposable income includes cash and in-kind income, also including natural consumption (commodities or services used for the needs of the household, received from an individual farm or from self-employment) as well as commodities and services received free of charge. Disposable income is allocated for expenses and for increasing savings" [GUS 2018].The comparative analysis of changes in the inequality level was based on the statistical data of the Central Statistical Office for the period 2012-2017. Descriptive statistics were used in the research. The relationship between the variables was measured using the Pearson correlation coefficient:

$$r_{ij} = \frac{cov\,(X_i, X_j)}{s_i s_j}$$

where: $cov\,X_i, X_j$ – covariance coefficient of the variable, $s_i s_j$ – standard deviation of the variable.

The measurement of inequalities is based on principles (so-called axioms) which should be followed when comparing the level of income inequalities (Table 1). These criteria result from both theoretical and empirical concepts of inequality research, such as the necessity to capture any change in income distribution across the population by the inequality indicator [Jabkowski 2009].

In the study, the Gini coefficient and Schutz-Pietra measure were used to assess the level of income inequality in a group of farm households. The distribution of inequalities was also analysed using the asymmetry coefficient (Table 2). These measures were chosen for their transparency and simple intuitive interpretation.

All measures of income inequality selected for analysis meet the following criteria: anonymity, measurement scale stability and population stability (Table 3). The Gini coef-

Table 3. Assessment of economic inequality measures based on axioms

Measure/axioms	Anonymity	Transfers according to Pigou-Dalton	Independence from the measuring scale	Independence from the size of Dalton's population	Decomposability
Gini coefficient	+	+ +	+	+	+ -
Schutz-Pietra measure	+	-	+	+	+ -
Asymmetry coefficient	+	+ -	+	+	-

"+" satisfies – weak version, "+" satisfies, "++" satisfies, "-" strong version – does not satisfy requirements

Source: own elaboration based on Table 1

ficient satisfies the most axioms being considered; however, it does not mean that it is the best. It only means that the way of defining income inequality presented hereby complies with selected rules. The Shutz-Pietra measure is insensitive to the transfers among incomes located on one side of the average income, and the asymmetry coefficient does not meet the decomposability condition.

RESULTS AND DISCUSSION

The basic factor determining the level of wealth of households is their income [Kozera, Stanisławska, Wysocki 2014]. Household income depends on many factors, including its belonging to the socio-economic group, which is determined on the basis of the main source of household income [Wołoszyn 2013].

During the research period, there is an upward trend in the average nominal disposable income of households per one person: from PLN 1,278.43 in 2012 to PLN 1,598.13 in 2017 (Figure 1). This indicates a 25% increase in this income over the analysed years. The largest improvement in the income situation was recorded over the period 2016-2017.

By contrast, the income situation in farm households was characterised by a variable tendency over the analysed period. During 2012-2013, disposable income per capita increased by nearly 6%; in 2014, in comparison to the previous year, there was a decrease in income by 9% , then over 2015-2017 an income increase was observed again (Figure 1).

In general, over the period considered, in farm households, disposable income per person in current prices increased from PLN 1,091.55 in 2012 to 1,575.57 in 2017 – which means an increase in income by 44.3%. Comparing the changes in the level of income in a given year to the previous year, it was observed that, in the group of farmers, disposable income per person grew the fastest in 2016-2017, and the average annual growth rate was over 36.8%.

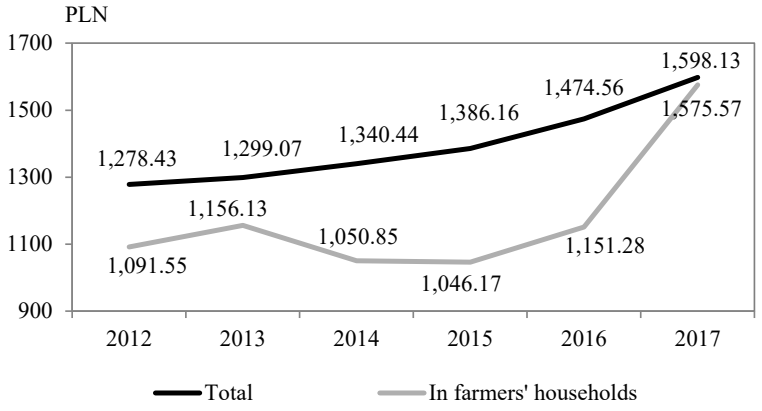

Figure 1. The average disposable monthly income per capita in a household in Poland over the years 2012-2017

