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BAZYLI CZYŻEWSKI
RADOSŁAW TROJANEK
Poznań University of Economics and Business
Poznań

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DRIVERS OF AGRICULTURAL LAND PRICES IN TERMS OF DIFFERENT FUNCTIONS OF RURAL AREAS IN POLAND*

Abstract

According to many researches, decoupled CAP subsidies capitalised on land prices. Most studies on land prices carried out in Europe relate to the SPS system and marginal changes in land values are noted as a result of the subsidising of agriculture. In the SAPS system, used in the new EU-12 Member States, these issues have not been sufficiently investigated. An attempt is made to fill these gaps by studying the drivers of land values in a leading agricultural region of Poland based on a sample of 653 transactions from 2010-2013.

The aim is to establish what land use values, amenities and payments for public goods contribute to land values in the SAPS system. The hypothesis is proposed that the key factors for land value are location-specific factors identified according to the economic functions of a given area. Thus, four log-linear models of hedonic regression are estimated (using GLS) for different types of rural areas. The models employ both parcel-level attributes and agricultural policy variables.

Results include the observation that single area payments contribute now to land value mainly in the peripheral areas and payments for public goods under SAPS decapitalize the value of land, because they do not compensate for the opportunity costs related to alternative ways of deriving rent from the land.

Keywords: agricultural policy, hedonic regression, land prices, public goods.

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Introduction

In the literature there persists an opinion that subsidies to agriculture, especially decoupled payments, are capitalised in the value of agricultural land. As a result, landowners execute higher land rents. In case of farmers, economic strength and liquidity of farms increases, as far as land capital can be collateral of loans. For land lease, a major part of subsidies goes to non-agricultural sectors. These mechanisms were well-researched under the Single Payment Scheme (SPS), which functions in the western European countries and in varied support schemes in the US, which is explicitly shown in the literature overview. The SPS is marked by marginal changes in land value as a result of agriculture subsidisation. However, what is lacking is research on determinants of agricultural land value in the Single Area Payment Scheme (SAPS), which functions under the CAP of the EU in the Central and Eastern European Countries. There are reasons to believe that both the impact of agricultural policy and other factors on the land value is different under the system. The basic difference between the SPS and SAPS consists in the fact that under the SAPS there is no such thing as transferable entitlements to payments and each hectare of land meeting the set conditions receives equal payment (both basic and complementary). Thus, except for single area payment, the land user can additionally receive complementary payments in predefined amount, e.g. to cereals, to LFA and/or on account of agri-environmental programmes. Theoretically, subsidies are assigned to an agricultural land user, but in practice they are taken over by the land owner. Consequently, given the fact that already at the beginning of each programming period the payment to each hectare of land is known and there is no limited envelope of entitlements to payments, the market can, with considerable advance, discount the impact of the agricultural policy in land prices. This exactly happened after 2004, when as a result of Poland's accession to the EU the prices of all classes and agricultural locations of land grew considerably and from that time they continue a strong upward trend, discounting the expected political rents. This process was possible without major obstacles because the agricultural land market in Poland is subject to regulation, which is, however, limited to the pre-emptive right for the governmental Agricultural Property Agency and difficulties in land purchase for foreigners. It is difficult to state, though, to what extent the current agricultural policy, especially payments to public goods, differentiate between the prices of land and capitalise in the value of agricultural land. There is also no research on the impact of land use values and non-agricultural amenities on its prices. The basic problem consists in the fact that it is difficult to quantify all of the non-agricultural amenities and find comparable measures for them. Thus, it is necessary to look for relevant aggregates for environmental and metropolitan amenities. The authors attempted to fill in the gaps indicated in the literature by conducting extensive research on determinants of agricultural land value in the leading agricultural region of Poland. The research was preceded by literature studies on the potential determinants of agricultural land prices in different conditions. The research aimed to answer the question how land use values, non-agricultural amenities and payments to public goods, capitalise in the land value in the SAPS? The authors make a hypothesis that location factors, identified by economic function of a given area, are vital for land value.

The aspect of public goods is especially interesting, because theoretically there should be no market mechanisms of their valuation. As proved by the economic theory, the very market is not able to ensure optimum supply of a public good, always leading to one shortage (Atkinson and Stiglitz, 1980). However, not all types of CAP subsidies bring about a tangible effect in the form of public goods. The idea of public good is in this case a kind of generalisation. In fact, this is not only about amenities with attributes of “non-competition” and “non-exclusivity” – the so-called clean public goods (Buchanan, 1968; Head, 1962) – but also about common goods. Although it is arguable whether the support from the first pillar of the CAP contributes to the creation of public and common goods, it is certain that the cross-compliance principle is a step in the right direction. Whereas a number of programmes from the second pillar of the CAP, targeted at rural areas development, undoubtedly contributed to direct creation of new or preservation of the already existing common goods, e.g. in the less-favoured areas (LFA), which in general cover valuable natural resources. Thus, the paper assumes that the following have the features of public goods: agri-environmental payments, payments to LFA and area payments (respectively, AENV, LFA and SAPS).

