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IMPACT OF THE TYPE OF AGRICULTURAL ACTIVITY UNDERTAKEN ON INCOME EARNED FROM INDIVIDUAL FARMS IN POLAND – A REGIONAL ANALYSIS

Keywords: agricultural income, available income, individual farm, agricultural activity, agricultural production

ABSTRACT. Variation in income earned from individual farms is affected by a variety of factors such as soil quality, technical advancement, agricultural policy reforms, work efficiency, as well as scale and directions of agricultural production. The level of income earned by business entities, including individual farms, is a significant factor that affects expenses incurred in relation to the operation of an agricultural business and expenses to satisfy the needs of each member of a farmer's household. The objective of this paper is to determine the impact of the type of agricultural activity undertaken and the area of agricultural land on income earned by individual farms in Poland. In addition, an attempt was made to evaluate regional variation in financial, area-related, and production indicators taken into consideration in the course of the study between individual farms. The results have been presented at the regional NUTS 2 level in Poland for 2017. Results of the study conducted have been visualised by means of the statistical, descriptive, comparative, and graphical method. Coefficients of variation V_s and correlation coefficients r_{xy} were calculated. The study has revealed that there is a significant regional variation in Poland in terms of income earned by individual farms. Regional variation has also been found in the scale and type of agricultural production undertaken. In addition, it has been proven that the level of income earned from individual farms depends on the type of agricultural activity undertaken and on the area of agricultural land.

INTRODUCTION

Income inequalities in various occupational groups or various household types are commonly known to have an array of potential undesirable economic and social consequences such as poverty and polarisation of population groups or regions [Murawska 2017, p. 210, Jędrzejczak, Pekasiewicz 2018, p. 151]. Income is an important category defining the socio-economic situation of every business entity, including individual agricultural holdings. Income reflects the economic surplus obtained by an entity that determines production, investment, savings, and current consumption decisions.

A great number of authors have analysed income variation in rural areas. Research in this field has been conducted by Alina Jędrzejczak and Dorota Pekasiewicz [2018], Maria Grzelak [2016], Agata Marcysiak and Adam Marcysiak [2014], Anna Murawska [2014,

2017], Joanna Pawłowska-Tyszko and Michał Soliwoda [2014], Robert Pietrzykowski [2016], and Agnieszka Strzelecka [2018], among others. Research on differences and determinants of income in farmers' households is important due to the fact that their income inequalities as measured with the Gini coefficient [1912] are the greatest compared to other household types, and are deepening, which constitutes evidence of a great disproportion¹ [cf. also: Jędrzejczak, Pekasiewicz 2018, Murawska 2017].

Income variation is determined by various factors. Agricultural holding income, including factors that affect it, was studied by Waldemar Michna [2005], Barbara Kutkowska and Tomasz Berbeka [2016], Joanna Pawłowska-Tyszko and Michał Soliwoda [2014], Simone Severini and Antonella Tantari [2013], and Danuta Zawadzka and colleagues [2011], among others. Specificity of the distribution of income earned from the operation of an individual farm in particular regions is closely related to agricultural conditions that result from different structures of holdings by area, soil quality, climate, or technical advancement, etc. A major role is played by agricultural policy reforms, financial outlays for agriculture from government budget, the financial support system, and the system of direct payments. Income variation is affected by work efficiency in agriculture, i.e. the use of labour, as well as by the implementation of technical developments and, consequently, optimal use of factors of production. However, the amount of a farmer's income is also affected by income other than from agriculture as well as scale and directions of agricultural production. It is also emphasised in the literature that, at present, territorial variation of agricultural production is affected, to a greater extent, by organisational and economic factors than by natural conditions. For instance, in some provinces (Greater Poland, Kuyavia-Pomerania, or the West Pomerania Province) structural transformations and processes of adaptation take place at a faster pace and more smoothly than in other parts of the country [Jędrzejczak, Pekasiewicz 2018, p. 151, Michna, 2005, p. 21-50].

MATERIAL AND METHODS

The objective of the study was to determine the impact of the type of agricultural activity undertaken on income earned by individual farms in Poland. In addition, an attempt was made to evaluate regional variation in income, production, and area-related indicators taken into consideration in the course of the study between individual farms. The results have been presented at the regional NUTS 2 level² in Poland for 2017. The numerical data source consisted of collective summary tables made available by Statistics Poland that pertain to regional variation in social and economic phenomena.

