OLSZTYN ECONOMIC JOURNAL
Abbrev.: Olszt. Econ. J., 2012, 7(1)

DETERMINANTS OF CHANGE IN PRODUCTION FACTORS AS INDICATORS OF FARM STRUCTURE TRANSFORMATIONS IN HIGHLY FRAGMENTED AGRICULTURE

***Artur Ostromęcki*[1], *Dariusz Zając*[1], *Andrzej Mantaj*[2]**

[1] Chair of Economic Policy
University of Rzeszów
[2] Chair of Quantitative Metods in Economics
University of Information Technology and Management in Rzeszów

K e y w o r d s: production factors, changes, structural transformation, regional policy.

A b s t r a c t

This paper presents the relationship between changes in production factors and selected production conditioning. Due to the type of data used, the analysis was based on a Kruskal–Wallis statistical test and the χ^2 test. This analysis determined the farmer's most manageable processes of change and their direct factors. The research findings should be used to develop effective instruments of regional policy towards agribusiness.

DETERMINANTY ZMIAN ZASOBÓW CZYNNIKÓW PRODUKCJI JAKO WYZNACZNIKI PRZEKSZTAŁCEŃ STRUKTUR W ROZDROBNIONYM ROLNICTWIE

***Artur Ostromęcki*[1], *Dariusz Zając*[1], *Andrzej Mantaj*[2]**

[1] Katedra Polityki Gospodarczej
Uniwersytet Rzeszowski
[2] Katedra Metod Ilościowych w Ekonomii
Wyższa Szkoła Informatyki i Zarządzania w Rzeszowie

S ł o w a k l u c z o w e: czynniki produkcji, zmiany, przekształcenia struktur, regionalna polityka gospodarcza.

A b s t r a k t

W artykule przedstawiono zależności między zmianami w zasobach czynników produkcji a jej wybranymi uwarunkowaniami. Ze względu na charakter danych analiza była prowadzona na podstawie statystyki testu Kruskala–Wallisa oraz testu $\chi 2$. Ocena zależności pozwoliła na ustalenie najbardziej sterowalnych przez rolnika procesów zmian oraz ich bezpośrednich determinant. Wyniki badań powinny posłużyć do konstrukcji instrumentów regionalnej polityki gospodarczej wobec agrobiznesu.

Introduction

The relationships between the various elements of economic system and their roles within the system capture the very essence of the economic structure. The efficiency of a given economy at the macro level is determined by the condition of the structure (MARCINIAK 1995, p. 54). It is a commonly accepted notion nowadays that a key role among a range of factors affecting economic structures is played by endogenous factors which are crucial for initiating adaptation processes. Past experience proves that structural changes involve transformation of both the immediate and distant economic environment, which makes it difficult to assess the changes merely from a sectoral perspective (CZYŻEWSKI 2003). Using the definition of problem areas the starting point for further analysis, we could attempt to determine one abnormal element of the economic sphere which accounts for economic underdevelopment (BAŃSKI 2000, p. 45). Regarding agriculture, it is the poor agrarian structure which determines the existence of areas with undeveloped agriculture. The agrarian factor is critical in this respect and it is commonly accompanied by a range of others: low production inputs, low qualifications of the farm holders and the rising age of the farm population.

However, it would be a major oversimplification to understand agricultural structure in terms of agrarian structure solely; there are other equally important structures which relate to other aspects of the complex agricultural system. Agrarian structure is directly related to agricultural holdings, whereas other structures may also determine the functions and processes taking place on the premises and by means of agricultural holdings. Agricultural structure is characterized by relative inertness: as a non-technical phenomenon it refuses to follow simple economic, administrative and legal measures. Changes in the structure of agriculture are subject to various macro- and microeconomic limitations such as the objective function, system of values and farm family demographics. Another factor connecting the macro- and micro-spheres is the increasing reliance of farm families on off-farm work and income. Moreover, merging sustenance holdings, or simply family farms, with agricultural holdings significantly contributes to the low rate of transformation of the socio-economic structure of agriculture. On the other hand, specific structural dimensions of agriculture are critical for making it sustainable and multifunctional as nowadays they allow agriculture to perform various fundamental public functions, i.e. economic, production, social, environmental and others. The real issue is that development of one dimension of structure related to one function of agriculture can affect, even adversely, another dimension and basis for another function. A frequently made mistake hence stems from focusing on one structure without accounting for its impact on others (ZEGAR 2009, pp. 9–10).