Literature review

There are three different trends in literature concerning the problem of land value, which take up the following issues:

- impact of agricultural policy and macroeconomic factors on the lack of balance between agricultural income and the agricultural land value;
- impact of public goods and environmental factors on the prices of agricultural land – a problem of discrepancy between the market values of land and its strictly use (production) values;
- Hedonic approaches which examine the quality factors affecting the land value as a heterogeneous resource.

In the literature of the first trend, the impact of payments to agriculture on increase in the price of agricultural land was emphasised, which becomes the main reason for the aforementioned lack of balance. Chryst (1965) and Harris (1977) researched the changes in the American agriculture as a result of enforcement of the Agricultural and Consumer Protection Act of 1973; Featherstone and Baker (1988) analysed the ramifications of the Food Security Act of 1985, and Goodwin et al. (2003) the effects of the Federal Agricultural Improvement and Reform Act of 1996. Recently, Towe and Tra (2013) covered the issue of the impact of energy policy on the prices of agricultural land, and Ifft (2015) the effect of decoupled payments. The researchers stated that elastic supply of land and means of production in agriculture increase efficiency of agricultural policy in supporting the development processes in agriculture. Governmental programmes can capitalise in the prices of agricultural land in varied forms, though. There is evidence that decoupled payments exercise greater impact on the land prices than coupled payments (Latruffe, LeMouël et al., 2009; Latruffe et al., 2008; Duvivier et al., 2005; Patton et al., 2008; Ciaian and Kancs, 2012). In the research by Nilsson and Johansson (2013), the marginal effect of single area payment in Sweden is 0.54, which proves that decoupled payments translate into higher prices of land. This was also confirmed by earlier research with elasticity coefficients below 1 (Clark et al., 1993; Weersink et al., 1999). Further research by Karlsson and Nilssona (2013) show, however, that single area payments do not have any impact on farm prices if these are measured at a local level. Because the effects of the impact of the policy on the land value are unclear, it is necessary to continue research in the field, especially in the conditions of the SAPS (Single Area Payment Scheme).

It is assumed that the prices of agricultural land reflect the discounted stream of the future cash flows linked to a parcel. When the probability of positive flows grows, the level of their capitalisation in land prices also raises. But then, landowners assign a lower discount rate to some cash flows, favouring decoupled payments. The land value, understood as a stream of land rent (or lease rent), is presented by equation (1):

$$L_0 = R_0 : s \tag{1}$$

R_0 – annual value of land rent (or lease rent),
L_0 – price of agricultural land (updated value of land rents),
s – discount rate (annual return rate on alternative assets, e.g. long-term interest rate).

Currently, farmers receive direct decoupled payments, but their major part is transferred to landowners through higher agricultural land lease rates. Financial benefits on subsidies do not capitalise in agriculture when the landowner is not a farmer. There is broad literature on the mechanism, both concerning the impact of subsidies in the US agriculture on the agricultural land lease rates (Kirwan, 2009; Herriges et al., 1992; Lence and Mishra, 2003; Roberts et al., 2003) and payments in the EU (Fuchs, 2002; Breustedt and Habermann, 2011).

Lease market failures (Sotomayer et al., 2000; Allen and Lueck, 2002) do not allow landowners to fully benefit from land lease. According to research by Breustedt and Habermann (2011), different location of parcels distorts the assumption on homogeneity of a good, since only farmers living sufficiently close to the parcel will be able to compete for its lease. This neighbourhood effect has not been fully recognised in literature. On the other hand, researchers confirm a positive impact of the CAP payments on the income from lease of agricultural land in LFA (Patton et al., 2008). In line with the research results by Breustedt and Habermann (2011), there are also other factors influencing the lease rates and indirectly the value of agricultural land, e.g. stocking density. Stocking density is influenced by different programmes, e.g. investment support from the second pillar of the Common Agricultural Policy (CAP); on the one hand, indirectly supporting incomes of farmers rearing livestock and, on the other, raising lease rents.

Other authors argue that the land value results from a combination of different macroeconomic factors such as agricultural prices, low percentage rates or agglomeration pressure (Weber and Key, 2014). These factors caused a significant increase in agricultural land prices both in Europe and in the US, where between 2004 and 2012 the nominal value of UAA doubled (USDA-NASS, 2006, 2012). Plaxico and Kletke (1979), and Lowenberg-DeBoer and Boehlje (1986) proved that the growth in the agricultural land prices increases the creditworthiness of farmers. Agricultural properties constitute over 80% of the total value of assets in the US agriculture being the main source of loan collateral for farmers (Nickerson et al., 2012). Theoretically, in such conditions a growing feedback demand for land may appear, thus raising its price (MacDonald, Korb and Hoppe, 2013). Breustedt and Habermann (2011) prove that the speculative bubble in the agricultural land market is possible, if the growing creditworthiness of farmers helps them to obtain higher or cheaper financing of land purchase, thereby strengthening the demand for land and its price, which results in further growth in the wealth of landowners and their credit possibilities (Adran and Shin, 2010; Rajan and Ramcharan, 2012).