¹ The most recent data [GUS 2018a] has shown that the Gini coefficient for farmers' households in 2017 was equal to 0.547 and its value increased compared to 2016, when it was equal to 0.541. This coefficient has had the highest value in this group of households for many years. The mean value of the Gini coefficient for Poland in 2017 was 0.298 and it decreased compared to the year before.

² This paper uses abbreviations for Polish provinces as per ISO 3166-2:PL codes developed by the International Organisation for Standardisation [ISO 2019]: DS – Lower Silesia Province, KP – Kuyavia-Pomerania Province, LB – Lubusz Province, LD – Łódź Province, LU – Lublin Province, MA – Lesser Poland Province, MZ – Mazovia Province, OP – Opole Province, PD – Podlasie Province, PK – Subcarpathia Province, PM – Pomerania Province, SK – Świętokrzyskie Province, SL – Silesia Province, WN – Warmia-Masuria Province, WP – Greater Poland Province, ZP – West Pomerania Province.

Considering the objective of the paper and the role of factors that affect income earned from the operation of individual farms, a few groups of indicators characterising individual holdings in agriculture were used for analyses:

- average monthly available income per capita in PLN earned from an individual holding in agriculture;
- area of agricultural land in individual holdings in percentage values,
- harvest of main crops in thousands of tonnes,
- animal stock in thousands of animals and in animals per 100 hectares of agricultural land,
- slaughter animal production in thousands of tonnes of meat and in kilograms per capita,
- milk production in millions of litres, litres per 1 hectare of agricultural land, and average annual milk yield from one cow in litres,
- structure of agricultural market output.

For improved visualisation of results of the study conducted, the statistical, descriptive, comparative, and graphical method has been used. To visualise differences in values of income, area-related, and production indicators, maximum and minimum values of the analysed data for provinces have been presented, and coefficients of variation V_s were calculated. In order to indicate correlations between income earned by individual farms and the area of these farms as well as the type of agricultural activity undertaken, correlation coefficients r_{xy} were calculated for the significance level $p < 0.05$.

RESULTS

As shown by collective data from the household budget survey, net average monthly receipts³ per capita in farmers' households in 2017 in Poland amounted to PLN 2,194.40 and were higher than total receipts for Poland by PLN 185.38 (Poland – PLN 2,009.02). When it comes to available income in farmers' households, it amounted to PLN 1,575.57 and was lower than total income for Poland by PLN 22.56 (Poland – PLN 1,598.13). The largest portion of available income in farmers' households is comprised of income earned from an individual holding in agriculture – 68% (PLN 1,075.03), followed by income from hired labour – 10% (PLN 162.06), income from social security payments – 10% (PLN 158.67), as well as income from other social benefits such as child-support benefits or state unemployment benefits – 9% (PLN 135.98). Income from self-employment constitutes a mere 1% of available income (PLN 18.11), as is the case with other income, e.g. gifts – 1% (PLN 25.02) [GUS 2018a].

As shown in Table 1, total available income in households in Poland (PLN 1,598.13) is composed of income from hired labour (PLN 831.94 – 54%), from individual holdings

³ Net receipts are all values households are credited with, without advance personal income tax payments made by a payer on behalf of a taxpayer and without social security and health insurance contributions. Net receipts consist of available income and savings items on the credit side [GUS 2011].

Table 1. Average monthly available income per capita in households in 2017

| Specification | Total | Including | | | | Disposable income |
|----------------|------------------|-------------------|--|----------------------|----------------------|-------------------|
| | | from hired labour | from individual holding in agriculture | from self-employment | from social benefits | |
| PLN per capita | | | | | | |
| Poland | 1,598.13 | 831.94 | 67.45 | 134.58 | 499.11 | 1,548.87 |
| V_s [%] | 9.1 | 15.1 | 99.8 | 28.6 | 7.1 | 9.1 |
| min | 1,254.30 (PK) | 611.77 (LU) | 9.56 (SL) | 79.92 (PK) | 456.21 (WP) | 1,217.38 (PK) |
| max | 1,912.09 (MZ) | 1,073.56 (MZ) | 297.55 (PD) | 200.48 (MZ) | 594.84 (SL) | 1,845.42 (MZ) |