The organization of production determines economic reasoning and the market system should effectively change it, whereas government interventionism should provide for non-food functions of agriculture on social grounds. Yet the disparities in agrarian structures are widening, which is exemplified by the fragmented structure of agriculture in the south-east of Poland. The rate of arable land decline is higher than in other parts of Poland. Furthermore, the higher decline rate of arable land and permanent grassland is a clear manifestation of the on-going process of extension of agriculture in the region. Despite the gradual increase in average size of arable land in the holdings in the region, it still lags well behind the rest of the country and contributes to the growing disparity at the national level in this respect. This fact significantly limits the competitive advantage of the holdings in the region mainly due to their relatively small scale of production. The poor ratio between human capital and arable land size is still worsening and continues to adversely affect the fragmented agricultural structure of the region. This is because the increase rate of fully employed persons per 100 ha of arable land is higher than in the other parts of the country. Another negative fact is the growing disparity with regards to investment capital and the use of utility buildings for agricultural purposes. Moreover, the higher increase rate of holdings with own tractors, compared to the rest of the country, in a region with a highly fragmented farming structure, continues to highlight the unreasonable relationships between various production inputs. Consequently, it leads to a further decrease in profitability and leads to more farmers deciding to exit the market: this strategy seems justified as a way to shift production away from self-sufficiency. The highlighted processes stimulate the need to identify factors contributing to the change of production factors in the agricultural holdings of the south-east of Poland. Such identification may help to recognize policy instruments to be used for the benefit of the regional agricultural and development policies. The past experience gained in the process of implementing the European Union Common Agricultural Policy and the related sectoral programs have proven their low efficiency. The significance of these measures for the areas characterized, on the one hand, by vast production inputs in agribusiness and, on the other, by undeveloped structures, cannot possibly be overestimated, not only in view of the region's perspectives for agricultural development, but also for the socially-desired non-agricultural functions of rural areas.

The objectives, data resources and methodology

The aim of the paper is to identify the determinants of change of major production factors in agricultural holdings (i.e. arable land size, labour capital, head of basic herd cattle, livestock building area and agricultural machinery

value) and tendencies affecting structural changes in the fragmented agriculture.

The data is based on the findings of the questionnaire surveys conducted in 2007[1]. The results of this sample-based research were obtained by means of proportional stratified random sampling. The questionnaire surveys were carried out among farmers – owners of agricultural holdings in the south-east of Poland, i.e. the area of Świętokrzyskie, Małopolskie and Podkarpackie provinces. Altogether, the survey was conducted on a sample of 856 farmers[2].

Changes in major production inputs were defined in the three-grade scale (i.e. decrease, no change and increase), which further affected the division of the holdings into three groups. Consequently, the allocated groups of holdings were analysed with regard to variables of production conditions. Under these circumstances, the correlations between changes in production factors and their conditioning were identified on the basis of the observed differences in conditioning intensity in the allocated holding groups. The choice of the applied statistical methods was limited by the fact that the variables defining production conditioning tended to fail to present the normality of distribution and homogeneity of variance in the distinguished groups of holdings. Hence, the analysis of the research findings used methods applied for ordinal traits whose criteria meet all the tested variables except for the farmer's gender.

In order to test the occurrence of significance of differences in characteristics (excluding the characteristics of farmer's gender) the statistical Kruskal–Wallis test was used to determine between the farm groups. The critical value of the least significant difference based on the χ^2 statistical test was used to assess the significance of differences between the ranks for characteristics within the distinguished groups. Statistically significant differences between the variables defining production conditioning confirmed their correlation with the variables used to distinguish different holding groups.

Before application of the statistical Kruskal–Wallis test, the null hypothesis was assumed that the examined populations demonstrate the same distributions. It boiled down to determination of the position of equal populations and, in this respect, the Kruskal–Wallis test is particularly sensitive to deviations from this assumption.

Having sorted out the values and assigned ranks, the statistics of the Kruskal–Wallis test were calculated according to the formula (ACZEL 2000, s. 731–735):

[1] The research was conducted as a part of the research grant "The role of local institutions in the process of transformation of agriculture with fragmented structure of holdings (following the accession of Poland to the European Union)" No. N114 009 31/2320 financed by the Ministry of Science and Higher Education and managed by prof. dr hab. Adam Czudec.

