FARMERS’ PERCEPTIONS OF AGRICULTURAL LAND AFTER ACCESSION TO THE EU - CASE STUDY

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Abstract. Poland’s accession to the European Union and the resulting availability of direct payments to farmland owners increased the prices of agricultural property. The main aim of the study was to identify the most desirable attributes of agricultural property and to verify whether these features affect the prices of traded farmland. The survey was conducted in the region of Warmia and Mazury. A statistical analysis (a multiple regression model of real estate prices was based on the conducted transactions) revealed that the market price of farmland is affected by factors: the location of land relative to rural settlements, soil quality, land fragmentation, forest cover and location of farms in less-favoured areas with natural handicaps for agricultural production. Location was the most robust predictor of agricultural property prices - about 1565.48 PLN/ha. Farmland situated far from rural settlements is associated with higher production costs and lower income. Soil quality was also an important determinant of property prices - about 574.88 PLN/ha. Land fragmentation and forest cover have a negative impact on property prices. Every additional land plot traded in a single notarial transaction reduced the price of 1 ha by PLN 60.88. A 10% increase in forest cover decreases the value/price of 1 ha of farmland by PLN 48.71. The price of agricultural property situated in less-favoured areas with natural handicaps (LFAs) was higher by PLN/ha 363.46 (EUR 1 = 4 PLN). The last attribute results from Poland’s membership in the European Union and participation in the Common Agricultural Policy. The support scheme increased the prices of agricultural property. Results are largely consistent with the findings of international studies. They provide valuable inputs for prospective buyers of agricultural property, investors and developers.

Key words: price of agricultural property, natural handicap.

JEL code: R14

Introduction

There are three groups of factors determining the prices of agricultural property: (a) natural (soil quality, hydrological conditions, landform, climate), (b) spatial and (c) organizational factors (urban development, demographic relationships, transport networks, retail networks, agrarian relations, prices of agricultural products and means of agricultural production, credit market constraints, state agricultural policy, taxes and charges levied on farmers, state-funded investments in agriculture, level of education, availability of agricultural support services).

The Polish real estate market is governed by several legal acts, including the Act on Real Estate Management of 27 August 1997 (Journal of Laws of 1997, No 115, item 741, as amended), the Act on the Management of State-owned Agricultural Property of 19 October 1991 (Journal of Laws of 1991, No 107, item 464, as amended) and the Act on the Formation of the Agricultural System of 11 April 2003 (Journal of Laws of 2003, No 64, item 592, as amended). The first two acts define the basic attributes that have to be taken into account in property appraisals. They include the type and location of property, land-use structure, designation and condition of property (Act on Real Estate Management, Act on the Management of State-owned Agricultural Property). The provisions of the above acts are supplemented by the National Valuation Standards, Interpretative Notes and Provisional Interpretative Notes. The latter instrument has been developed for professional property appraisers. Provisional Interpretative Note V. 4 for the Appraisal of Agricultural Property contains a detailed list of attributes that are taken into account in agricultural property valuation, including type of agricultural land, composition, fertility and agricultural suitability of soil, factors that influence soil’s productive capacity (erosion, suitability for the production of specific crops, soil culture/agricultural condition, ease of cultivation, stoniness), availability of farming production facilities and devices, alternative land use (TNI 2004).

European integration and the implementation of Common Agricultural Policy instruments have led to changes in the structure of farms and the prices of agricultural property. The above processes have expanded the list of factors that affect the prices of traded property. Several studies have attempted to estimate the extent to which support policies increase farmland prices (Lattrufe et al., 2008; Strelecek et al., 2010). Gaian et al. (2012) also investigated the effect...
of institutional factors, including transaction costs, credit market constraints, profitability, contract enforcement, alternative land use and social capital.

The aim of this study was to identify the attributes of agricultural property that are regarded as significant by Polish farmers (after Poland's accession to the European Union) and to determine whether those attributes affect the prices of farmland. The value of agricultural property is determined by legal regulations, physical attributes, location and productive capacity of land. The objective of this study was to determine the significance of various attributes for property market actors.

**Materials and Methods**

The survey was conducted in the region of Warmia and Mazury. The analyzed region has the area of 241.73 km² and occupies 7.7% of Poland’s territory. Population density is 59 persons/km², 40.1% of the region’s population inhabits rural areas, and 15.9% of residents work in agriculture (CSO, 2008). The region is situated in the northern Poland. It borders with Russia (Kaliningrad region) in the North, the region of Pomorze in the West, the region of Kujawy and Pomorze and the region of Mazowsze in the South, and the region of Podlasie in the East.

