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THE SPATIAL ASPECT OF CONCENTRATION OF AGRICULTURAL LAND PRICES IN POLAND

KONCENTRACJA CEN ZIEMI ROLNICZEJ W POLSCE W ASPEKCIE PRZESTRZENNYM

Key words: spatial analysis, the Gini coefficient

Słowa kluczowe: analiza przestrzenna, współczynnik Giniego

Abstract. The article presents data for the prices of good, medium and low land from 1999 to 2012. In addition to the price of land, direct subsidies are also considered. Direct subsidies have been taken into account in accordance with the award period 2004-2012. The data used in this analysis come from the Central Statistical Office (CSO) and from the Agency for Restructuring and Modernization of Agriculture (ARMA). The aim of this study was to compare the diversity of spatial concentration of agricultural land prices in the years 1999-2012, taking the quality of land and direct subsidies into account. In order to obtain spatial concentration of agricultural land prices, the spatial Gini coefficient was calculated. For sake of comparison, the study was also based on the classical Gini coefficient.

Introduction

In terms of socio-economic development of the national economy, a declining importance of agriculture is observed. These changes are related to the ratio between livestock and crop production, changes in the agrarian structure of agricultural holdings, the proportion of employment as well as income from agricultural and off-farm production. The farm is taking on other functions, such as agritourism, and rural communities are becoming ever more so attractive to urban residents. Agricultural land is ceasing to be a mere means of production and is becoming more attractive as a way of locating capital. In addition, government policies are leading to new earning opportunities in the way of offering direct subsidies and also by offering the possibility of speculating on the agricultural real estate market. Agriculture is a high-risk department of production, associated with natural conditions – the climate. Within countries, the degree of spatial concentration of agricultural land is reflected in agricultural economics. By way of funding, developed countries can achieve high production efficiency. In the European Union, since 1960, a Common Agricultural Policy consisting of two pillars – structural and market – has been implemented. The structural pillar concerns the development of rural areas. As a result of these changes, the structure associated with agricultural land has been altered and result from the needs of the population and the evaluation of common agricultural policy. Changes in agriculture are spatial. Taking all spatial units into account, (namely regions, provinces, districts and communes) it would be recommendable to include all available information in the analysis, however this could give rise to many difficulties.

Therefore, in the present analysis, an attempt is made to determine the ideal measures to describe location and concentration by taking space into account. However, the approach is complex and it has still not been possible to create an indicator that would satisfy the postulates of an “ideal” measure of spatial concentration [Combes, Overman 2004].

The aim of this study was to compare the diversity of spatial concentration of agricultural land prices in the years 2004 - 2012, considering the quality of land and direct subsidies.

Material and methods

The data used in this analysis come from the Central Statistical Office (CSO) for the period 1999-2012 and from the Agency for Restructuring and Modernization of Agriculture (ARMA). In this study direct subsidies as well as the price of agricultural land, with the division of the quality of the land in accordance with CSO norms, were considered. The analysis for Polish provinces covers the years 1999 to 2012. Direct subsidies were taken into account in accordance with the award years 2004-2012. In order to obtain the spatial concentration of agricultural land prices, the spatial Gini coefficient [Ceapraz 2008, Duraton, Overman 2005] was calculated. For the sake of comparison, the study was also based on the classical Gini coefficient.

In the case of spatial data, certain economic variables were considered and could be higher in value because of the diversification of regions (a higher value in a large region and vice versa). The way to correct this problem was to adopt a relative value. In the case of a research variable – the price of agricultural land – its spatial distribution was determined. The study attempted to determine if the concentration of land and land prices was similar for the studied regions (provinces), or whether they differed from each other. This study also attempted to compare the prices of land in order to state similarities in regions. The study searched for answers concerning provinces in which there is a concentration of prices. The classic Gini coefficient was calculated with respect to the uniform distribution that each region was assigned an equal share in the total value of the research variable:

$$G = 1 - 2 \int_0^1 L(y)dy \quad (1)$$

Typically written as:

$$G = \frac{1}{n} \left(n + 1 - 2 \left(\frac{\sum_{i=1}^n (n+1-i)y_i}{\sum_{i=1}^n y_i} \right) \right) \quad (2)$$

Where:

$L(y)$ – Lorenz curve function,

y_i – value of research variable.