[2] For more on the sampling method used see CZUDEC et al. 2008, pp. 15–17.

$$H = \frac{12}{n(n-1)} \left(\sum_{j=1}^{k} \frac{R_j^2}{n_j} \right) - 3(n+1),$$

were n denotes the number of observations, n_j is the number of observations in the sample j, and R_j define observation ranks in the j^{th} group, whose total number equals k.

The statistics of this test generally allow determination of the differences between populations, yet in order to verify which of the populations were affected more specifically, we compared the modules of differences between the mean ranks of samples i and j:

$$D = |\bar{R}_i - \bar{R}_j|$$

and the value of C_{KW}:

$$C_{\text{KW}} = \sqrt{\chi^2_{\alpha,k-1} \left[\frac{n(n+1)}{12} \left(\frac{1}{n_i} + \frac{1}{n_j} \right) \right]},$$

where $\chi^2_{\alpha,k-1}$ is the critical size of distribution χ^2, at $\alpha = 0.05$ and $\alpha = 0.01$ for defining statistically significant and highly significant differences respectively.

Regarding the farmer's gender, the statistical χ^2 test was applied to assess the gender correlation with the variables determining the criteria for distinguishing various holding groups. The data used to calculate the test statistics was organized in two-dimensional arrays, yet due to the adopted classification of the changes in major production factors, three classes were always isolated and two classes were used for the other variable (man/woman). The assessment of correlations between the examined variables allocated in a two-dimensional array was proceeded by adoption of the null hypothesis concerning their independence. If p_{ij} defines the probability of belonging of a randomly selected element to the class i and j with respect to the characteristics accounted for in the array and, when $p_{i.}$ and $p_{.j}$ are respective boundary probabilities, the null hypothesis takes on the form (JÓŹWIAK, PODGÓRSKI 1998, pp. 358–362):

$$H_0: p_{ij} = p_{i.}\, p_{.j} \text{ for pairs of } i, j \text{ indexes}$$

and the alternative hypothesis is:

$$H_1: p_{ij} \neq p_{i.}\, p_{.j} \text{ for some pairs of } i, j \text{ indexes.}$$

The boundary probabilities can be calculated:

$$\hat{p}_i = n_i/n$$

and

$$\hat{p}_{.j} = n_{.j}/n$$

Assuming independence of variables, the expected values in the array can be calculated:

$$\hat{n}_{ij} = n\hat{p}_i\,\hat{p}_{.j} = n(n_{i.}/n)\,(n_j/n) = (n_{i.}\,n_{.j})/n.$$

The statistics of the χ^2 test was calculated followed the formula:

$$\chi^2 = \sum_{i=1}^{k}\sum_{j=1}^{l}\frac{(n_{ij}-\hat{n}_{ij})^2}{\hat{n}_{ij}}.$$

The number of the degrees of freedom is determined by the product $(k–1)(l–1)$.

The null hypothesis was rejected at the significance level $\alpha = 0.05$, when $\chi^2 \geq \chi^2_{\alpha,(k-1),(l-1)}$.

The research findings

The analysis of the researched issues began with a description of changes in the size of arable land in relation to the major conditionings of production in agricultural holdings in the five years prior to the research: in this respect, the statistical Kruskal–Wallis and χ^2 tests were applied. Their values are presented in the second column of table 1 and the fact when they refer to the χ^2 statistics has been noted.

Following the results of the statistical Kruskal–Wallis test, we can observe that changes in the arable land size (decrease, increase or no change) were most strongly related to changes in the actual size of arable land in farms. It means that the more arable land farmers possessed, the more they enlarged the amount of their agricultural resources' it is worth noting that all differences in arable land size in the distinguished holding groups related to changes in this production factor were statistically highly significant. This denotes a trend of growing stratification of farms with regard to the above characteristics. At a somewhat lower, yet still statistically significant level, the increase in arable land size was correlated with an increase in economic strength of holdings, farm machinery value, the EU financial support and intensity of farmer's interaction

with the institutional environment. At the lowest, yet still statistically significant level, we can observe a correlation between an increase in arable land size and a decrease in farmer's age and his farm management experience. The only factor which was not statistically significantly correlated with changes in arable farm size was the farmer's gender (Tab. 1).

The next issue which was the subject of our analysis was the relationship between changes in labour capital and factors affecting the production capabilities of agricultural holdings (Tab. 2).