V_s – coefficient of variation, min – minimum value, max – maximum value, province name designations have been provided in footnote no. 2

Source: own work based on [GUS 2018b]

in agriculture⁴ (PLN 67.45 – 4%), from self-employment (PLN 134.58 – 9%), and from social benefits (PLN 499.11 – 33%). The greatest regional variation at the NUTS 2 level in Poland covers income earned from individual holdings in agriculture ($V_s = 99.8\%$). The lowest monthly income from individual farms is earned in the Silesia Province (PLN 9.56) and the highest – in the Podlasie Province (PLN 297.55) (Table 1).

Variation in income earned from the operation of an individual farm is affected by a variety of factors. Regional disproportion in area of agricultural land plays a major part. As evidenced by the calculated coefficients of variation V_s (Table 2), there is a significant regional variation in area of agricultural land belonging to individual farms in Poland, which in turn translates into differences in income earned from the operation of an agricultural business. It has been revealed that the percentage of individual farms with an area of up to 1 ha and from 1.01 through 1.99 ha and the income they achieve are significantly negatively correlated ($r_{xy} = -0.548$ and -0.622 , respectively). As far as relations between the amount of income and percentage of agricultural holdings with an area of 2.00 through 4.99 ha are concerned, no significant correlation has been noted; however, in case of farms with a larger area, such correlations have been found. Significant positive correlations occur between income earned from the operation of an agricultural business and the percentage of individual farms with an area of 5.00 through 9.99 ha ($r_{xy} = 0.531$), 10.00 through 14.99 ha ($r_{xy} = 0.649$), 15.00 through 19.99 ha ($r_{xy} = 0.593$), and 20.00 through 29.99 ha ($r_{xy} = 0.559$) (Table 2).

⁴ Income from an individual holding in agriculture is the difference between the value of agricultural production (including own consumption) and current expenditures incurred therefore (i.e. purchase of products and services, remuneration and mandatory social security contributions for hired labourers) less taxes related to the operation of an individual holding in agriculture plus agricultural subsidies [GUS 2018b].

Table 2. Variation and impact of agricultural land area on income earned from individual holdings in agriculture in Poland in 2017 – a regional NUTS 2 analysis

| Area of agricultural land [ha] | Number of individual farms [thous.] | | | V_s [%] | r_{xy} |
|-----------------------------------|-------------------------------------|-----------|-----------|------------|---------------|
| | Poland | min | max | | |
| | | 1,406.6 | 20.0 (LU) | 212.6 (MZ) | 65.7 |
| | Structure of farms by area [%] | | | V_s [%] | r_{xy} |
| Up to 1.00 | 1.6 | 0.5 (MZ) | 4.6 (SL) | 47.8 | -0.548 |
| 1.01-1.99 | 19.3 | 6.6 (PD) | 36.1 (MA) | 49.2 | -0.622 |
| 2.00-4.99 | 33.1 | 19.0 (WN) | 44.7 (MA) | 30.1 | -0.393 |
| 5.00-9.99 | 22.0 | 12.4 (PK) | 27.9 (MA) | 23.2 | 0.531 |
| 10.00-14.99 | 9.7 | 2.2 (PK) | 17.5 (PD) | 43.9 | 0.649 |
| 15.00-19.99 | 4.7 | 0.8 (MA) | 10.2 (PD) | 54.1 | 0.593 |
| 20.00-29.99 | 4.4 | 0.6 (MA) | 11.0 (WN) | 59.8 | 0.559 |
| 30.00-49.99 | 2.9 | 0.4 (MA) | 9.7 (WN) | 67.6 | 0.341 |
| 50.00 ha and more | 2.3 | 0.4 (MA) | 11.2 (ZP) | 87.7 | -0.092 |
| Average total area of a farm [ha] | 10.58 | 4.7 (MA) | 23.8 (ZP) | 47.0 | 0.188 |

V_s – coefficient of variation. min – minimum value, max – maximum value, r_{xy} – coefficient of correlation between agricultural land area and income earned from individual holdings in agriculture (in bold – significant, for the significance level $p < 0.05$), province name designations have been provided in footnote no. 2

Source: own work based on [GUS 2018b]

As revealed by data presented in Table 3, the type of agricultural activity undertaken has a significant impact on regional differences in income earned from an individual holding in agriculture. Coefficients of variation V_s calculated for the analysed indicators that are characterised by harvest of main crops, animal stock, volume of slaughter animal production, or milk production prove a significant regional variation in plant and animal production undertaken in Poland (Table 3).

