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THE IMPORTANCE OF NON-AGRICULTURAL ECONOMIC ACTIVITY OF FARMERS IN THE MODERNIZATION PROCESS OF FARMS

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Abstract. The aim of this article is to identify and assess the degree and conditionings of the phenomenon of subsidizing farms from the income obtained by farmers from their non-agricultural economic activity. The empirical material of the article are the results of the survey conducted in 2011–2012, i.e. the questionnaire interview with 210 farmers, owners of individual farms, additionally engaged in non-agricultural economic activity, from the area of south-east Poland, i.e. from three voivodships: Świętokrzyskie, Małopolskie and Podkarpackie. The analysis of the research results shows that the processes associated with running a farm, which are important from the farmers' point of view, are supported financially from the income obtained by them from non-agricultural economic activity, as evidenced by statistically significant and positive parameters of logistic regression of the models presented in the article, in almost all the analyzed cases.

Key words: non-agricultural economic activity of farmers, subsidizing a farm, logistic regression

INTRODUCTION

Today, agriculture has ceased to play the major role in the economy and social sphere of rural areas, although there are still strong links between agriculture and the rural economy. More and more new forms of non-agricultural economic activity emerge in rural areas next to agricultural activities. As a result, the level and dynamics of development

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of these areas are no longer determined by agriculture mainly, but they are increasingly determined by non-agricultural economic activity [Zegar 2000, Woś 2002, Hunek 2006, Rizov 2006, Czudec 2009, *Agriculture for Development*… 2010].

In the relations between agriculture and rural areas and non-agricultural sectors of the rural economy the following scenarios are theoretically possible [Czudec 2009]:

- agriculture as an important segment of rural economy, occupying a permanent place in the structure of agribusiness, but at the same time generating a negative impact on rural areas (degradation of natural environment, disappearance of biodiversity, depopulation of villages, etc.);
- agriculture as an important segment of rural economy, providing both the villagers and the whole society with public goods by implementing environmental, social and cultural functions;
- agriculture supplying rural economy with productive factors, i.e.: resources of labour, land and capital, used in non-agricultural economic activity and thus contributing to making the development of rural areas more dynamic;
- agriculture functioning as a result of implementation by the village of new, non-agricultural functions, so that the villagers not engaged in it and people coming to the village as tourists create a demand for goods and services supplied by them;
- agriculture, due to taking over by the rural areas of new, non-agricultural functions, becomes marginalized and ceases playing an important role in the rural environment.

It should be added that none of the above scenarios ultimately excludes the possibility of the development of multifunctional agriculture and rural areas, and implementation of the last four increases the need for taking on new functions by agriculture [Czudec 2009].

From the point of view of multifunctionality of agriculture and rural areas, non-agricultural economic activity of farmers and agricultural population is particularly important. In connection with the development of this activity on farms a new non-agricultural function appears – it means the subordination of the agricultural family and household, and often also the farm, to a non-agricultural company. At the same time, the relations between the farm and non-agricultural economic activity can be of two-fold character, i.e. complementary or competitive.

If non-agricultural activity is of complementary character to agriculture (e.g. agritourism, food processing, agricultural services, etc.), then there is a chance for a harmonious development of both spheres. Pro-agricultural nature of a non-agricultural enterprise stimulates and enhances the agricultural function of the farm. It also contributes to good conditions for development of new functions of agriculture. This can curb the process of deagrarization of rural economy, manifesting itself, i.a., in disappearance of productive functions in a large part of farms. Moreover, due to this it becomes possible for the village to maintain its valuable environmental, social and cultural qualities. It is also possible to effectively solve the problem of low incomes of agricultural people and enrich the traditional values of the rural environment in this way.

The course of events and the complex of consequences is quite different if the new non-agricultural enterprise is not connected with agriculture and is created "next to" the farm, performing the competitive function towards it. This competition focuses mainly on the labour factor, bringing in consequence the extensification of agricultural production,

the reduction or elimination of animal husbandry, followed by fallowing the land and the change in the function of farm buildings which are used for non-agricultural activity. As a result, it usually means permanent abandonment of the hitherto existing model of running the farm. If this leads to transfer of land to farms with development prospects (i.e. able to regenerate their production potential), then this is a desirable process from the point of view of the need for structural changes in agriculture. However, in the opposite situation, when land is fallowed, it reinforces the process of deagrarization of villages, and results in exclusion of high quality lands from agricultural production, which is a definitely negative effect of these changes.