Firstly, it should be noted that the results of the statistical Kruskal–Wallis test demonstrated much lower values in this case when compared with the former. Among the variables affecting production, share of farm income in the total family income had the highest statistically significant correlation with increase in labour capital. The correlation was slightly lower in the case of arable land size in holding, its economic strength, value of machinery, smaller labour capital in relation to arable land size and the volume of EU financial support. Hence, the findings show that labour capital grew in the holdings where farming constituted the major source of family income as well as in the largest in size and

Table 1

Changes in size of arable land by selected factors affecting production in agricultural holdings

Production conditioning	Kruskal–Wallis statistics and χ^2 tests	Assessment of differences in production conditions among the holding groups by changes in arable land size		
		decrease – no change	decrease – increase	no change – increase
Arable land size [ha]	134.75**	**	**	**
Labour capital [full-time employment]	33.58**	**	**	**
Labour capital [full-time employment/ha of arable land]	71.69****	**		
Value of agricultural machinery [zł]	95.97**	**	**	**
Livestock buildings' area [m^2]	21.21****	**		
Economic strength of the holding [ESU]	100.01**	**	**	**
Farm income share in the total family income [%]	59.55**	**	**	**
Farmer's gender	$\chi^2 = 1.27$			
Farmer's age [years]	24.63****	**		
Farm management experience [years]	7.25*	**		
Farmer's contacts with institutions [0:1]	94.28**	**	**	**
European Union financial support [zł]	95.97**	**	**	**

* – significance at probability $p=0.05$

** – significance at probability $p=0{,}01$

Source: own calculations following the questionnaire – based research.

Table 2

Changes in labour capital by selected factors affecting production in agricultural holdings

Production conditioning	Kruskal–Wallis statistics and χ^2 tests	Assessment of differences in production conditions among the holding groups by changes in labor capital		
		decrease – no change	decrease – increase	no change – increase
Arable land size [ha]	15.85**		**	**
Labour capital [full-time employment]	3.81			
Labour capital [full-time employment/ha of arable land]	5.78*			*
Value of agricultural machinery [zł]	13.12**		*	**
Livestock buildings' area [m^2]	4.63			
Economic strength of the holding [ESU]	14.35**		**	**
Farm income share in the total family income [%]	16.5**		**	**
Farmer's gender	$\chi^2 = 1.33$			
Farmer's age [years]	5.08			
Farm management experience [years]	2.42			
Farmer's contacts with institutions [0:1]	4.07			
European Union financial support [zł]	12.59**		**	**

* – significance at probability $p=0.05$
** – significance at probability $p=0.01$
Source: own calculations following the questionnaire – based research.

economically strongest agricultural holdings which also took the most advantage of the EU financial assistance – the correlation among these factors tends to be high and positive. Half of the distinguished conditions proved statistically insignificant for changes in labour capital: farmer's gender again, their age, experience in farm management, intensity of interactions with institutions, livestock buildings area size and labour capital in holding (Tab. 2). It seems there are problems in identifying specific factors accounting for a farm labour capital increase among the elements of farm production.

The next focus of our analysis was to test the correlation between changes in head of basic herd cattle and factors determining production capabilities of agricultural holdings (Tab. 3).

Increase in head of basic herd cattle was most strongly correlated with increase in the holding's economic strength, which means that the economically strongest farms focused on livestock production predominantly. Similarly, yet at a slightly lower degree, an increase in head of basic herd cattle was related to the size of arable land and the share of farm income in the total family income.

Table 3
Changes in head of basis herd cattle by selected factors affecting production in agricultural holdings

Production conditioning	Kruskal–Wallis statistics and χ^2 tests	Assessment of differences in production conditions among the holding groups by changes in head of basic herd cattle		
		decrease – no change	decrease – increase	no change – increase
Arable land size [ha]	61.65**		**	**
Labour capital [full-time employment]	27.79**		*	**
Labour capital [full-time employment/ha of arable land]	17.58**		**	**
Value of agricultural machinery [zł]	44.99**	**	**	**
Livestock buildings' area [m^2]	40.33**		**	**
Economic strength of the holding [ESU]	76.86**	*	**	**
Farm income share in the total family income [%]	54.08**	*	**	**
Farmer's gender	$\chi^2 = 4.06$			
Farmer's age [years]	10.84**		*	*
Farm management experience [years]	0.39			
Farmer's contacts with institutions [0:1]	36.36**		**	**
European Union financial support [zł]	40.22**		**	**

* – significance at probability $p=0.05$
** – significance at probability $p=0.01$
Source: own calculations following the questionnaire – based research.