The largest harvest of products of plant origin in 2017 has been noted in the Lublin, Greater Poland, Mazovia, Kuyavia-Pomerania, and Lower Silesia Provinces, whereas the poorest harvest – in the Lubusz, Subcarpathia, Podlasie, and Opole Provinces. The calculated correlation coefficient has not shown any significant correlations between the harvest of main crops in individual provinces in Poland and differences in income earned from individual farms (with the exception of meadow hay – $r_{xy} = 0.537$) (Table 3).

The analyses conducted have proven that variation in the level of income earned from the operation of an individual holding in agriculture is affected by cattle stock (cattle in thousands of animals and cattle in animals per 100 hectares of agricultural land) and this has been confirmed by the calculated correlation coefficients ($r_{xy} = 0.713$, $r_{xy} = 0.812$). The most pronounced significant effect on regional variation in the level of income has been shown by milk production, both in millions of litres ($r_{xy} = 0.724$) and in litres per one hectare of agricultural land ($r_{xy} = 0.815$), as well as average annual milk yield from

Table 3. Variation and effect of the type of agricultural activity on income earned from individual holdings in agriculture in Poland in 2017 – a regional NUTS 2 analysis

| Specification | Poland | V_s [%] | min | max | r_{xy} |
|--|----------|-----------|------------|--------------|--------------|
| Harvest of main crops [thous. t] | | | | | |
| Total cereals | 28,214.7 | 58.9 | 765.4 (LB) | 4,036.5 (WP) | 0.348 |
| Total basic cereals, including: | 22,022.6 | 58.3 | 603.2 (PK) | 3,063.2 (LU) | 0.284 |
| – wheat | 9,642.0 | 62.7 | 172.9 (PD) | 1,643.2 (LU) | 0.130 |
| – rye | 2,526.0 | 95.9 | 9.2 (MA) | 538.5 (WP) | 0.226 |
| – barley | 3,397.4 | 69.4 | 66.7 (PD) | 558.7 (WP) | 0.227 |
| – oat | 1,417.3 | 79.2 | 20.3 (OP) | 244.3 (MZ) | 0.406 |
| – triticale | 5,039.8 | 75.1 | 77.0 (PK) | 874.3 (WP) | 0.359 |
| Potatoes | 8,390.5 | 68.3 | 85.4 (LB) | 1,222.4 (WP) | 0.143 |
| Sugar beet | 13,067.9 | 114.3 | 0.2 (PD) | 2,894.9 (KP) | 0.261 |
| Rape and agrimony | 2,045.0 | 70.9 | 20.9 (SK) | 298.0 (DS) | 0.122 |
| Meadow hay | 14,856.3 | 74.3 | 193.2 (OP) | 2,839.9 (MZ) | 0.537 |
| Animal stock in individual farms | | | | | |
| Cattle [thous. of animals] | 5,848.5 | 96.7 | 67.1 (LB) | 1,116.9 (MZ) | 0.713 |
| Cattle per 100 ha of agricultural land [animals] | 43.5 | 58.8 | 11.1 (DS) | 96.8 (PD) | 0.812 |
| Pigs [thous. of animals] | 8,955.2 | 114.9 | 103.2 (ZP) | 2,584.9 (WP) | 0.295 |
| Pigs per 100 ha of agricultural land [animals] | 66.6 | 70.5 | 16.4 (ZP) | 166.1 (WP) | 0.177 |
| Slaughter animal production in terms of meat | | | | | |
| Total slaughter animal production in meat per capita [kg] | 132.7 | 59.7 | 32.3 (DS) | 305.9 (WP) | 0.685 |
| Total production of meat and fat [thous. t], including: | 4,815.1 | 95.9 | 68.0 (PK) | 1,009.1 (WP) | 0.285 |
| – beef | 561.9 | 103.3 | 3.6 (LB) | 117.9 (WP) | 0.457 |
| – veal | 1.4 | 137.6 | 0 | 0.4 (MZ) | 0.538 |
| – pork | 1,893.9 | 100.4 | 17.9 (DS) | 489.8 (WP) | 0.291 |
| – offal | 282.3 | 99.0 | 3.4 (PK) | 62.6 (MZ) | 0.310 |
| Milk production and average annual milk yield from one cow in litres in individual farms | | | | | |
| Milk production [mln l] | 12,433 | 114.3 | 55.3 (LB) | 2,812.1 (MZ) | 0.724 |
| Milk production [l/ha AL] | 925 | 82.1 | 142.0 (ZP) | 2,598.0 (PD) | 0.815 |
| Average annual milk yield from one cow [l] | 5,597 | 25.0 | 2,323 (LB) | 6,409.0 (WP) | 0.599 |