Thus, starting up and running non-agricultural economic activity by farmers and agricultural population and getting in this way of income from non-agricultural sources may affect the farm in two ways. Namely, it can stimulate agricultural production, e.g. through the support with additional financial means or, on the contrary, it may weaken the interest of farmers in its intensification. This fact is related to the free flow of capital between the farm and the additional non-agricultural economic activity. This may also lead to a conflict of functions performed on the farm. Thus, non-agricultural enterprises of farmers and agricultural population, depending on their nature, may become both an opportunity for the development of the farm (agriculture), as well as a threat to this process [Tomczak 1994, Sikorska-Wolak 1995, Orłowska 1998, Makarski 1999, Czudec 2009].

AIM, EMPIRICAL MATERIAL AND RESEARCH METHODS

The aim of this article is to identify and assess the degree and conditioning of the phenomenon of subsidizing the farm from the income obtained by farmers from their non-agricultural economic activity.

The empirical material of the article are the results of surveys conducted in 2011–2012 (i.e. the questionnaire interview with 210 farmers, owners of individual farms additionally engaged in non-agricultural economic activity). Surveys were of partial-representative research character (purposive-random sampling). The unit of the sample were individual farms with non-agricultural economic activity, from the area of south-east Poland, i.e. from three voivodships: Świętokrzyskie, Małopolskie and Podkarpackie[1]. The area for research was selected based on the division of Poland into agricultural regions by W. Michna [1998, 1999]. It includes megaregion I, subregion b, i.e. the region of the overpopulated village and fragmented agricultural structure of farming. Such a spatial scope of the research was of purposive character as it was hypothetically assumed that multifunctional development of village and agriculture is necessary and desirable in the area of agriculture with fragmented structure of farms with a particular role of farmers' non-agricultural economic activity.

Farm management involves many different aspects, and each of them is associated with incurring some costs. The conducted research confirmed the occurrence of the

[1] The survey was conducted within the realization of the habilitation research project N N114 191240, financed by Narodowe Centrum Nauki w Krakowie (National Centre of Science in Krakow), under supervision of dr Dariusz Zając.

phenomenon of subsidizing the farm from the income obtained by farmers in non-agricultural activity, and the expenditures are related to: purchase of land, charges for hired labour, purchase of fixed and current means of production, enlarging population of livestock animals, fees for production services provided by external entities, payment of taxes and repayments of loans taken out for the needs of the farm. In this connection the above expenditures may or may not have occurred, the variables describing them are of dichotomous character. Against the background of these variables there were examined, in turn, age and education of the farmer, the number of people in the farming family, resources and quality of land used for agriculture, the nature of agricultural production and the rate of its marketability and the share of the farm and non-agricultural economic activity in the structure of the agricultural family's livelihoods. For this purpose, logistic regression was used [Mach 2010] which allowed determining the degree of probability of financial support of the farm from the income obtained by farmers from non-agricultural activity, taking into account the circumstances of this phenomenon.

The equation of logistic regression model can be expressed as [Stanisz 2006]:

$$P(Y = 1 \mid x_1, x_2, ..., x_k) = \frac{e^{a_0 + \sum_{i=1}^{k} a_i x_i}}{1 + e^{a_0 + \sum_{i=1}^{k} a_i x_i}}$$

where: x_i – independent variables;
a_i – regression coefficients ($i = 0, 1, \ldots, k$).

Structural parameters of the model were estimated by quasi-Newton method for maximum likelihood estimation. The regression coefficients in this model allow determining the odds ratio with respect to the variable at which it is in the equation, i.e. the so-called exposed variable, assuming that the other independent variables will not change, acting as control variables.

The so-called odds ratio for the unit change refers to the situation where the value of the independent variable x_i will increase by one unit. It expresses the odds ratio of occurrence of the event described by the dependent variable before and after the increase in the size of the independent variable by the unit, and it is described by the expression e^{a_i}.

To the model there were accepted independent variables where the parameters a_i proved to be statistically significant. The null hypothesis assuming that these parameters are equal to zero, was verified with the use of the statistics of Student's t-test. It was rejected when $t \geq t_{\alpha,\ n-k}$, where $n - k$ is the number of degrees of freedom of changes, n – the number of observations and k – the number of parameters being estimated in the equation.