The model was built with the use of multiple regression analysis to determine the statistical significance of the listed attributes and their impact on the quoted prices of agricultural property. According to many authors (Pawlukowicz, 2007; Hozer et al., 2002), the econometric model (regression analysis, regression model) is a basic statistical tool that supports analyses of trends on the real estate market.

The initial database contained the prices of 1354 agricultural properties traded by private owners and the state in 2008-2010. Preliminary contracts and prices quoted in non-market transactions (donations, inheritance, life annuity) were removed from the database. In the following stage, developed property, property covered by forests, property situated in the direct vicinity of recreational water bodies, property situated in areas zoned for non-agricultural use (recreational, residential, industrial) and property in the vicinity of such areas, property that is subject to an easement, leased property and property that holds mineral resources were also removed from the database. Property intended for other types of land use (industrial, recreational, residential) in the local zoning plan were also removed. The final database comprised transaction prices of 504 agricultural properties (54% transactions involved properties in less-favoured areas and 46% transactions involved properties outside those areas). Data processed in the Statistica v.10 application.

A multiple regression model was used in the study. A general regression model can be expressed by the following formula:

$$\hat{P}_i = \sum_{j} a_j z_{ij} i + \epsilon_i$$

where:
- \( P \) – property price;
- \( a \) – regression coefficient;
- \( z \) – property attribute;
- \( \epsilon \) – random modelled component;
- \( i \) – \( i \)th property attribute;
- \( j \) – \( j \)th property;
- \( t \) – time.

Based on the results, the following attributes were selected to describe the analyzed prices of agricultural property: date of transaction (TIME), location (DIST), area (AREA), fragmentation (FRAG), soil quality (SQ), location in less-favoured areas with natural handicaps (LFAs), landform (SLOP), forest cover (FCOV), percentage of agricultural land (ALAN) and population density (PDEN). Similarly to the study by Sawilow (2011), a time variable was incorporated into the model. Data obtained from orthophotomaps (www.geoportal.gov.pl), the Ministry of Agriculture (www.minrol.gov.pl), the Central Statistical Office and the Land and Building Register.
Table 1

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Aver.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIME</td>
<td>Month and year of transaction between 1 January 2008 and 31 December 2010</td>
<td>19.00</td>
<td>1.00</td>
<td>36.00</td>
</tr>
<tr>
<td>AREA</td>
<td>Area of property in hectares</td>
<td>10.1704</td>
<td>2.0000</td>
<td>49.0200</td>
</tr>
<tr>
<td>FRAG</td>
<td>Number of land plots per transaction</td>
<td>1.7976</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>DIST</td>
<td>Location (distance in kilometres from compact settlements)</td>
<td>1.5952</td>
<td>1.0</td>
<td>3.0</td>
</tr>
<tr>
<td>LFA</td>
<td>Location in and outside less-favoured areas with natural handicaps</td>
<td>0.5615</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>SQL</td>
<td>Soil quality</td>
<td>0.7539</td>
<td>1.00</td>
<td>3.00</td>
</tr>
<tr>
<td>FCOV</td>
<td>Forest cover in the respective municipality</td>
<td>25.99%</td>
<td>4.00%</td>
<td>63.00%</td>
</tr>
<tr>
<td>ALAN</td>
<td>Percentage of agricultural land in the respective municipality</td>
<td>59.26%</td>
<td>20.00%</td>
<td>82.00%</td>
</tr>
<tr>
<td>PDEN</td>
<td>Population density (persons/km2) in the respective municipality</td>
<td>33.06</td>
<td>12.16</td>
<td>80.50</td>
</tr>
<tr>
<td>SLOP</td>
<td>Landform</td>
<td>0.5357</td>
<td>0.0000</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Source: author’s calculations

Research results and discussion

Price distribution, analyzed by the F-test for 10 independent variables and 493 (N-m-1) transactions, was $F=277.8153$ ($F_{crit} = 1.89$). Therefore, the hypothesis that regression coefficients are not significant should be rejected, and an alternative hypothesis should be adopted. The linear model explained total variance of the dependent variable in 73%, and standard deviation of the residuals was determined at $SD=761.76$. The developed model was characterized by satisfactory quality. Five out of ten analyzed independent variables describing property attributes were statistically significant. They were: soil quality (SQL), location in less-favoured areas with natural handicaps (LFA), land fragmentation (FRAG), location (DIST) at significance level $\alpha=0.05$, and forest cover (FCOV) at significance level $\alpha=0.10$ (Table 2). The remaining variables – transaction date (TIME), landform (SLOP), area (AREA), population density (PDEN) and percentage of agricultural land in the respective municipality (ALAN) – were not significant on the analyzed market of agricultural property. The coefficients in the regression model and their statistical significance are presented in Table 2.

