SOCIO-ECONOMIC FEATURES OF RURAL HOUSEHOLDS IN CENTRAL POMERANIA AND THEIR PROFITABILITY – PILOT STUDY RESULTS

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ABSTRACT

The aim of the research is to identify the socio-economic features of rural households affecting the probability of obtaining a higher average monthly net income per person based on 100 entities in Central Pomerania, on the basis of pilot studies (direct questionnaire technique) using a logistic regression model. The dependent variable was the probability that the surveyed rural household would receive an average monthly net income per person above the median level for the studied sample. The selection of independent variables was made on the basis of literature studies. The results of the analyses confirmed that the following characteristics had a statistically significant impact on the tested probability: age, education of the head of the household and professional activity of household members. These parameters increase the probability of obtaining a higher average monthly net income per person in rural households of Central Pomerania.

Key words: income, rural household, logistic regression, Central Pomerania, Poland
JEL codes: D1, D10, D14, D31

INTRODUCTION

The amount of income in rural and urban households is varied. It depends on external (market) factors independent of these entities, as well as from the development phase cycle these households are in and their characteristics. A rural household is a farm run and maintained by people living in rural areas. In Poland, the rural residents constitute about 40% [GUS 2019a] of the population. The average disposable income per person in households in Poland in 2018 amounted to 1,693.46 PLN [GUS 2019b]. Among rural households, we distinguish those whose main source of income is farm income. The results of research presented in the literature prove that

these entities are characterized by the lowest (next to pensioners) level of average monthly income per person [Gasińska 2016, Grzelak 2016, Urban 2016]. In 2017, the average disposable income per person in households from rural areas amounted to 1,359.22 PLN and was 22.4% lower than the average value set for urban households [GUS 2018]. Thus, a question arises about the socio-economic features of rural households that favour a higher income.

The aim of the research is to identify the socio-economic characteristics of rural households affecting the probability of obtaining a higher average monthly net income per person on the example of entities in Central Pomerania, based on completed pilot studies.

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THEORETICAL FOUNDATIONS

The income situation of households varies depending on where they are situated. Income increases proportionally to the increase in size of the place of residence. This is due to the specificity of the labour market, under which the highest-paid jobs are in the largest cities [Kozera et al. 2014]. Income from hired work and self-employment is higher in the urban labor market as compared to incomes that can be obtained in rural areas [Chmielewska 2013, Łącka 2017]. The possibilities of increasing the profitability of agricultural production are limited, so rural households can obtain additional resources for development primarily through the employment of their members outside agriculture. However, the rural population, due to worse education than city dwellers and less developed infrastructure of rural areas, encounters considerable difficulties in obtaining non-agricultural jobs. In addition, this population is characterized by a significant diversification of professional status, resulting primarily from relationships between rural residents and individual farming [Kołodziejczak 2008].

Production activity in agriculture is not sufficient to provide a decent income to all inhabitants of rural areas, and especially to owners of small farms. In rural areas, there is a surplus of labour force in agriculture and a lack of jobs for the landless population. In recent years, thanks to the increase or change in qualifications, workplace change, economic migration to other parts of the country or abroad, or seasonal earnings, there is a noticeable process of growing employment of rural residents outside their own farm [Leśniak-Moczuk 2008]. There is a shift away from running family farms, moving from multi-generational to two-generation families and changing the forms and motivations for economic activity of the population.

The modernization of rural areas has influenced the lifestyle of their inhabitants. There has been a decline in the importance of agriculture in the rural economy [Kozera et al. 2014]. Łącka [2017] proved that the increase in disposable income per person in rural households made it possible to increase expenditures for satisfying higher-order needs. Thus, expenses for leisure and cultural goods and services, and the use of hotels and restaurants, increased as well. Expenditure

for these purposes was lower than in the case of urban households, but their increase indicates a boost in the well-being of inhabitants of rural areas and a decrease in the distance that separated them from residents of urban households in this respect. Differences in incomes between rural and urban households also result from a larger number of people making up the households in the country than the city. This affects the level of income per person. Income inequalities are conditioned by many factors. Among them, we distinguish internal (individual) and external. The former are associated with the characteristics of the individual, their gender, age, education, professional affiliation, health status. External factors include, among other things, place of residence, membership in a socio-economic group and state policy in the field of levelling income inequalities with budget transfers [Łącka 2017].