In order to evaluate the matching of the model there were used the so-called logarithm of likelihood and McFadden's ratio. The logarithm of likelihood is calculated as the –2log difference from the likelihood function of the obtained model and the –2log from the likelihood function of the model containing only the intercept. The statistics designated

in that way, with distribution close to χ^2, is used to verify the null hypothesis that all the parameters of the model in the population are equal to zero. In turn, the so-called McFadden's pseudo R^2 coefficient is determined by the formula:

$$R^2_{McFadden} = 1 - \frac{\ln L_p}{\ln L_0}$$

where L_p and L_0 are respectively the value of the likelihood function of the obtained model and the model containing only the intercept. The value of this ratio, indicating how more suited to the empirical data is the model adopted for the analysis in relation to the model, in which the explanatory variable is the constant only, is in the range 0–1, and its size decreases with the increase in number of observations.

RESULTS

The analysis of research results will start by the assessment of the phenomenon of subsidizing the purchase of land from the income obtained by farmers from non-agricultural activity. It should be assumed that land, as the primary factor of production in agriculture, is of particular importance. It turns out that the use of funds obtained from non-agricultural activity for increasing the resources of land occurred in two cases. It grew in the statistically proven manner with the improvement of the quality of land on the farm expressed by the soil valuation indicator and with the increase in the share of the income from the farm in the structure of livelihoods of the agricultural family. With the improvement of the quality of land by one point of the soil valuation indicator there increased by an average of more than five times the chance for financing the purchase of land from the income obtained from non-agricultural activity, and this chance increased 1.05 times with the increase of 1% of the share of the income from the farm in the structure of the livelihoods of the family (Table 1). Thus, in subsidizing of this expense to the farm from non-agricultural sources more interested are the farmers owning better quality land used agriculturally and obtaining higher incomes from agriculture. It should be added that the size of the test probability p for the statistics χ^2 was equal to 0.0001, and McFadden's ratio took the value of 0.2 proving a good matching of discussed model.

Table 1. Characteristics of the conditions of subsidizing the purchase of land from the income obtained by farmers from non-agricultural activity

Specification	Soil valuation indicator	Share of income from farm in structure of livelihood of family
Regression coefficients	1.68[a]	0.05[a]
Test probability p for statistics of test t	0.02	0.03
Odds ratio for unit change	5.34	1.05

[a] – significance at probability $p = 0.05$.

Source: The authors' elaboration on the basis of the survey on farms (questionnaire interview with farmers).

In turn, subsidizing hired labour charge from the income obtained by farmers from non-agricultural activity proved to be positively associated with the area of the farm and with the share of income from this activity in the structure of livelihoods of the family. In the first case, the increase of the variable by 1 ha of farmland caused a 1.13-fold increase, and in the second case the increase of the variable by 1% caused a 1.12-fold increase in the chance for subsidizing hired labour charge from the income obtained from non-agricultural activity. In contrast, this relation shaped differently as to the age of the farmer as with the increase in age by one year, the chance for subsidizing hired labour charge from the income obtained from non-agricultural activity decreased to 0.78 of its size for the farmer younger by one year (Table 2). Thus, in subsidizing this expense to the farm from non-agricultural sources more interested are younger farmers, from farms larger in area and obtaining a higher income from non-agricultural economic activity. It should be added that the size of the test probability p for the statistics χ^2 was equal to 0.00001, and McFadden's ratio took the value of 0.47, proving a good matching of this model.

Table 2. Characteristics of the conditions of subsidizing hired labour charge from the income obtained by farmers from non-agricultural activity

Specification	Farm's area	Share of incomes from non-agricultural activity in the structure of family's livelihoods	Farmer's are
Regression coefficient	0.12[a]	0.11[b]	–0.25[a]
Test probability p for statistics of test t	0.01	0.009	0.012
Odds ratio for unit change	1.13	1.12	0.78

[a] – significance at probability $p = 0.05$, [b] – significance at probability $p = 0.01$.

Source: The authors' elaboration on the basis of the survey on farms (questionnaire interview with farmers).

The data contained in Table 3 show that to the improvement of land quality by one point of soil valuation indicator there corresponds, on average, more than four times greater chance for subsidizing repayment of loans, taken for the needs of farm, from the income obtained by farmers from non-agricultural activity, while it increases 1.05 times with the increase by one percent of the share of income from the farm in the structure of livelihoods of the agricultural family. Therefore, it should be concluded that in subsidizing this expense to the farm from non-agricultural sources more interested are the farmers owning better quality land used agriculturally and obtaining higher incomes from agriculture. For this model the size of test probability p for the test statistics χ^2 was equal to 0.0002, and McFadden's ratio took the size of 0.18, therefore it meets the criteria for a good matching with the empirical data.