Source: own elaboration based on [GUS 2018]

Referring to the level of income for all households in Poland, it was noticed that over the entire study period, farmer incomes were below the national average. The largest deviation from the average level was noticed in 2016, i.e. by 22% (PLN 323.28) to the disadvantage of farm households.

The calculated measures of income inequality prove that farm households are characterised by a high diversity of income distribution (Table 4). Both indices point to similar trends in changes in the degree of income inequality, in Poland, in 2012-2017.

Table 4. Measures of income inequality in farm households during 2012-2017

Years	Asymmetry coefficient	Gini coefficient [%]	Schutz-Pietra measure
2012	8.11	55.9	0.338
2013	15.67	59.9	0.364
2014	3.41	54.4	0.325
2015	6.10	55.3	0.329
2016	5.90	54.1	0.322
2017	4.78	54.7	0.326

Source: original work based on [GUS 2018]

The Gini coefficient showed that, in the examined period, the average absolute difference between the income of randomly selected persons from a farm household constituted 109-120% of the average income in the group of farm households. The value of the Gini coefficient in 2013 was almost 60% and is alarming. It is well above the value typical for the distribution of income inequality in developed countries.

The Schutz-Pietra index indicated that, in the examined period, 33-36% of total disposable income in farm households had to be transferred to persons with an income lower than or equal to the average income in this group, so that income inequalities could be eliminated. In addition, in the group of farm households, the distribution of income per capita was characterised by right-hand asymmetry. This means that more than half of the households received income per capita below their average value. All of the analysed measures of income inequality in the analysed years were characterized by large variability. Relating extreme years to each other, i.e. 2012 and 2017, a slight decrease in income inequality in farm households can be seen.

Positive and very strong relationships exist between the examined income inequality indicators (Table 5). The strongest relationship occurs between the Gini coefficient and the Schutz-Pietra index – one variable explains the other one in 99% of cases. Very high values of the Pearson correlation coefficient ($r > 0.9$)show that, in the analysis of the level of inequality in the group of farm households, one selected inequality indicator can be focused on.

Table 5. The Pearson correlation coefficients (r) for measures of income inequality

	Asymmetry coefficient	Gini coefficient	Schutz-Pietra measure
Asymmetry coefficient	1.000	0.970	0.969
Gini coefficient	0.970	1.000	0.995
Schutz-Pietra measure	0.969	0.995	1.000

Source: original work based on Table 4

Income inequalities measured by the Gini coefficient, analysed according to the main source of household income,

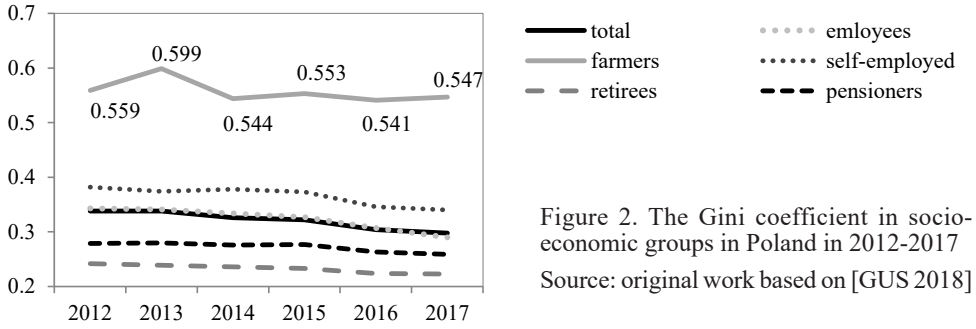

Figure 2. The Gini coefficient in socio-economic groups in Poland in 2012-2017

Source: original work based on [GUS 2018]

show that, during the years 2012-2017, the highest income inequalities were observed in households whereby the main source of income was a farm (Figure 2). Compared to other occupational groups, income inequalities among farmers were characterised by the highest variability – from 54.1% in 2016 to 59.9% in 2013. In the other groups of households, income inequalities reached a much lower level and did not show any significant deviations. The lowest income inequalities occurred in the households of pensioners – the Gini coefficient values fluctuated below