Table 3. Cont.

| Specification | Poland | V_s [%] | min | max | r_{xy} |
|---|--------|-----------|-----------|-----------|---------------|
| Structure of agricultural market output [%] | | | | | |
| Total plant production, including: | 40.8 | 38.0 | 7.8 (PD) | 74.6 (DS) | -0.586 |
| – cereals | 12.0 | 70.9 | 3.5 (PD) | 37.6 (DS) | -0.403 |
| – industrial crops | 4.8 | 88.9 | 0.3 (PD) | 19.9 (OP) | -0.332 |
| – potatoes | 3.3 | 59.4 | 1.2 (PD) | 7.9 (LD) | -0.473 |
| – vegetables | 9.7 | 68.1 | 1.2 (PD) | 26.9 (MA) | -0.397 |
| – fruit | 7.9 | 107.9 | 0.9 (OP) | 25.7 (LU) | -0.040 |
| Total animal production, including: | 59.2 | 30.8 | 25.4 (DS) | 92.2 (PD) | 0.586 |
| – cattle | 7.1 | 51.5 | 1.9 (ZP) | 12.1 (PD) | 0.541 |
| – pigs | 12.7 | 56.4 | 2.4 (DS) | 29.3 (PM) | 0.046 |
| – poultry | 15.6 | 48.6 | 7.1 (LU) | 28.1 (LB) | -0.204 |
| – eggs | 6.0 | 65.4 | 1.7 (LU) | 15.0 (WP) | -0.272 |
| – cow's milk | 16.8 | 79.7 | 5.3 (DS) | 56.9 (PD) | 0.822 |

V_s – coefficient of variation, min – minimum value, max – maximum value, r_{xy} – coefficient of correlation between the type of agricultural activity and income earned from individual holdings in agriculture (in bold – significant, for the significance level of $p < 0.05$), province name designations have been provided in footnote no. 2

Source: own work based on [GUS 2018b]

one cow in litres ($r_{xy} = 0.599$). Significant positive correlations occur between income achieved by individual farms and total slaughter animal production in kgs of meat per capita ($r_{xy} = 0.685$) and production of veal and calf fat in thousands of tonnes ($r_{xy} = 0.538$). As the analyses have shown, no effect of regional variation in pig production on income earned from the operation of individual farms has been established. It transpired that there are no significant correlations with respect to variation in pig stock and slaughter animal production in terms of pork, and income variation at the NUTS 2 level in Poland (Table 3).

The investigation of r_{xy} values calculated for the structure of agricultural market output and for income also led to noteworthy correlation findings confirming previous results. A negative correlative dependence occurs between income and total plant production as well as individual products of plant origin and market output of poultry and eggs, although they are significant only in the case of the structure of total plant production ($r_{xy} = -0.586$). On the other hand, a positive correlative dependence takes place between income earned from individual farms and the structure of total market output of animal products ($r_{xy} = 0.586$), market output of cattle ($r_{xy} = 0.541$) and cow's milk ($r_{xy} = 0.822$).

CONCLUSIONS

Income earned by individual farms from the operation of an agricultural business in Poland is regionally varied. The lowest income is earned from the operation of an agricultural business in the Silesia Province, whereas the highest – in the Podlasie Province. Regional variation of this income is determined by various factors. Area of agricultural land is one of the major determinants of the level of income earned from the operation of an individual farm. It has been revealed that as the percentage of individual farms with an area of up to 2 hectares increases from region to region, the income earned from the operation of an agricultural business becomes significantly lower. On the other hand, a significant positive correlative dependence occurs between income earned and the percentage of individual farms with an area of 10-30 hectares, which means that income increases parallel to an increase in the area of agricultural land. However, in the case of the percentage of individual farms with an area larger than 30 hectares no such effect of this indicator on income earned has been shown.