In the case of subsidizing the charge for production services rendered by third parties on the farm from the income obtained by farmers from non-agricultural activity, it turns out that it is statistically significantly associated only with the share of the income from the farm in the structure of livelihoods of the family. To the increase in the share

Table 3. Characteristics of conditionings of subsidizing repayment of loans, taken for the needs of the farm, from the income obtained by farmers from non-agricultural economic activity

Specification	Soil valuation indicator	Share of incomes from farm in the structure of family's livelihoods
Regression coefficient	1.48[a]	0.05[a]
Test probability p for statistics of test t	0.03	0.03
Odds ratio for unit change	4.39	1.05

[a] – significance at probability $p = 0.05$.

Source: The authors' elaboration on the basis of the survey on farms (questionnaire interview with farmers).

of this income by 1% there corresponds 0.96 of the chance for subsidizing this expenditure. From this fact it appears that farms of a higher share of income from the farm in the structure of livelihoods of the family are more self-sufficient in this regard. Thus, in subsidizing this expense to the farm from non-agricultural sources more interested are the farmers obtaining lower incomes from agriculture and higher incomes from non-agricultural activity. Logistic regression coefficient of the model describing this relation took the value –0.04, the test probability p of the test statistics t 0.04, of the statistics χ^2 0.0002, while McFadden's ratio was equal to 0.1.

Among the expenses on farm management, included in the research, there are still two which turned out to be statistically significantly associated with subsidizing from the income obtained by farmers from non-agricultural activity. They are: the purchase of fixed assets and payment of taxes. In both cases, subsidizing them is in a positive manner dependent on the share of the income from non-agricultural activity in the structure of livelihoods of the family (Table 4).

For the increase by 1% in the share of the income from non-agricultural activity in the structure of livelihoods of the family, the chance for subsidizing the purchase of fixed assets increases 1.035 times, and for subsidizing payment of taxes 1.05 times. Odds ratios do not actually take large values in these cases, but it should be noted that they refer to one-percent increases in the share of the income from non-agricultural activity, and further more they indicate that with their increasing sizes the farmers subsidize from this source both the purchase of fixed assets as well as payment of taxes related to the farm (Table 4). Therefore, it should be concluded that in subsidizing these expenses more interested are the farmers obtaining a higher income from their non-agricultural economic activity. For the model in which the dependent variable was the purchase of fixed assets, the size of the test probability p for the statistics χ^2 was equal to 0.01, and McFadden's ratio took the size of 0.05. In the model with the dependent variable describing payment of taxes, the size of the test probability p for the statistics $\chi^2$was also equal to 0.01, and McFadden's ratio took the size of 0.05. Thus, in both cases the model meets the criteria for a good matching with the empirical data, although the relations between the variables analyzed were not as clear as before.

Table 4. Characteristics of conditionings of subsidizing the purchase of fixed assets and payment of taxes related to the farm from the income obtained by farmers from non-agricultural economic activities according to their share in the structure of livelihoods of the family

Specification	Purchase of fixed assets	Payment of taxes
Regression coefficients	0.03[a]	0.02[a]
Test probability p for statistics of test t	0.004	0.03
Odds ratio for unit change	1.035	1.05
Test probability p for statistics of test χ^2	0.01	0.01
McFadden's ratio R^2	0.08	0.05

[a] – significance at probability $p = 0.01$.

Source: The authors' elaboration on the basis of the survey on farms (questionnaire interview with farmers).

Other variables included in the research, i.e. expenses on purchase of current means of production and associated with increase in livestock population, showed no statistically significant relations with subsidizing them from the income obtained by farmers from non-agricultural activity. It should also be noted that this subsidizing did not appear related, in any of the examined cases, to the farmer's education, the number of persons in the agricultural family, or to the type of agricultural production and its marketability.

CONCLUSIONS

The analysis of research results shows that the processes, which are important from the point of view of farmers, associated with running a farm, are supported financially from the income obtained by them from non-agricultural economic activity. This is evidenced by statistically significant and positive parameters of logistic regression of the presented models in almost all analyzed cases. The article shows, among other things, the presence of only positive and statistically significant relations between the share of income from non-agricultural activity of farmers in the structure of livelihoods of their families and subsidizing from this source the expenses incurred on the farm related to charges for hired labour, purchase of fixed means of production and payment of taxes. All this may mean that these two spheres of economic activity of farmers, i.e. agricultural and non-agricultural, are interrelated, and often the functioning and development of the farm to a large extent depend on the possibility to subsidize it from non-agricultural sources. Finally, it should be concluded that the logistic regression model used in the article can be a useful tool for the analysis of economic and organizational dependencies occurring on farms with non-agricultural economic activity.