As part of the Single Payment Scheme (SPS) farmers in the EU are obliged to maintain UAA, towards which they claim their right to payments, in good agricultural and environmental condition (Falconer and Ward, 2000; Swinbank and Daugbjerg, 2006). This requirement, as mentioned before, is known as cross-compliance. The land area, which needs to be taken care of, equals the average amount of hectares declared by a farmer in the reference period of 2000-2002. The above-quoted authors state that the requirements linked to the cross-compliance principle hold back farmers from taking decisions on land purchase in the conditions of growing prosperity of farms and easier access to bank loans (Rude, 2000), despite the fact that farmers are less and less reluctant to take up risk (Hennessy, 1998; Koundouri et al., 2009). Consequently, decoupled payments more support investments in farms and supply of hired labour force than purchase of agricultural land (Guyomard, Le Mouël and Gohin, 2004). Hence, a reform decoupling payments and production will have little effect on both demand of farmers for land and supply of land, because those purchasing land in the reference period will have to keep it in good agricultural and environmental condition adhering to the cross-compliance principle (O'Neill and Hanrahan, 2012) and have little chances for winning additional entitlements to payments. For this reason, in such conditions SPS agricultural land structure petrifies and it is possible that the upward trend in the agricultural land market will not survive in the long term.

Whereas in the new Member States of the EU-12 under the SAPS thus, the situation in the agricultural land market is different. Farmers do not need any historical entitlements to acquire subsidies because the very land ownership grants them the entitlements. Hence the demand for land raises and the agricultural land market is very mutable, especially in the agricultural areas affected by the "land hunger".

As regards capitalisation of public goods in the land prices, the mainstream economic theory does not assume such a possibility, claiming that the agricultural land value is determined by the discounted stream of expected income on investments (Burt, 1986; Featherstone and Baker, 1987; Capozza and Helsley, 1989). Only few attempts were made to assess the demand for public goods in the rural areas, for which, in general, market data is lacking (Czajkowski et al., 2014; Carson and Czajkowski, 2014). The research by Delbecq, Kuethe and Borchers (2014) argues that the value of agricultural land is only partly explained by farm income. The aforementioned authors point to non-agricultural attributes of agricultural land, which determine their market value. These are divided into three groups: population and urban impact, recreational values, and location specificities. These include such features linked to public goods as availability of water recreation or forest areas. Statistically significant (by quoted authors) are the following variables: housing development possibilities, population density, afforestation, hunting permits, distance to a golf field, distance to the nearest secondary or tertiary school, and average household income. The literature proved that there is a discrepancy between the land market value and its production value (agricultural use). The value of agricultural land exceeding benefits from its use in agricultural production allows to approximately estimate the value of non-market goods and services provided by the land factor. If there is no major environmental or agglomeration potential in a given area the surplus in the land value against its production values can be the measure of the speculative bubble in the land market (Delbecq et al., 2014, pp. 587--600). This inflated value, regardless of its source, is considered to be the basis for agricultural property taxation (O'Dea, 2013; Sherrick and Kuethe, 2014). There is evidence that in many areas in the US the market value of agricultural land exceeds its use value in agricultural production (Barnard, 2000; Flanders, White and Escalante, 2004). Agricultural property, as mentioned above, constitutes over 80% of the total value of assets in agriculture. For this reason, the agricultural land prices are perceived as a key determinant of the financial situation of agriculture in the US (Briggeman et al., 2009; Nickerson et al., 2012). The newest results of empirical research suggest that the viability of farms in highly developed countries will decrease in the nearest future to the advantage of non-agriculture and non-market determinants of income (Delbecq et al., 2014), which are increasingly more important for the financial situation of agriculture. Because non-agricultural determinants of the economic surplus very often take on the form of public goods, labour markets and land markets in agriculture can suffer from free-riding (Kamiński et al., 2012). Agricultural land provides varied public goods, such as: biodiversity, climate balance, rural culture, open space, and functions indirectly influencing food quality and human health. Wasson et al. (2013) claims that the attributes of a parcel, which cover its recreational, perceptive and environmental values, are necessary to determine agricultural land value. Because these attributes are excluded from the set of variables defining the agricultural land value, it is impossible to fully explain the land price fluctuations. According to the above-quoted authors, awarding (by agricultural policy) premiums to the aforementioned attributes and penalties for their degradation, play a major role, especially in areas abounding in them. For example, in west Wyoming (USA) the value of non-agricultural amenities of land constitute from 5% to 60% of the parcel value (one-third on average). Some European research contradict these observations, though. According to Nilsson and Johansson (2013), environmental charges in agriculture in Sweden have a negative impact on land prices. They claim that municipalities receiving agri-environmental support have very sensitive ecosystems, in which it is difficult to run agricultural economy. A similar conclusion was formulated in earlier works by Rutherford et al. (1990).