RESEARCH MATERIALS AND METHODOLOGY

The study covered rural households in the Central Pomerania area. The source of empirical data was the results of a pilot study conducted in May 2019 on a group of 120 rural households (direct questionnaire technique). One hundred correctly filled questionnaires were obtained (83.33% response rate). Respondents were asked to provide information for 2018. In selected questions, the time range of the study covered the years 2004–2018. The research was carried out as part of the project entitled *Financial aspects of the functioning of Central Pomerania's households*. Empirical verification of factors affecting the income of surveyed rural households in the region of Central Pomerania was carried out using a logistic regression model. As the dependent variable, the probability of the average monthly net income per person exceeding the level of 1,500 PLN was assumed. This is the upper range boundary where the median income determined for the surveyed group of rural households is situated, which in 2018 amounted to 1,416.83 PLN. The dependent variable takes two possible values: 0 – lack of a given feature (55 indications), 1 – possession of a given feature (45 indications).

The selection of independent variables to build a logistic regression model was made on the basis of literature studies. Six independent variables related to

Table 1. Hypothetical influence of independent variables adopted in the model of socio-economic factors determining the probability of obtaining higher than average monthly net income per person in the examined rural households of Central Pomerania

	Variables included in the analysis	Predicted variable impact
Y	A dummy variable, defining whether the household in 2018 was characterized by an average net income per capita exceeding 1,500 PLN. If yes, the variable takes the value = 1, otherwise it takes the value = 0	
x_1	A dummy variable that determines whether a household receives income from its agricultural holding. If yes, the variable takes the value = 1, otherwise it takes the value = 0	–
x_2	A dummy variable that determines whether a household has more than one type of income source. If yes, the variable takes the value = 1, otherwise it takes the value = 0	+
x_3	Variable defining the age of the head of the household (years)	+
x_4	Variable defining the education of the head of the household	+
x_5	Variable defining the share of household members who perform paid work in the total number of household members (%)	+
x_6	Variable defining the share of dependent children in the total number of household members (%)	–

1 – at most elementary, 2 – elementary and finished vocational course, 3 – basic vocational, 4 – incomplete secondary, 5 – secondary, 6 – post-secondary, 7 – higher

Source: Authors' own study.

household socio-economic features were adopted to assess the probability under study. Table 1 presents the characteristics and hypothetical impact of the distinguished factors on the probability of obtaining a higher than average monthly net income per person in the examined rural households of Central Pomerania.

Among the independent variables, a variable was adopted determining whether the household receives income from its agricultural holding (x_1). The results of research presented in the literature prove that households of farmers in Poland are characterized by the lowest level of average monthly income per person. In addition, agricultural income is characterized by seasonality and variability in time, so it is possible to assume uncertainty as to its amount, which is influenced by many factors[1]. Therefore, the negative impact of the analysed variable on the probability was assumed. The study also included a variable determining whether the household has more than one type of income source (x_2). This may include, among other things: income earned from hired work, income from a farm, income

from activities (other than agricultural), income from pensions or income from property, and any other source of income alternative to the basic source of farm household. The positive influence of the discussed factor on the probability of obtaining a higher income per person in the household was assumed.

The next adopted variable is the age of the household head (x_3). Based on results of research presented in the literature [Wałęga 2012], a positive impact of this factor on the dependent variable was assumed. Variables also include the education of the household head (x_4). It was assumed that a higher level of education has a positive impact on the possibility of obtaining a higher level of net income per person by surveyed rural households [Tuyen 2015]. Subsequently, the variable characterizing the professional activity of household members, expressed as the share of household members who perform paid work in the total number of household members (x_5) was taken into account. Due to the construction of this variable, its higher value indicates higher professional activity of

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[1] More on the factors determining the amount of income from an agricultural holding [Sadeghi et al. 2001, Safa 2005, Kalabisová and Křístková 2007, Beckman and Schimmelpfennig 2015, Boháčiková et al. 2017, Balarabe et al. 2018].

household members, which has a positive impact on the total income of the household in a given period and on a higher level of income per person. Among the variables referring to the size and composition of the household, the share of dependent children in the total number of household members (x_6) was also taken into account. The higher the number of dependent children, the lower the income per person in the household. Therefore, a negative influence of this variable on the examined phenomenon was assumed.