Not as strong as in the former case, but still statistically highly significant, were the correlations between the increase in head of basic herd cattle with higher values of agricultural machinery in holdings and EU financial support, larger livestock building area size, more frequent farmer's contacts with institutions, higher labour capital as well as lower ratio of labour capital per 1 ha of arable land and lower farmer's age. In the instances of farmer's gender and his farm management experience, no statistically significant correlation with change in head of basic herd cattle was proven. However, a moderately strong correlation of change in head of basic herd cattle with the size of livestock building area was observed, which may result from the impact of the specific economic conditions of cattle breeding on agricultural producer's decisions (Tab. 3).

The aim of the next assessment was an attempt to determine the relationship between changes in the possession of livestock building capital and factors affecting production capabilities of agricultural holdings (Tab. 4).

Table 4
Changes in livestock building capital by selected factors affecting production in agricultural holdings

Production conditioning	Kruskal–Wallis statistics and χ^2 tests	Assessment of differences in production conditions among the holding groups by changes in livestock building capital		
		decrease – no change	decrease – increase	no change – increase
Arable land size [ha]	59.91**			**
Labour capital [full-time employment]	6.36*			*
Labour capital [full-time employment/ha of arable land]	35.18**			**
Value of agricultural machinery [zł]	40.27**			**
Livestock buildings' area [m^2]	23.68**			**
Economic strength of the holding [ESU]	55.06**			**
Farm income share in the total family income [%]	24.15**			**
Farmer's gender	$\chi^2 = 0.03$			
Farmer's age [years]	2.83			
Farm management experience [years]	0.39			
Farmer's contacts with institutions [0:1]	42.17**			**
European Union financial support [zł]	40.54**			**

* – significance at probability $p=0.05$
** – significance at probability $p=0.01$
Source: own calculations following the questionnaire – based research.

The highest increase in the size of livestock building area was noted in the economically strongest holdings and those with the largest amount of arable land: here we can observe a correlation similar to the former ones in the analyses of factors affecting changes in arable land size, head of basic herd cattle and labour capital in the holdings. In this light, these factors should be assessed as the major determinants of the above changes. Among the factors affecting agricultural production which did not show any statistically significant correlation with changes in the size of livestock building area were, again, farmer's age, gender and his farm management experience (Tab. 4).

The final characteristics used to group the holdings were changes in the value of agricultural machinery. Its correlation with factors affecting agricultural production is presented in Table 5.

Table 5
Changes in value of agricultural machinery by selected factors affecting production in agricultural holdings

Production conditioning	Kruskal–Wallis statistics and χ^2 tests	Assessment of differences in production conditions among the holding groups by changes in value of agricultural machinery		
		decrease – no change	decrease – increase	no change – increase
Arable land size [ha]	133.03**		**	**
Labour capital [full-time employment]	35.58**	**	**	**
Labour capital [full-time employment/ha of arable land]	68.52**	*		**
Value of agricultural machinery [zł]	181.96**	*	**	**
Livestock buildings' area [m^2]	27.38**			**
Economic strength of the holding [ESU]	128.04**		**	**
Farm income share in the total family income [%]	90.01**		**	**
Farmer's gender	$\chi^2 = 2.70$			
Farmer's age [years]	28.87**			**
Farm management experience [years]	2.08			
Farmer's contacts with institutions [0:1]	92.04**		**	**
European Union financial support [zł]	167.69**		**	**

* – significance at probability $p=0.05$
** – significance at probability $p=0.01$
Source: own calculations following the questionnaire – based research.

The increase in value of agricultural machinery was surveyed primarily in the holdings which already possessed high worth of machinery and statistically significant differences of their average values were observed among all holding groups. Another variable highly correlated with changes in agricultural machinery in holdings proved to be the volume of the EU financial support which, in fact, was most often used to subsidize purchase of this resource. A weaker, if compared to the others, yet still high with a positive correlation of increase in the worth of agricultural machinery was observed with arable land size, holding's economic strength and the intensity of the farmer's interaction with institutions (Tab. 5).