The Hedonic approach is probably the most widespread in literature method of researching the factors determining land value. This approach is not focused on a particular type of value determinants (e.g. profits on cultivation, rural facilitations, ownership right), but considers all of the possible quality variables which are important for a potential purchaser upon transaction. The methodology of Hedonic analysis is broadly covered in literature (see Palmquist and Danielson, 1989; Faux and Perry, 1999; Nivens et al., 2002; Miranowski and Hammes, 1984; Ma and Swinton, 2012; Maddison, 2000). In line with various research factors such as: soil quality, environmental values, agricultural practices, location of parcels, availability of (distance to) shops and public transport, road infrastructure, influence the land price (Troncoso et al., 2010; Carreño et al., 2012; de la Fuente et al., 2006; Gavier-Pizarro et al., 2012; Leguizamón, 2013; Bárcena et al., 2004; Pengue, 2005a), and also land ownership right (ownership or lease), which determines agricultural culture and quality of agrotechnical treatments (Choumert and Phélinas, 2015; Abdulai et al., 2011; Myyrä et al., 2007; Soule et al., 2000). The above-quoted Choumert and Phélinas (2015) noted that parcels leased (either by natural persons or cooperatives) are relatively cheaper than parcels having ownership rights, while all other factors are similar. This supports the thesis according to which land having ownership rights is better cultivated than leased land.

Methodology

The first documented use of Hedonic regression took place in 1922, when G.A. Hass constructed a model of agricultural land prices. Given that the results were published as a technical report it is assumed that the impact of the research on popularisation of the Hedonic method was minor (Colwell and Dilmore, 1999). Similar research on agricultural land prices was held by Wallece (1926), and on vegetable prices – Waugh (1928). However, Andrew Court (1939) is considered to be the forefather of the Hedonic method. He examined the impact of car characteristics on their prices. Whereas Ridker was most likely the first one to use the Hedonic method to research the housing market – in the research he tried to determine the impact of air pollution reduction on house prices (Coulson, 2008). Theoretical basis of the Hedonic method was elaborated by Lancaster (1966) and Rosen (1974).

The idea behind the Hedonic method boils down to the assumption that the price of a heterogeneous good can be described by its characteristics. To put it differently, the method can be used to determine the worth of characteristics of a given good. In order to define the impact of individual characteristics on the value of a given good, econometric formulas are constructed, where the price of a given good is the dependent variable and its quantitative and qualitative characteristics are its independent variables, i.e.:

$$P = \beta_0 + \sum_{i=1}^{K} \beta_i X_i + u \qquad (2)$$

where:
P – price of a good,
β – regression coefficient,
X – characteristic of a good (cost-formation factor),
u – random error.

In Hedonic methods it is important to select the form of the regression function. In case of researching changes in property market prices, empirical research most often uses the log-linear regression function:

$$logP_i = \alpha_0 + \sum_{k=1}^{K} \alpha_k \cdot X_{ik} + \sum_{m=1}^{M} \beta_l \cdot Z_{im} + u_i \qquad (3)$$

where:
$i = 1,\ldots n$ transactions,
P_i – property price,
X_k – K land price-formation factors (see Table 1),
Z_m – agricultural policy M variables.

This function represents the fixed effects coefficient regression model. However, the researched population is biased by clustering and the price functions can have different location and inclination, depending on the type of rural areas that they pertain to, which also follows from the conducted literature review (e.g. this refers to the fact that environmental subsidies capitalise differently in the land value in tourist regions and differently in typically agricultural regions). Thus, the research used random quota sampling method on a sample of a total of 653 agricultural property transactions held over four years (ca. 10% of all transactions from the researched area), proportionally to the share of each of the four of the below-described types of rural areas in the Wielkopolska region (Wielkopolskie Voivodeship). This was based on data concerning transactions obtained from the registers of characteristics and values of properties kept by Poviat Starosty [*starostwo powiatowe*], cadastral data from the national Geoportal and soil and agricultural maps from the Voivodeship Geodetic and Cartographic Resource. This region is considered as the leader in agricultural production[1], agricultural engineering and agribusiness development in Poland, which guarantees a full cross-section of attributes influencing land prices and also theoretically slight significance of speculative motives at its purchase. Demand and supply relations in the agricultural land market in the Wielkopolska region are termed as "land hunger". A strong unique side of the research is description of each transaction (in 90% in private trade) by a set of 16 characteristics covering use values, non-agricultural amenities and payments for public goods under the CAP of the EU (see Table 1). According to the authors, such a spatial and subjective scope allows to fully execute the research targets.

[1] 15% of agricultural production in Poland, including 10% of plant production and 20% of livestock production, while the average for a voivodeship in Poland is 7% of the national agricultural production.