In order to find the best combination of factors significantly affecting the probability of obtaining a higher average monthly net income per person in the examined rural households of Central Pomerania, the method of backwards elimination was applied. Evaluation of the degree of fit of the logistic regression model to the empirical data was carried out using the statistics of Cox–Snell R^2, Nagelkerke's R^2 and count R^2. Verification of the significance of individual model parameters was made using z^2 Wald test. To assess the goodness of fit of the obtained model, the area under curve value (AUC) was used. The quality of the logistic regression model was also evaluated using the receiver operating characteristic curves (ROC).

CHARACTERISTICS OF THE STUDIED POPULATION

For the majority of rural households surveyed (55%), the basic source of income was income earned from paid work (Table 2). In turn, 19% of the analysed entities indicated self-conducted non-agricultural business activity as the most important source of income in the household. The surplus obtained from the farm was the main source of subsistence for 14% of the surveyed units. The obtained results also show that 28% of entities included in the study were characterized in 2018 by an average monthly net income per person in a household not exceeding 1,000 PLN (of which 3% of units achieved income lower than 500 PLN per person). For 30% of surveyed rural households, the amount in the income category in question was higher than 2,000 PLN.

Descriptive statistics of variables accepted into the model, on the basis of which further characteristics of the analysed entities were made, are presented in Table 3.

Running a farm and earning income from it was declared by 23% of households included in the survey. It was also found that 58% of entities obtained income

Table 2. Structure of surveyed rural households of Central Pomerania according to the obtained income

Specification	Share of households (%)
The main source of income	
paid work	55
conducting non-agricultural business activity	19
income from the farm	14
retirement pension	11
pension	1
social benefits or other sources	0
The average monthly net income per person in a household	
below 500 PLN	3
501–1 000 PLN	25
1 001–1 500 PLN	27
1 501–2 000 PLN	15
over 2 000 PLN	30

Source: Authors' own study.

Table 3. Descriptive statistics of independent variables adopted for the model

Continuous variable	Average	Median	Minimum	Maximum	Standard deviation
x_3	47.58	47.00	22.00	84.00	13.61
x_5	52.60	50.00	0.00	100.00	27.32
x_6	31.05	33.33	0.00	75.00	22.59

Discrete variable	Average	Number of farms in which the head of the household had the following education						
		at most elementary	elementary and finished vocational course	basic vocational	incomplete secondary	secondary	post-secondary	higher
x_4	5.33	8	2	35	4	25	7	19

Dichotomous variable	Average	Occurrences 1	Occurrences 2
x_1	0.23	23	77
x_2	0.58	58	42

Source: Authors' own study.

from more than one type of source. The average age of the household head was 47.58 years. The largest group among the entities in question were those whose household head had basic vocational education (35%). 19% of respondents declared having a higher education by the head of the household. The average value of the share of employed persons in the total number of household members was 52.60%, while the average share of children dependent on households was 31.05%.

RESULTS AND DISCUSSION

Based on the adopted research assumptions, all of the independent variables were considered in the initial model of the probability of obtaining a higher average monthly net income per person in the surveyed rural households of Central Pomerania. Table 4 presents the results of these estimations.

Using the backwards elimination method, based on the Akaike information criterion (*AIC*), predictors were eliminated from the initial model one by one and the evaluation of change in the values of the criteria adopted for the assessment of the model quality was made. In the end, three independent variables were

eliminated: obtaining income from an agricultural holding (x_1), having more than one type of income (x_2) and the share of dependent children (x_6). The impact of the eliminated variables on the tested probability was not statistically significant. In each stage, an improvement in the accepted measure of fit was observed (reduction of the *AIC* value). Three predictors remained in the final model (Table 5).

The estimated final model of the probability of obtaining higher average net income per person in surveyed agricultural households in Central Pomerania has the following form:

$$\text{prob}(Y = 1) = \Lambda(0.047x_3 + 0.287x_4 + 0.037x_5 - 5.959)$$

where $\Lambda(x) = \dfrac{e^x}{1 + e^x}$ – distribution function of logistic distribution.