When taking spatial data into account, the calculation must be sorted according to the coefficients of location:

$$Lq = \frac{x_k}{y_k} \quad (3)$$

Equal weights for the quantification of (x) the Gini coefficient has been replaced by the distances of variables x and y ordered by the coefficients of location. For the cumulative values of the studied variables the Gini coefficient is calculated as:

$$G_s = 1 - \sum_{i=1}^n (x_{k+1} - x_k)(y_{k+1} + y_k) \quad (4)$$

following research:

x_k – is the cumulative proportion of total price of agricultural land in Poland,

y_k – is the cumulative proportion of price of agricultural land in a province.

The Gini coefficient takes values in the range [0, 1]. If the Gini coefficient is one then the total concentration of the characteristic in the studied region is observed. When the Gini coefficient is zero, it means there is a lack of concentration and the structure characteristics of the studied region have the same distribution throughout the country. In addition to the Gini coefficient, other indices of spatial concentration should also be made: Herfindahl –Hirschman, Isard, Krugman, Theil, Gibbs-Martin, Ellison-Glaeser and others. In the following part the paper presents the results of the analysis.

Results

In this study, the average price of land (good, medium, low) was analyzed. The analysis was dictated by the changes that occurred during the studied period. A greater interest in land of low quality is being witnessed and thus, a more dynamic increase in prices in this type of land can be observed in comparison with good and medium lands [Pietrzykowski 2013]. Figure 1 shows that changes in price dynamics due to quality can only be observed as of 2004. This is probably associated with the new possibilities that arose after Poland's accession to the European Union. Figure 1 is divided into two parts. The first part contains information concerning the dynamics of prices from 1999 to 2004; the second part considers the years following 2004. In Table 1 simple indices were calculated on the basis of 2004. It is visible that the 2004 changes in prices of agricultural land are at the same level and it can be concluded that growth relatively remains the same. It should be noted however that the dynamics of change in land prices of good and medium land is higher than the price of low land. After 2004 there was a reversal of the increase in land prices due to quality. It is visible that land prices of low quality in this period were changing. The price of good and medium land rose but dynamics of price changes were similar. The land prices of low quality land increased in 2012 by 325% compared to 2004, and the price of good and medium land by 240% and 254%, respectively (Tab. 1). Changes in agricultural land prices are extremely noticeable in the context of quality of soil, however other factors such as direct and complementary subsidies cannot be ignored. Additionally, the phenomenon of using agricultural land for building purposes is also worth noting.

The following part of this study addresses the concentration of agricultural land prices at the level of provinces. In order to determine the concentration of land prices, the Gini coefficient (according to formula 2) was calculated for the period 1999 to 2012. Due to the previous results, Gini coefficients of good, medium and low land were calculated (Fig. 2). For the price of land, a weak concentration could be observed. During the analyzed period, the Gini coefficients took values ranging from 0.12 to 0.20. Therefore, it can be concluded that prices in different regions were distributed evenly.

Table 1. Simple indices for land prices (good, medium and low quality soils) on the basis of 2004
Tabela 1. Indeksy proste dla cen ziemi (dobrej, średniej i słabej jakości) w porównaniu do 2004 r.