Table 1

Independent variable of agricultural land prices

Variable	Description
Type of a rural gmina (municipality)	4 types of areas: integrated with a city, competitive agriculture, peripheral, rural tourism
Transaction year	2010-2013; dummy variables
Area	Total area of purchased land in ha
Distance to the nearest city	km
Distance to the nearest poviat (district) city (NUTS 4)	km
Land productivity	Valorisation by type of the agricultural complex, drawn up by the Institute of Soil Science and Plant Cultivation in Puławy, considering the soil class, yielding and being an approximate of profitability of agricultural production
Land layout	Unitless ratio, ordinal; the more parcels fall to one property the lower is the ratio
Shape	Unitless ratio, ordinal: rectangle / trapeze / triangle / irregular
Perimeter	m
Waveform factor	calculated as per formula: 40*π*(area/perimeter^2)
Development possibilities	Dummy variable (yes/no)
Distance to buildings	m
Access	Dummy variable (asphalt/dirt road)
Only area payment (code in the model: 'area')	Dummy variable (yes/no); in the SAPS payment system per ha it is the same for each hectare, which meets the requirement of good agricultural practice
Area payment plus LFA payment (code in the model: 'area&LFA')	Dummy variable (yes/no); in the SAPS payments per ha are the same for each hectare, which participated in the given programme
Area payment, plus LFA payment, plus agri-environmental payment (code in the model ('area&LFA&en'))	Dummy variable (yes/no);

Source: own study.

As mentioned before, 4 groups of rural areas were selected, referring to the typology developed for the Wielkopolskie Voivodeship (Raport pełny z badania, 2014) and for each of them a separate price function was estimated:

1) Rural areas (*poviats*) integrated with a city are characterised by the fact that they spread, losing typical rural character and taking on the character of

informal city districts in the areas closest to the city-core. Thus, the areas lose their agricultural functions, and most of the income of the population living there comes from off-farm sources.

2) Areas of competitive agriculture – these are characterised by presence of economically strong farms, being the chief source of income for their residents (it is often large-area agriculture). These *poviats* are characterised by lower population density than in case of integrated areas and their integral parts are small towns fulfilling the role of administrative and supply background for the agricultural activity.
3) Peripheral areas are characterised by a predominance of farms of small economic strength with high scale of long-term and latent unemployment, poverty, social exclusion. On these areas the condition of technical, economic and social infrastructure continues to deteriorate, even though it is poorly developed. They are also characterised by low and decreasing population density.
4) Rural tourism areas, characterised by high share of forests and lakes and valuable natural resources, with well-developed infrastructure for rural tourism. In these *poviats* the recreational values (environmental rent) undoubtedly increase the value of agricultural land and a major part of their area (ca. 20%) are NATURA 2000 sites, covering landscape parks, national parks and primeval forests.

Selection of the function follows from several reasons (Malpezzi, 2003): firstly, the log-linear model enables the value added (resulting, e.g. from higher standard) to change proportionally to size and other characteristics, e.g. dwelling (in case of a linear function better standard will have the same impact on the value of a dwelling of 30 m^2 and 100 m^2, while in case of log-linear function this impact will be different). Secondly, estimated regression coefficients are easy to interpret. The coefficient of a given variable may be interpreted as a percentage change in value of a dwelling caused by a unit change in the price-formation factor. Thirdly, the log-linear function often mitigates problems linked to a changeable variance of the random component.

Agricultural parcels differ by nature. This heterogeneousness can cause heteroscedasticity of residuals of the estimated price function. Indeed, heteroscedasticity was confirmed in the developed models (as per White's test). Thus we have chosen the GLS procedure, resistant to the phenomenon (using backward stepwise regression), assigning the unexplained, by parcel attributes, part of price volatility to the agricultural policy impact – Zm. We have also considered the time factor, introducing the dummy variables for each year in 2010-2013. With a significant number of independent variables autocorrelation can prove to be a major issue, leading to estimator encumbrance. To assess the problem, the paper uses the so-called Variance Inflation Factors (VIF). In the developed models the values of VIF do not exceed 1.2 (and VIF averages do not exceed 1.16; see Tables 2-5), which complies with even the most conservative requirements that recommend the VIF average to stay below the value of 2 (Chatterjee and Hadi, 2006). The assessed models are quite well adjusted, because they explain from 60% to 90% of price volatility, depending on the type of rural area. It can be assumed that the volatility unexplained by the model reflects the impact of speculations on the land prices, which differs depending on rural areas of varied functions. Marginal effects for these models are presented in Tables 2-5.