REFERENCES

Agriculture for Development, 2010. The World Bank, Washington.
Czudec, A. (2009). Ekonomiczne uwarunkowania rozwoju wielofunkcyjnego rolnictwa. Prace Naukowe Wydziału Ekonomii Uniwersytetu Rzeszowskiego, Monografie i Opracowania 6. Wydawnictwo Uniwersytetu Rzeszowskiego, Rzeszów.
Hunek, T. (2006. Dywersyfikacja aktywności „rolniczej Polski". [In:] T. Hunek (Ed.), Perspektywy rolniczej Polski w Unii Europejskiej – 25. Wieś Jutra, Warszawa.
Mach, Ł. (2010). Zastosowanie regresji logistycznej do określenia prawdopodobieństwa sprzedaży zasobu mieszkaniowego. [In:] R. Knosal (Ed.), Komputerowo Zintegrowane Zarządzanie. Vol. II. Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją, Politechnika Opolska, Opole.
Makarski, S. (1999). Uwarunkowania i rezultaty rozwoju przedsiębiorczości w agrobiznesie. Roczniki Naukowe SERiA, 1, 3.
Michna, W. (1998. Zróżnicowanie regionalne wsi i rolnictwa a poziom subsydiowania kredytów. IERiGŻ, Warszawa.
Michna, W. (1999). Założenia do polityki regionalnej państwa w sferze rolnictwa i obszarów wiejskich w pierwszej dekadzie XXI wieku. Roczniki Naukowe SERiA, 1, 1.
Orłowska, A. (1998). Funkcje pozarolnicze w przedsiębiorstwie rolniczym. [In:] Materiały z V Kongresu SERiA.
Rizov, M. (2006). Rural Development Perspectives in Enlarging Europe: The Implications of CAP Reforms and Agricultural Transition in Accession Countries. European Planning Studies, 14, 2.
Sikorska-Wolak, I. (1995). Przedsiębiorczość jako przejaw innowacyjności. [In:] Doradztwo rolnicze a kształtowanie się przedsiębiorczości rolników. SGGW – Katedra Doradztwa Rolniczego, Warszawa.
Stanisz, A. (2006). Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. [In:] Modele liniowe i nieliniowe. Vol. 2. StatSoft, Kraków.
Tomczak, F. (1994). Doświadczenia ewolucji rolnictwa rodzinnego w kraju o gospodarce rynkowej. SGH, Warszawa.
Woś, A. (2002). Przestrzeń ekonomiczna rolnictwa. IERiGŻ, Warszawa.
Zegar, J.St. (2000). Kierunki rozwoju rolnictwa i obszarów wiejskich – uwarunkowania regionalne. [In:] A. Stasiak (Ed.), Możliwości wielofunkcyjnego rozwoju wsi polskiej w kontekście integracji z Unią Europejską. KPZK PAN, Warszawa.

ZNACZENIE POZAROLNICZEJ DZIAŁALNOŚCI GOSPODARCZEJ ROLNIKÓW W PROCESIE MODERNIZACJI GOSPODARSTW ROLNYCH

Streszczenie. Celem artykułu jest identyfikacja oraz ocena stopnia i uwarunkowań zjawiska dofinansowania gospodarstwa rolnego z dochodów uzyskiwanych przez rolników z prowadzonej przez nich pozarolniczej działalności gospodarczej. Materiał empiryczny artykułu stanowią wyniki badań ankietowych przeprowadzonych w latach 2011–2012, tj. wywiad z kwestionariuszem wśród 210 rolników, czyli właścicieli indywidualnych gospodarstw rolnych prowadzących dodatkowo pozarolniczą działalność gospodarczą,

z terenu południowo-wschodniej Polski, tj. z trzech województw: świętokrzyskiego, małopolskiego i podkarpackiego. Analiza wyników badań wykazała, że ważne z punktu widzenia rolników procesy związane z prowadzeniem gospodarstwa rolnego są wspierane finansowo z dochodów uzyskiwanych przez nich z pozarolniczej działalności gospodarczej, o czym świadczą statystycznie istotne i dodatnie parametry regresji logistycznej przedstawionych w artykule modeli w prawie wszystkich analizowanych przypadkach.

Słowa kluczowe: pozarolnicza działalność gospodarcza rolników, dofinansowanie gospodarstwa rolnego, regresja logistyczna

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