The significance of the model was assessed based on the likelihood ratio test. The model is significant at the 1% significance level (the LR-statistics value is 20.78, the critical value of this statistic for three degrees of freedom is 11.34). 70% of cases were correctly classified on the basis of the model (count

Table 4. Results of the estimation of model parameters – initial model

Specification	Variable parameter	Standard error	z^2 Wald test	Significance level	Odds ratio
x_1 (income from agricultural household)	−0.530	0.564	0.884	0.347	0.588
x_2 (more than one source of income)	0.018	0.505	0.001	0.971	1.019
x_3 (age of the household head)	**0.055**	**0.024**	**5.145**	**0.023**	**1.056**
x_4 (education of the household head)	**0.302**	**0.151**	**4.022**	**0.045**	**1.353**
x_5 (share of household members who perform paid work in the total number of household members)	**0.041**	**0.012**	**11.015**	**0.001**	**1.041**
x_6 (share of dependent children in the total number of household members)	0.007	0.012	0.324	0.569	1.007
Intercept	−6.696	2.239	8.945	0.003	0.001

$AIC = 129.65$; Cox–Snell $R^2 = 0.1973$; Nagelker's $R^2 = 0.2639$; count $R^2 = 0.72$; $AUC = 0.743$; $LR = 21.98$ ($df = 6$, $p = 0.001$).
Variables statistically significant at the significance level of 5% are marked in bold.

Source: Authors' own study.

Table 5. Results of the estimation of model parameters – final model

| Specification	Variable parameter	Standard error	z^2 Wald test	Significance level	Odds ratio
x_3 (age of the household head)	0.047	0.022	4.804	0.028	1.048
x_4 (education of the household head)	0.287	0.146	3.853	0.050	1.332
x_5 (share of household members who perform paid work in the total number of household members)	0.037	0.010	12.519	< 0.001	1.038
Intercept	−5.959	1.840	10.482	0.001	0.003

$AIC = 124.85$; Cox–Snell $R^2 = 0.1876$; Nagelkerke's $R^2 = 0.2510$; count $R^2 = 0.70$; $AUC = 0.738$; $LR = 20.78$ ($df = 3$, $p = 0.0001$).

Source: Authors' own study.

$R^2 = 0.70$). The quality assessment of the constructed model was based on the Cox–Snell R^2 coefficient (0.2507), Nagelkerke's R^2 (0.2813) and using the ROC curve, which is shown in the figure (p. 107).

The area under ROC curve is 0.738. Because a field larger than 0.5 was obtained, this indicates a good quality of the constructed model. The study showed that three independent variables had a statistically significant positive influence on the tested probability: age (x_3) and education (x_4) of the head of the household, as well as a variable related to the professional activity of household members (x_5). The results of estimation of the final model parameters showed that in the surveyed population, with increasing age of the household head (x_3, *ceteris paribus*), the chance of reaching an average monthly net income per person exceeding the level of 1,500 PLN increases by 4.8%. It was also found that along with the level of education of the household head (x_4, *ceteris paribus*), the probability of obtaining a higher level of the income category in question increases as well. Each higher education level of the household head (transition to the next educational level) contributes to the increase of the chance (by 33.2%) to obtain an average monthly net income
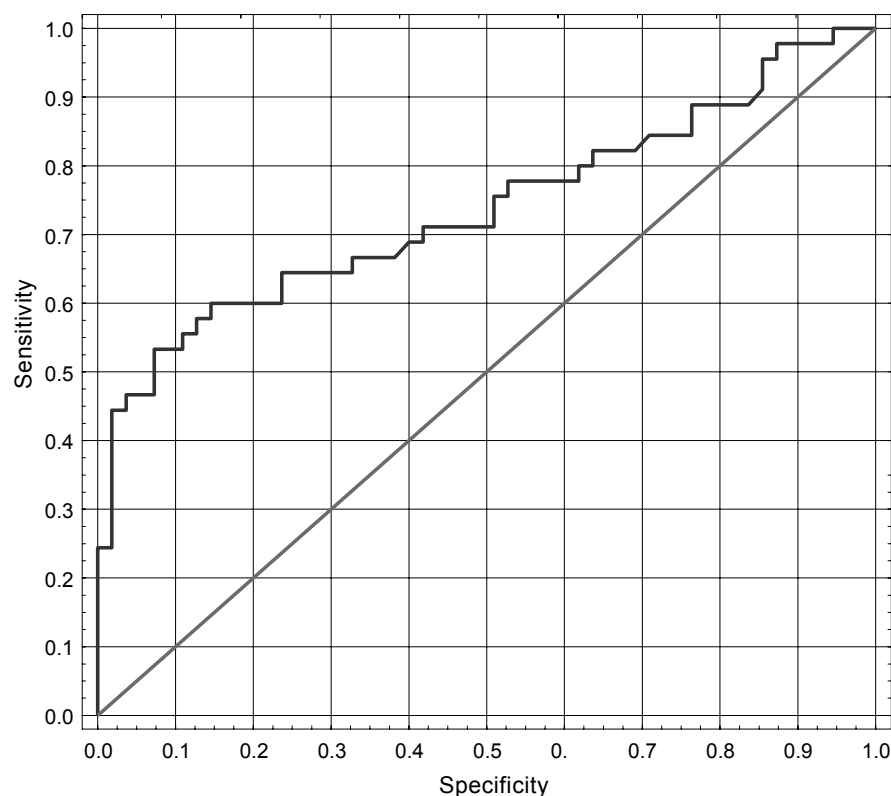
Fig.   Receiver operating characteristic curve for the model of probability of obtaining average net monthly income higher than 1,500 PLN per capita in surveyed agricultural households in Central Pomerania