Research results

First of all, it needs to be noted that agricultural land market in the Wielkopolskie Voivodeship is characterised by major variation: average price of purchased property was ca. PLN 103,000 (median PLN 60,000) at standard deviation of PLN 128,000, which gives a coefficient of variation of 1.24. To a lesser degree, the price varies per 1 ha: the average price is ca. PLN 26,000 (median PLN 24,000), with standard deviation at PLN 16,000 (coefficient of variation 0.6). Distribution of the two of the aforementioned variables is not normal (Shapiro-_Wilk tests give grounds for rejection of the hypothesis of normal distribution from $p<0001$) and is characterised by right-side asymmetry (for price per property – strong). In such a case it turned out that the set of independent variables at the level of transactions, i.e. omitting the location factors, to a slight degree explains the volatility of price of agricultural properties and prices per ha (R^2 coefficient was lower by 0.3). This can be partly attributed to speculations in the land market and a major demand imbalance, but the key significance in this case belongs to the location factors, especially the aforementioned type of rural areas. This problem can be solved either by multi-level (hierarchical) modelling or by estimation of separate functions for different locations. The hierarchical approach showed that the “type of rural areas” is a factor of key significance. The observation of the sample – broken down by this criterion – showed that the type of rural areas not only changes the location and inclination of the regression function but also signs for some regressors. Hence, it was decided to estimate four log-linear models of land property prices for each type of area separately and their comparison. These models are characterised by normal distribution (for $p>0.01$) and good matching (R^2 between 0.6 and 0.88) – see Tables 2-5. The issue of multicollinearity does not exist in their case. As mentioned above, parameters were estimated with the GLS method.

Table 2

Results of regression function for rural tourism area

Independent variable	Dependent variables: property price logarithm				
	regression coefficient b	EXP for b	standard error	p value	
Const	10.8032	49 177.92	0.216956	<0.0001	***
2012	-0.25981	0.771196	0.128072	0.0472	**
Area (ha)	0.104701	1.110379	0.00640357	<0.0001	***
Development possibilities (yes)	0.268605	1.308138	0.11088	0.0186	**
Distance to the nearest city (km)	0.062951	1.064975	0.0245442	0.0130	**
Land productivity (index)	0.007726	1.007756	0.00268565	0.0056	***
Access by dirt road (yes)	0.171264	1.186804	0.0961178	0.0801	*
Area&LFA&env (yes) – see Table 1	-0.2339	0.791439	0.124572	0.0655	*
Number of observations	65				
R^2	0.879069				
Corrected R^2	0.864218				
Average for a dependant variable	12.11319				
Standard deviation for dependant variable	0.924049				
ViF[a] average	1.146429				
Doornik-Hansen[b]	8.36531, p = 0.015258				
Shapiro-Wilk	0.956666, p = 0.0230445				
Lilliefors	0.103088, p ~= 0.08				
Jarque-Bera	11.5959, p = 0.00303376				

[a] Variance Inflation Factors; VIF(j) = 1/(1 - R(j)^2).

[b] Last 4 rows present statistical tests for normality of distribution of residuals (we reject H0 that the distribution is normal when p <0.01).

Source: calculated in grelt 1.10.1 programme based on data from registers of characteristics and values of properties kept by Poviat Starosty, cadastral data from the national Geoportal and soil and agricultural maps from the Voivodeship Geodetic and Cartographic Resource.

Model for rural tourism areas (Table 2) is characterised by the best adjustment (R^2=0.88, see Table 1), which proves that the speculative motives are relatively rare for land purchase. The least significant is the area of purchased properties, because its growth by 1 ha increased the price by only 11% (see column EXP in Table 1). For comparison, in areas integrated with a city and peripheral areas it is over 30%. Apart from this, only in this model a growth in the distance to the city has a positive influence on the land price, because thus the environmental rent increases – per each kilometre from the city by ca. 6% and also location near a dirt road. Only in this model the production value of the agricultural complex was statistically significant and had a positive effect on price. But then, the development possibility had the strongest impact on the price growth because it increased the property price by as much as 30%. It is logical, if we assume that the motives for land purchase in these areas are investments in accommodation base, summer cabins or mansions. However, it is the most interesting that the properties with the possibility (tested in practice) to receive additional LFA and environmental payments had prices by ca. 20% lower. This proves that farming limits linked to receipt of this form of payments have a negative impact on the land rent and decrease the possibilities of earning in the field of rural tourism as well. This shows the programme of payments for public goods under the CAP in a bad light, because in rural tourism areas it should be complementary and not substitutional as regards multifunctional rural development. It can be also concluded that these payments are too low and do not compensate for the costs of lost benefits linked to environment-friendly farming. It should be also noted that an intercept – which assuming that other regression coefficients equal zero – shows an approximate of the so-called intrinsic land value or the so-called "worth". In this case there are several dummy variables, whose residual variants are included in the intercept. It least concerns each of the four models, thus comparison of intercepts enables to define the relative worth (intrinsic land value in individual locations). It is interesting that it is the highest in rural tourism areas characterised by valuable natural resources, which are followed by areas integrated with a city (urbanisation rent), and typically agricultural areas, the last ones are peripheral areas.

Model for peripheral areas (Table 3) is distinguished by the strongest marginal impact of area on the price of property – growth by 1 ha increases the price by 33%. Moreover, as it can be assumed, distance to the city and to buildings is of key importance here. A growth in the distance to the city by 1 km lowers the price by ca. 3% and to buildings by as much as ca. 20%. From the perspective of the research target, it is most interesting that in these locations area payments and paradoxically – environmental payments, meet their role and are capitalised in prices of agricultural land. Receipt of area payments increases the price of property by ca. 23%, and area and environmental payments by 36%.