CONCLUSIONS

The analyses carried out over the years 2012-2017 concerning the level of income inequality allowed for achieving the research objective which was the identification and assessment of the inequality level in the distribution of income in farm households in Poland.

The research hypothesis, whereby over the years 2010-2017, a systematic increase in income inequalities in farm households took place, was verified negatively.

Between 2012-2017, the income situation of farm households improved. The analysis of the dynamics of changes showed that, in farm households, the highest average annual rate of changes in disposable income per capita occurred over the years 2016-2017.

Comparing the extreme years with each other, i.e. 2012 and 2017, the measures of inequality – the Gini coefficient and Schutz-Pietra index demonstrated a decrease in the level of income inequality in the group of farm households. However, it should be noted that these changes were relatively small – the Gini coefficient in 2017 compared to 2012 decreased by 1 percentage point, and the Schutz-Pietra index by 1.2 points.

In addition, the analysed inequality coefficients were characterised by high variability – it cannot be determined whether, over the years, there was a systematic decrease or increase in income inequality among farm households, as, after a year of decline, a further increase was observed, followed by a further decline in the value of the studied coefficients.

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NIERÓWNOŚCI W ROZKŁADZIE DOCHODÓW W GOSPODARSTWACH DOMOWYCH ROLNIKÓW W POLSCE

Słowa kluczowe: rolnicze gospodarstwo domowe, dochód rozporządzalny, nierówności dochodowe, współczynnik Giniego

ABSTRAKT

Celem opracowania jest identyfikacja i ocena poziomu nierówności dochodowych w gospodarstwach domowych rolników. Zastosowanymi metodami badawczymi były studia literaturowe oraz analiza danych statystycznych udostępnionych przez GUS za lata 2012-2017. Przedmiotem badania były dochody rozporządzalne *per capita* rolniczego gospodarstwa domowego. Przyjęto hipotezę badawczą zakładającą, że w latach 2010-2017 w rolniczych gospodarstwach domowych następował systematyczny wzrost nierówności dochodowych. Stwierdzono, że w analizowanych latach w gospodarstwach domowych rolników nastąpił wzrost dochodów rozporządzalnych *per capita.* Oceniając poziom nierówności dochodowych w tej grupie gospodarstw zauważono spadek rozwarstwienia dochodowego mierzonego poziomem współczynnika Giniego, miarą Schutza-Pietry, chociaż zmiany te były bardzo małe. Porównując poziom współczynnika Giniego pomiędzy wszystkimi grupami gospodarstw domowych, wyodrębnionymi ze względu na główne źródło utrzymania, to grupa gospodarstw rolniczych charakteryzowała się najwyższym poziomem nierówności dochodowych. Ponadto w porównaniu z pozostałymi grupami zawodowymi nierówności dochodowe rolników charakteryzowały się największą zmiennością. Sytuacja ta może być spowodowana charakterem dochodu gospodarstwa rolnego, który uwarunkowany jest m.in. wielkością i produktywnością gospodarstwa, stopniem jego specjalizacji, a także warunkami pogodowymi.

AUTHORS

MAŁGORZATA RACZKOWSKA, PHD
ORCID: 0000-0002-8540-8958
Warsaw University of Life Sciences – SGGW
Faculty of Economic Sciences
Department of Economics and Economic Policy
166 Nowoursynowska St., 02-787 Warsaw, Poland

KINGA GRUZIEL, PHD
ORCID: 0000-0003-2429-3795
Warsaw University of Life Sciences – SGGW
Faculty of Economic Sciences
Department of Economics and Economic Policy
166 Nowoursynowska St., 02-787 Warsaw, Poland