Year/ Rok	Soil quality/Jakość gleby		
	good/ dobra	medium/ średnia	low/ niska
1999	0.67	0.66	0.59
2000	0.73	0.72	0.66
2001	0.80	0.79	0.72
2002	0.77	0.75	0.73
2003	0.87	0.86	0.84
2004	1.00	1.00	1.00
2005	1.22	1.27	1.37
2006	1.36	1.43	1.61
2007	1.76	1.88	2.19
2008	2.13	2.37	2.84
2009	2.38	2.66	3.20
2010	2.48	2.82	3.48
2011	2.76	3.09	3.79
2012	3.40	3.54	4.25

Source: own study

Źródło: opracowanie własne

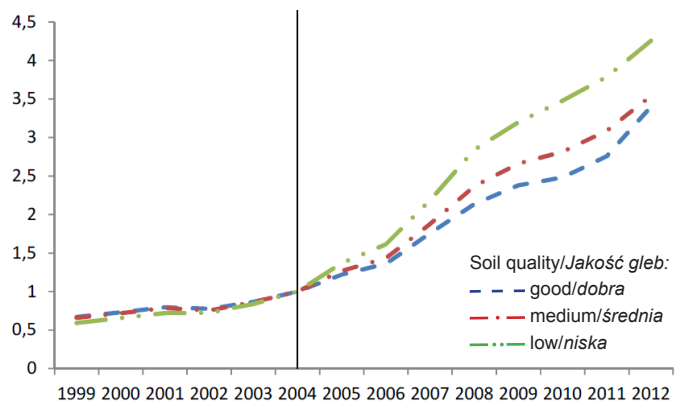


Figure 1. Changes in agricultural land (low, medium, and good) prices in the period 1999-2012

Rysunek 1. Zmiany cen ziemi rolniczej (słabej, średniej i dobrej jakości) w latach 1999-2012

Source: own study

Źródło: opracowanie własne

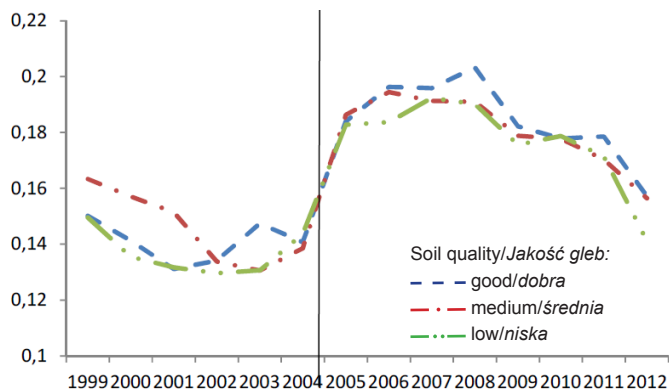


Figure 2. Gini coefficients for land prices with the division of land into good, medium and low in the years 1999 to 2012

Rysunek 2. Współczynniki Giniego dla cen ziemi rolniczej dobrej, średniej i słabej jakości w latach 1999-2012

Source: own study

Źródło: opracowanie własne

However, it seems that when it comes to the dynamics of change in agricultural land prices, they are not concentrated in a particular way in one or two provinces. Due to the spatial nature of the phenomenon under study, the spatial Gini coefficient has been used and calculated according to formula 4 in order to assess the concentration of agricultural land prices. Considering spatial concentration, it can be determined whether or not the price of land of good, medium or low quality is more or less distributed by province. Chart 3 shows the spatial Gini indices which were calculated taking the spatial impact of soil quality in the years 1999 to 2012 into account. The Gini index values are similar to zero, which would indicate a lack of concentration. However, a certain analogy to the situation shown in Figure 1 can be noted. This means that the sequence of coefficients starts from land of medium and good quality and ends on land of low quality. Also, due to the fact that the nature of the spatial phenomenon was considered, it was possible to determine actual change in the period, which was a lack of concentration in land prices.

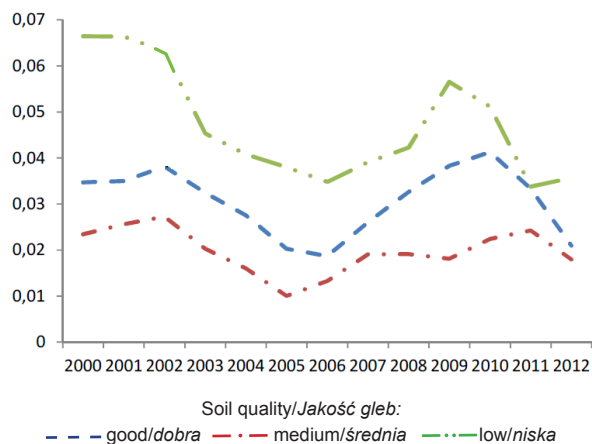


Figure 3. Gini coefficients with spatial weights for land prices considering the division of land into good, medium and low in the period 1999-2012