Source: Authors' own study.

per person exceeding 1,500 PLN. The parameters of the constructed model also indicate that a theoretical increase by a unit of the share of household members who perform paid work in the total number of household members (x_5, *ceteris paribus*) will increase the chance of obtaining income exceeding the set level by 3.8%. The direction of influence of these variables on the probability tested is consistent with the assumptions adopted in the model (see Table 1).

SUMMARY

Rural households are characterized by a lower average net income per person than households from urban areas. The aim of the research was to determine the socio-economic features of households in rural areas conducive to increasing the probability of obtaining a higher income per capita from the value of the me-

dian for the selected group of entities from Central Pomerania area – on the basis of pilot studies (direct questionnaire technique) using a logistic regression model. The analysis included six diagnostic variables characterizing the socio-economic features of rural households from the Central Pomerania area in 2018 (the selection of independent variables was made on the basis of literature studies).

In the course of research, it was established that among the identified features which could influence the level of income, statistical significance was demonstrated by three variables: age, education of the head of the household and professional activity of members of the household. These parameters increase the probability of obtaining a higher average monthly net income per person in the surveyed rural households of Central Pomerania. The first two features refer to the knowledge, skills and competences acquired as

a result of formal education and professional experience. The impact of estimated parameters on variables indicates that the market values these features in the form of higher remuneration. The last of these parameters determines the number of professionally active people in a rural household. It affects the increase of income, and hence its higher value per one person. The obtained results confirm the need to strive for a rural development policy which would be aimed at employment support of as many people living in the Polish countryside as possible.

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CECHY SPOŁECZNO-EKONOMICZNE WIEJSKICH GOSPODARSTW DOMOWYCH POMORZA ŚRODKOWEGO A ICH DOCHODOWOŚĆ – WYNIKI BADANIA PILOTAŻOWEGO

STRESZCZENIE

Celem badań jest identyfikacja cech społeczno-ekonomicznych wiejskich gospodarstw domowych, wpływających na prawdopodobieństwo uzyskania wyższego przeciętnego miesięcznego dochodu netto per capita na przykładzie 100 podmiotów na terenie Pomorza Środkowego, na podstawie wyników przeprowadzonego badania pilotażowe (technika ankiety bezpośredniej) z zastosowaniem modelu regresji logistycznej. Za zmienną objaśnianą przyjęto prawdopodobieństwo osiągnięcia przez badane wiejskie gospodarstwo domowe przeciętnego miesięcznego dochodu netto per capita przekraczającego poziom mediany dla badanej próby. Doboru zmiennych niezależnych (objaśniających) dokonano na podstawie przeprowadzonych studiów literaturowych. Wyniki analiz potwierdziły, iż statystycznie istotny wpływ na badane prawdopodobieństwo miały następujące cechy: wiek, wykształcenie głowy gospodarstwa domowego oraz aktywność zawodowa członków gospodarstwa domowego. Parametry te zwiększają prawdopodobieństwo uzyskania wyższego przeciętnego miesięcznego dochodu netto per capita w wiejskich gospodarstwach domowych Pomorza Środkowego.

Słowa kluczowe: dochód, wiejskie gospodarstwo domowe, regresja logistyczna, Pomorze Środkowe, Polska