Table 2

| LINEAR MODEL |
|--------------|----------------|
| Independent variable | Coefficients | SD |
| CONST.       | 8993.44 | 206.27 |
| LFA          | 363.46 | 88.31 |
| SQL          | 574.88 | 66.31 |
| FRAG         | -60.68 | 23.86 |
| DEST         | 1565.48 | 44.06 |
| FCOV         | -48.71 | 26.84 |
| R2=0.7361    | Adjusted R2=0.7334 |
| SD=761.76    | F=277.82 |

Source: author’s calculations; results were processed in STATISTICA v. 10.

According to Kocur-Bera (2005), the percentage of agricultural property on the local market in the respective municipality (ALAN) can considerably influence farmland prices. On the analyzed market, this attribute was highly correlated with forest cover (FCOV) because both attributes are mutually complementary. The discussed attribute (ALAN) was removed from the model because it was less correlated with price than forest cover (FCOV). The remaining variables were not
highly correlated, and the coefficient of correlation was determined below 0.60.

Location (DIST) was the most robust predictor of agricultural property prices (Abelairas-Etxebarria, Astorkiza, 2012). Farmland situated far from rural settlements is associated with higher production costs and lower income. According to estimates, farm incomes decrease by 4-50% per every kilometre separating farmland from rural settlements (Woch et al., 2011). This attribute was analyzed in view of the distance separating farmland from compact rural settlements where most farm households are situated. A change in farmland location by one category (distance of 2 km towards compact settlements) increases the price per 1 ha by PLN 1565.48 (EUR 1 = 4 PLN). Farmland situated further than 6 km away from compact rural settlements fetched the lower prices.

Soil quality (SQL) was also an important determinant of property prices. This attribute was divided into three quality categories: high quality soils – Class I, II and IIIa arable land and Class I and II meadows and pastures, medium quality soils – Class IIIb, IVa and IVb arable land and Class II and IV meadows and pastures, and low quality soils – Class RV and VI arable land and Class V and VI meadows and pastures. This attribute increased the price per 1 ha of agricultural property by PLN 574.88 (EUR 1 = 4 PLN).

Farmland prices were also influenced by land fragmentation (FRAG). The most desirable for owners are that the property consists of adjacent plots of land that form a single arable field. In analysis, several adjacent plots of land were classified as a single plot, and for properties comprising fragmented land plots, the number of land plots traded in one notarial deed was entered into the database. Land fragmentation (FRAG) has a negative impact on property prices. Every additional land plot traded in a single notarial transaction lowered the price of 1 ha by PLN 60.88 (EUR 1 = 4 PLN).

The price of agricultural property situated in less-favoured areas with natural handicaps (LFAs) was higher by PLN 363.46 (EUR 1 = 4 PLN). The above increase was noted after Poland had joined the European Union when the land situated in less-favoured areas received additional financial support.

In Poland, agricultural property situated in less-favoured areas (LFAs) has been classified by the Institute of Soil Science and Plant Cultivation in Pulawy based on the provisions of Council Regulation (EC) No 1257/99. LFAs are classified mainly based on low land productivity and evaluations of productive farmland that reflect the agricultural potential of natural resources. Farmland is assessed in view of soil quality, climate, landform and hydrological conditions as well as social and economic factors such as employment in agriculture and income per farming unit (Zalacznik D).

The smallest farming unit in LFAs is a cadastral unit in a municipality. Farming units are classified as belonging to a less-favoured area when more than half of agricultural producers in a given cadastral unit cultivate land that falls into one of the three categories of LFAs.

In line with the provisions of Council Regulation (EC) No 1257/99, there are three types of LFAs in Poland:

1) mountainous LFAs situated at altitudes higher than 500 m above sea level (this category covers 197 770 ha of land, i.e. 1.2 % of Polish farmland);
2) hilly LFAs situated at the altitude of 350-500 m above sea level (this category covers 489 140 ha of land, i.e. 3% of Polish farmland);
3) lowland LFAs: lowland Zone I with unfavourable conditions for agricultural production and lowland Zone II with highly unfavourable conditions for agricultural production (both zones cover 8 541 380 ha of land, i.e. 52.3 % of Polish farmland).