Regional variation in income earned from individual farms in Poland is affected by the type of agricultural production undertaken – plant or animal production. The study conducted has shown that as the percentage of total market output of plant products increases from region to region, the income earned from the operation of an agricultural business in individual farms becomes significantly lower. It has been discovered that there is a significant negative correlative dependence at the NUTS 2 level between income and the percentage of total market output of plant products, whereas neither shares of individual plant products in the structure of output nor main crop size have any effect on income.

The analyses conducted enabled the formulation of a number of conclusions concerning relations between regional income variation and animal production. And so, it transpired that there is a positive correlative dependence between the level of income and cattle stock as well as milk production. This consequently leads to the conclusion that individual farms achieve significantly higher income in regions where cattle husbandry and milk production are dominant. The same cannot be concluded with regard to the effect of pig stock or volume of pig, poultry, or egg production on the level of income. No significant relationships with income earned from individual farms have been noted in the case of these indicators.

In conclusion, it can be stated that regional variation in income earned from the operation of an individual farm in Poland does not depend solely on economically, politically, or technologically based factors but also on the volume and type of agricultural production undertaken and on the area of agricultural land, which has been confirmed in this paper. Individual farms with an area of 10 to 30 hectares and those involved in animal production, and specifically in cattle and milk production, achieve significantly higher income, whereas small farms with an area of up to 2 hectares and those involved in plant production achieve lower income. Awareness of vast income gaps among farmers' households in Poland and of the significant impact of the type of agricultural activity undertaken on income earned may be the background for further multi-faceted research aimed at discovering reliable and documented causes of economic and social disparities in rural areas.

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WPLYW RODZAJU PROWADZONEJ DZIAŁALNOŚCI ROLNICZEJ NA DOCHODY UZYSKIWANE Z GOSPODARSTW INDYWIDUALNYCH W POLSCE – ANALIZA REGIONALNA

Słowa kluczowe: dochód rolniczy, dochód rozporządzalny, gospodarstwo indywidualne, działalność rolnicza, produkcja rolnicza

ABSTRAKT

Na zróżnicowanie dochodów uzyskiwanych z gospodarstw indywidualnych wpływa wiele czynników, takich jak: jakość gleb, klimat, zaawansowanie techniczne, reformy polityki rolnej, wydajność pracy oraz skala i kierunki produkcji rolniczej. Poziom dochodów uzyskiwanych przez jednostki gospodarcze, w tym również gospodarstwa indywidualne, jest istotną przesłanką wpływającą na ponoszone koszty związane z prowadzeniem działalności rolniczej oraz wydatki w celu zaspokajania potrzeb wszystkich członków gospodarstwa domowego rolnika. Celem artykułu jest określenie wpływu rodzaju prowadzonej działalności rolniczej oraz powierzchni użytków rolnych na dochody uzyskiwane przez gospodarstwa indywidualne w Polsce. Podjęto także próbę oceny regionalnego zróżnicowania gospodarstw indywidualnych pod względem uwzględnionych podczas badania wskaźników finansowych, powierzchniowych oraz produkcyjnych. Wyniki zaprezentowano na poziomie regionalnym NUTS 2 w Polsce dla 2017 roku. W celu zobrazowania wyników przeprowadzonego badania posłużono się metodą statystyczną, opisową, porównawczą i graficzną. Obliczono współczynniki zmienności V_s oraz korelacji r_{xy} . Badania wykazały, że w Polsce występuje istotne regionalne zróżnicowanie pod względem uzyskiwanych dochodów przez gospodarstwa indywidualne. Regionalne zróżnicowanie występuje również w zakresie skali i rodzaju prowadzonej produkcji rolniczej. Ponadto wykazano, że poziom dochodów uzyskiwanych z gospodarstw indywidualnych jest uzależniony od rodzaju prowadzonej działalności rolniczej oraz powierzchni użytków rolnych.

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