Rysunek 3. Przestrzenny współczynnik Giniego dla cen ziemi rolniczej dobrej, średniej i słabej jakości w latach 1999-2012

Source: own study

Źródło: opracowanie własne

Comparing the Gini indices, it can be concluded that the index not taking spatial weights into account is higher than the relative indices, which were created on the basis of the share prices for different quality of soil in the region in relation to the overall price in Poland. This confirms the thesis that land prices in Poland are evenly distributed according to soil quality.

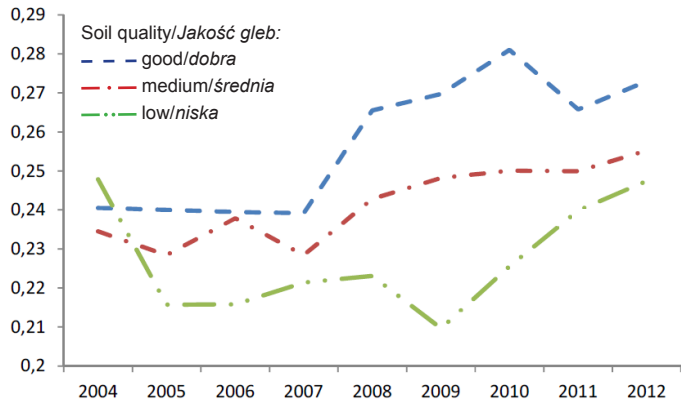
Similar calculations for direct subsidies, taking spatial weight into consideration, were made. Relative indices were created, taking into account the land prices of different soil qualities in the region in relation to the total direct subsidies scheme in Poland. Given the direct subsidies, a weak concentration of agricultural land prices was shown. However, a slight increase of concentration for land prices in the regions in relation to the direct subsidies scheme could be observed (Fig. 4).

Figure 4. Spatial Gini coefficients for land prices taking into account the spatial participation of the direct subsidies scheme in the period 2004-2012.

Rysunek 4. Przestrzenny współczynnik Giniego dla cen ziemi rolniczej słabej, dobrej i średniej z uwzględnieniem udziału jednolitych płatności obszarowych w latach 2004-2012

Source: own study

Źródło: opracowanie własne



Conclusions

As a result of statistical analysis, no concentration of agricultural land prices due to the quality of land in provinces in relation to land prices in Poland was observed. The use of the spatial Gini coefficient enabled a more thorough analysis of the studied problem. There was a weak concentration in land prices in regions in relation to the direct subsidies scheme. The analysis found that, in the period 1999-2012, despite a substantial increase in agricultural land prices, its distribution in different regions was similar. This study presents the dynamics of agricultural land prices according to quality. After 2004, there was a reversal of the growth rate of prices. The price of land of low quality was characterized by a faster speed of growth in comparison to land of good and medium quality. This phenomenon is probably connected with the new possibilities that came about in Polish agriculture after Poland's accession to the European Union, but also with a general greater ability to use low quality agricultural land.

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Streszczenie

Celem pracy było porównanie różnorodności przestrzennej koncentracji cen gruntów rolnych w latach 1999-2012 z uwzględnieniem jakości ziemi i dopłat bezpośrednich. Do określenia koncentracji przestrzennej wykorzystano współczynnik Giniego uwzględniając odpowiednie wagi przestrzenne. Przedstawiono dane dotyczące cen gruntów rolnych (dobrych, średnich i słabych zgodnie z podziałem GUS) w latach 1999-2012. Uwzględniono także jednolite dopłaty bezpośrednie, które przyznawano latach 2004-2012. Dane wykorzystane do analizy pochodziły z GUS i z ARiMR. Dla porównania różnorodności wykorzystano klasyczne współczynniki Giniego.

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