In Poland and other EU Member States, efforts are currently being made to develop a new classification system for LFAs (Matthews et al., 2013). The following criteria should be included in the new system: (a) geophysical conditions (soil, climate); (b) harmonization of natural conditions; (c) economic and environmental models; (d) land-use structure; (e) models at NUTS 2 level; (f) reference methods for analyzing water quality (Nitrates Directive); (g) risk of pesticide; (h) identification of high nature value (HNV) farming areas; (i) reference methods for determining the risk of farmland abandonment; (j) reference methods for the classification of remote and peripheral areas; (k) farmland, including permanent grasslands, excluding forests; (l) indicative thresholds for the EU 27; (m) the new criteria should be straightforward, scientifically clear, internationally accepted and formulated as the result of negotiations; (n) the new criteria should not be crop specific (previous criteria included reference crops, such as wheat and corn); (o) common criteria should apply to overall areas and should not deal with eligibility for LFA payments at farm
level (ISPRA, 2007). The new system of common criteria is scheduled for introduction in Poland in 2018.

The last statistically significant determinant of agricultural property prices is forest cover (FCOV). A 10% increase in forest cover decreases the value/price of 1 ha of farmland by PLN 48.71. The effect of forest cover on agricultural production is determined by various factors. In general, the influence of forest cover is manifested in three areas: losses resulting from the spread of invasive species, presence of wild animals near forests, and changes in crop yield resulting from land improvement and climate conditions.

The results of a comprehensive study carried out by the Institute of Soil Science and Plant Cultivation in Pulawy (IUNG), the Forest Research Institute and the Polish Academy of Sciences have confirmed the hypothesis that the influence of forest cover on the yield of primary Polish crops can be diverse and difficult to quantify (Jakubczak and Wolk 1977; Talalaj and Wegorek 1995). Forest cover has a beneficial effect on biomass production in light soils (in particular sandy soils) characterized by low water holding capacity, high permeability and high susceptibility to wind erosion as well as in years with extreme weather conditions, in particular drought and strong freezing winds (Koreleski, 2006). Polish farmers are generally of the opinion that the direct vicinity of forests has a negative effect on agricultural production, and the results of survey confirm this observation. Several studies have demonstrated that crop yields are 60-92% lower in fields located in direct proximity of forests (Talalaj, 1997; Woch, 2001). Cereal yield within immediate reach of the trees is determined by their height and depends on the species of grain and the quality of arable land (Podolski, 2007). In the Polish region of Lower Silesia, damage caused by wild animals reduced the price of agricultural land by 3-10%, and the greatest losses were observed within a radius of 100-300 m from forest boundaries (Koreleski, 2006).

Audited attributes apply to the region of Warmia and Mazury. Region keeps mainly on agriculture and tourism. The research shows that two attributes - the land fragmentation and forest cover, reduce prices of agricultural properties in the study area. The impact of three attributes - location, soil quality and location on less-favoured areas have positive effect on property prices. For farmers from the region of Warmia and Mazury payments from the Common Agricultural Policy is a very important factor in household budgets. Therefore, they are willing to pay for agricultural property situated in less-favoured areas more money.

**Conclusions**

The main aim of this study was to identify the most desirable attributes of agricultural property and to verify whether those features affect the prices of traded farmland. The model was built with the use of multiple regression analysis to determine the statistical significance of the listed attributes and their impact on the quoted prices of agricultural property. The following attributes were selected to describe the analyzed prices of agricultural property: date of transaction, location, area, fragmentation, soil quality, location in less-favoured areas with natural handicaps, landform, forest cover, percentage of agricultural land and population density. Five out of ten analyzed independent variables describing property attributes were statistically significant. They were: soil quality (influence 574.88 PLN/ha), location in less-favoured areas with natural handicaps (influence 363.46 PLN/ha), land fragmentation (the impact of lowering 60.68 PLN/ha), location (influence 1565.48 PLN/ha) and forest cover (the impact of lowering 60.68 PLN/ha). The remaining variables were not significant on the analyzed market of agricultural property on the region of Warmia and Mazury (Poland). A statistical analysis revealed that the market price of farmland is affected by new factors – land plots located in areas with difficult farming conditions (LFAs) are expensive than other, such as Poland’s accession to the EU and the availability of direct payments.

A thorough knowledge of attributes that affect the prices of agricultural property provides valuable inputs for land owners, prospective buyers, investors and developers.

**Bibliography**


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