Table 3

Regression results for peripheral areas

Independent variable	Dependent variables: property price logarithm				
	regression coefficient b	EXP for b	standard error	p value	
Const	10.1534	25 678.26	0.0822652	<0.0001	***
2010 (yes)	-0.21872	0.803545	0.113505	0.0548	*
2011 (yes)	-0.12735	0.880425	0.0559672	0.0235	**
Area (ha)	0.285049	1.329827	0.01146	<0.0001	***
Distance to the nearest city (km)	-0.02922	0.9712	0.00648758	<0.0001	***
Distance to buildings (m)	-0.00024	0.999763	7.07341e-05	0.0009	***
Area payment on (yes) – see Table 1	0.209708	1.233318	0.054653	0.0001	***
Area&env. (yes) – see Table 1	0.307492	1.36001	0.0818652	0.0002	***

Number of observations	355
R^2	0.676785
Corrected R^2	0.670265
Average for a dependant variable	10.95707
Standard deviation for dependant variable	0.800178
ViF[a] average	1.076143
Doornik-Hansen[b]	5.7928, p = 0.0552216
Shapiro-Wilk	0.993156, p = 0.106296
Lilliefors	0.041126, p ~= 0.15
Jarque-Bera	4.48144, p = 0.106382

[a] Variance Inflation Factors; VIF(j) = 1/(1 - R(j)^2).

[b] Last 4 rows present statistical tests for normality of distribution of residuals (we reject H0 that the distribution is normal when p <0.01).

Source: as in Table 2.

Model for areas of competitive agriculture (Table 4) is characterised by the fact that property waveform factors (including land layout) are important. It can be explained that large parcels of regular shape facilitate agrotechnical treatments. Apart from that it should be noted that greater distance to the city by 1 km increases the land price by 3%. This is explained by the Thünen's rings theory (Sinclair, 1967; Wigier, 2012), according to which the production results and efficiency per area unit increase along with the distance to the urban centre and decrease in the impact of urbanisation. As a result, the value of land of typically agricultural uses near cities is inversely proportional to its market price. This theory seems to be justified for a given type of rural areas, the more that production profitability is preconditioned by its scale and larger acreages are located further from the cities. It is most surprising that in this model the presence of LFA payments causes such a high drop in agricultural property prices, i.e. by 38%. It can be agreed that the LFA are by assumption characterised by lower profitability of agricultural land, but this programme aims at compensation for difficulties linked to less-favourable farming conditions. Therefore, it can be assumed that the programme does not fully meet its role.

Table 4

Results for areas of competitive agriculture

Independent variable	Dependent variables: property price logarithm				
	regression coefficient b	EXP for b	standard error	p value	
Const	10.3617	31 624,9	0,228027	<0,0001	***
2010	-0.54426	0.580271	0.151515	0.0008	***
2012	-0.472928	0.623175	0.226307	0.0419	**
Area	0.158104	1.171288	0.023218	<0.0001	***
Distance to the nearest city (km)	0.0326636	1.033203	0.0101866	0.0024	***
Waveform factor	0.0525118	1.053915	0.0264091	0.0524	*
Area&LFA (yes) – see Table 1	-0.465631	0.627739	0.191535	0.0188	**
Number of observations	56				
R^2	0.711919				
Corrected R^2	0.676644				
Average for a dependant variable	11.35700				
Standard deviation for dependant variable	0.952673				
ViF[a] average	1.170833				
Doornik-Hansen[b]	8.33389, p = 0.0154995				
Shapiro-Wilk	0.944521, p = 0.0121777				
Lilliefors	0.107954, p ~= 0.1				
Jarque-Bera	10.4555, p = 0.00536549				

[a] Variance Inflation Factors; VIF(j) = 1/(1 - R(j)^2).

[b] Last 4 rows present statistical tests for normality of distribution of residuals (we reject H0 that the distribution is normal when p <0.01).

Source: as in Table 2.

Whereas *the model for areas integrated with a city* (Table 5) shows attributes significant in the Hedonic analysis for rural properties. It is the distance to agglomerations or local metropolises (at the NUTS4 level). Decrease in the distance by 1 km, increases the price by ca. 3%, while the development possibility (increases it by 30%) and distance to buildings (its decrease by 1 km increases the price by ca. 20%) have the strongest impact on the price. It is no surprise then that receipt of the LFA payments and agri-environmental payments decreases the price by ca. 21%, because it reduces the possibility to integrate rural areas with the city and urbanisation rent. It should be also noted that only in this model the prices of agricultural properties in 2010-2012 continued a dynamic increase trend.