Conclusions

The undertaken analysis makes it possible to determine groups of holdings and their most effective regulation by means of regional policy instruments in order to facilitate transformation of production organization in agriculture with a highly fragmented structure.

a) The policy tools stimulating arable land size should be addressed primarily to larger-in-size farm holdings.

b) The statistically low significance of correlation of changes in labour capital with various production factors proves the rather limited absorption capabilities of free labour by fragmented agriculture. Moreover, these relationships are affected by a variety of other hard-to-define factors which still influence the use of free labour.

c) The rise of economic efficiency and profitability in fragmented agriculture could be accomplished by developing livestock production, which is highly plant-dependent[3], and as was demonstrated by the research findings, the larger-in-size farms should take advantage of the relevant policy programs in the first place.

d) The most efficient incentive to develop agricultural machinery capital is to make use of the EU subsidies and this strategy tends to have been most widely employed by the farmers owning larger – in terms of area – holdings. It should also be noted that the use of tools of regional policy for encouraging transformation of production structure and improving the economic situation in fragmented agriculture should take advantage of the benefits of the synergy effect between all of the above-mentioned factors.

The presented research demonstrates that the use of a regionally individualized economic policy towards agribusiness is fully justified (*cf.* LAGNEVIK, KOLA 1998, pp. 286–297, after: STROJNY 2010, pp. 139–150). The presented incentives should be taken into account in the process of formulation of the appropriate policy programs. However, the question arises whether local governments can fully rely on legal and organizational support and expertise of a wide spectrum of institutions in the process of development and implementation of regional agribusiness management policy.

In conclusion, although the real issue is the fragmented structure of agriculture, it is also an issue of the process of elimination of farming in small

[3] Agriculture in developed countries relies primarily on livestock production on which crop production is largely dependent. This approach is supported by a simple economic calculation: animal-based products tend to be characterized by a much higher degree of processing than plant-based ones. Livestock production also plays a very important role in Poland both in terms of its share in overall agricultural production and as a source of a farm family's income (cf. MUSIAŁ 2011, pp. 19, 20).

and economically inefficient holdings in favour of the development of non-farming activities. In this way, a new image of a more efficiently managed intensive farm suitable for a fragmented agrarian structure can be created.

Translated by DAMIAN S. PYRKOSZ

Accepted for print 6.02.2012

References

ACZEL A.D. 2000. *Statystyka w zarządzaniu. Pełny wykład.* PWN, Warszawa, s. 731–735.

BAŃSKI J. 2000. *Rolnicze obszary rezerw produkcyjnych.* Wieś i Rolnictwo, 2(107): 45.

CZUDEC A., KATA R., MIŚ T., ZAJĄC D. 2008. *Rola lokalnych instytucji w przekształceniach rolnictwa o rozdrobnionej strukturze gospodarstw.* Wydawnictwo Uniwersytetu Rzeszowskiego, Rzeszów, 15–17.

JÓŹWIAK J., PODGÓRSKI J. 1998. *Statystyka od podstaw.* PWE, Warszawa, s. 358–362.

LAGNEVIK M., KOLA J. 1998. *Are Porter Diamonds forever?*, In: *Competitiveness in the Food Industry*, Eds. W.B. Traill, E. Pitts. Blackie Academic & Professional, an imprint of Chapman & Hall, London, s. 286–297.

Makroekonomiczne problemy agrobiznesu w Polsce w okresie przedakcesyjnym. 2003. Ed. A. Czyżewski. Zeszyty Naukowe AE w Poznaniu, 30.

Makro- i mikroekonomia dla inżynierów. 1995. Ed. S. Marciniak. PWN, Warszawa, s. 54.

MUSIAŁ W. 2011. *Teraźniejszość i przyszłość drobnych gospodarstw rolnych w Unii Europejskiej*, Centrum Doradztwa Rolniczego w Brwinowie Oddział w Krakowie, s. 19, 20.

STROJNY J. 2010. *Ocena konkurencyjności międzynarodowej gospodarki rolno-żywnościowej w oparciu o macierz atrakcyjności oraz pozycji rynkowej.* Zeszyty Naukowe SGGW w Warszawie, 3(52): 139–150.

ZEGAR J.S. 2009. *Struktura polskiego rolnictwa rodzinnego pod koniec pierwszej dekady XXI wieku.* IERiGŻ-PIB, Warszawa, s. 9–10.