Table 5

Regression results for areas integrated with a city

Independent variable	Dependent variables: property price logarithm				
	regression coefficient b	EXP for b	standard error	p value	
Const	10.5595	38 541.85	0.168448	<0.0001	***
2012	0.365197	1.440798	0.0914242	<0.0001	***
Area	0.268104	1.307483	0.0196893	<0.0001	***
Development possibilities (yes)	0.284155	1.328639	0.105855	0.0081	***
Distance to buildings (m)	-0.000209492	0.999791	7.00293e-05	0.0032	***
Area&LFA&env (yes) – see Table 1	-0.236479	0.789402	0.0958439	0.0147	**
Distance to the nearest poviat city (km)	-0.0265165	0.973832	0.0114457	0.0218	**

Number of observations	163
R^2	0.620030
Corrected R^2	0.605416
Average for a dependant variable	10.68202
Standard deviation for dependant variable	0.887121
ViF[a] average	1.159167
Doornik-Hansen[b]	0.521619, p = 0.770428
Shapiro-Wilk	0.992336, p = 0.539156
Lilliefors	0.0447485, p ~= 0.58
Jarque-Bera	0.469044, p = 0.790949

[a] Variance Inflation Factors; VIF(j) = 1/(1 - R(j)^2).

[b] Last 4 rows present statistical tests for normality of distribution of residuals (we reject H0 that the distribution is normal when p <0.01).

Source: as in Table 2.

Conclusions

Research on the determinants of land prices in the SAPS lead to the following conclusions:

- Price volatility is very high, just like the impact of speculations on prices, which are driven by a growing upward trend from the moment of introduction of area payments in 2004. The significance of speculations is relatively slim in rural tourism areas.
- The location factor “type of rural area” is of key significance given its functions. The observation of the sample – broken down by this criterion – showed that the type of rural areas not only changes the location and inclination of the regression function but also signs for some regressors. It is the type of the area that decides whether and how land use values (e.g. area, waveform factor and agricultural complex) and non-agricultural amenities (e.g. development possibilities, distance to a metropolis, intrinsic value, speculations) influence the formation of land price.
- Agricultural policy, especially payments to public goods (SAPS, LFA and AENV), is relatively very important (marginal effects) for shaping the value of agricultural land as compared to other attributes of properties at parcel level.
- Payments to public goods in the form of SAPS, LFA and AENV are capitalised in the land prices only in peripheral areas. In other cases they do not meet their role, and even they decapitalise the land value. In particular in rural tourism areas these programmes should be complementary and not substitutional against multifunctional rural development. The SAPS system already in 2004 launched an upward trend for agricultural land prices in all classes and locations. Thus, expectations regarding an increase in value of land prices are already discounted therein. Therefore, presently, SAPS in most of the locations is not a factor differentiating land value, given its common availability and low requirements regarding its obtaining, and other payments do not compensate for costs of lost benefits linked to alternative possibilities of execution of land rent.

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BAZYLI CZYŻEWSKI
RADOSŁAW TROJANEK
Uniwersytet Ekonomiczny
Poznań

CZYNNIKI WARTOŚCI ZIEMI ROLNEJ W KONTEKŚCIE ZRÓŻNICOWANYCH FUNKCJI OBSZARÓW WIEJSKICH W POLSCE

Abstrakt

Dotychczasowe badania dowodzą, że subsydia oderwane od produkcji kapitalizują się w wartości ziemi rolnej. Większość tych badań prowadzonych w Europie dotyczy jednak sytemu SPS obowiązującego w „starych" krajach członkowskich UE-15, gdzie rozpoznane są marginalne zmiany wartości ziemi w wyniku subsydiowania rolnictwa oraz problem zakresu oddziaływania polityki rolnej na rynki (problem of the incidence of agricultural policy). Natomiast w systemie SAPS, w nowych krajach członkowskich UE-12, kwestie te nie są dostatecznie zbadane. Dlatego też Autorzy podjęli próbę uzupełnienia wskazanych luk, prowadząc badania determinant wartości ziemi w wiodącym rolniczym regionie Polski na próbie 653 transakcji z lat 2010-2013.

Celem badań jest odpowiedź na pytanie, jak wartości użytkowe gruntu, użyteczności pozarolnicze (amenities) i płatności za dobra publiczne kapitalizują się w wartości ziemi w systemie SAPS? Autorzy stawiają hipotezę, że kluczowe dla wartości ziemi są czynniki lokalizacyjne zidentyfikowane według ekonomicznej funkcji danego obszaru.

W pierwszym etapie oszacowano funkcję regresji postaci log-liniowej dla poszczególnych typów gmin wiejskich. W modelu uwzględniono zarówno czynniki cenotwórcze działek, jak i zmienne odnoszące się do polityki rolnej. Zaobserwowano m.in., że jednolita płatność obszarowa pozytywnie wpływa obecnie na wartość ziemi jedynie na obszarach peryferyjnych, natomiast płatności za dobra publiczne w systemie SAPS dekapitalizują wartość ziemi, ponieważ nie rekompensują kosztów utraconych korzyści związanych z alternatywnymi możliwościami realizacji renty gruntowej.

Słowa kluczowe: polityka rolna, regresja hedoniczna, wartość ziemi, dobra publiczne.

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