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Determinants of agricultural land price in Poland – a case study covering a part of the Euroregion Baltic

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Abstract – The main aim of this study was to identify the factors that drive the prices of agricultural property after Poland's accession to EU in regions where agriculture is the predominant mode of production. A statistical model of real estate prices was developed based on the conducted transactions. The key determinants of agricultural property prices were: location of land relative to rural settlements, soil quality, land fragmentation, forest cover in the municipality and location of farms in less-favored areas with natural handicaps for agricultural production. 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. Our results are largely consistent with the findings of international studies. They provide valuable inputs for prospective buyers of agricultural property and investors.

Keywords: agricultural land / characteristics of agriculture property / less-favoured area / land acquisition

Résumé – Déterminants du prix des terres agricoles en Pologne – Étude de cas sur une partie de l'Euro-région Baltique. L'objectif principal de cet article est d'identifier les facteurs influençant les prix des terrains agricoles après l'adhésion de la Pologne à l'Union européenne, dans les régions orientées principalement vers la production agricole. Un modèle statistique du prix des propriétés a été développé, basé sur les transactions réalisées sur le marché. Les facteurs principaux déterminant les prix des propriétés agricoles sont : la localisation des terrains par rapport aux zones d'habitation rurales, la qualité du sol, la dispersion des parcelles, le taux de boisement de la commune et la localisation des exploitations dans les zones moins favorisées qui comportent des handicaps naturels pour la production agricole. Le dernier critère résulte de l'adhésion de la Pologne à l'Union européenne et à la Politique agricole commune. Le système d'aide a provoqué l'augmentation des prix des terrains agricoles. Nos résultats sont, en grande partie, cohérents avec les études internationales dans ce domaine. Ils constituent un apport important pour les acheteurs potentiels de terres agricoles et pour les investisseurs.

Mots clés : terre agricole / caractéristiques de l'agriculture / zone défavorisée / acquisition foncière

1 Introduction

There are two groups of factors determining the prices of agricultural property: natural factors as well as spatial and organizational factors. The latter can be further subdivided into exogenous and endogenous anthropogenic factors. Exogenous anthropogenic factors are relatively permanent (including urban development, demographic relationships, transport networks, retail networks) and susceptible to variation (agrarian relations, prices of agricultural products and means of agricultural production, credit market constraints, State's agricultural policy, taxes and charges levied on farmers, State-funded investments in agriculture, level of education, availability of agricultural support services). Endogenous anthropogenic factors include the size and shape of land plots, land-use structure, location and proximity of transport networks.

According to Marks-Bielska (2013), the main reasons behind the ownership transformations on the Polish farmland market after 1989 were: historically based attitudes toward land and its cultural and symbolic value, socialist heritage (despite the fact that private ownership was widespread in agriculture during the socialist era), a regard for land as a multifunctional good (*e.g.* production factor, natural resource, public good), citizens' and, in particular, farmers' attitudes toward land ownership and agricultural lease, changes in agriculture and ownership rights to improve the efficiency of land management, membership in the EU and participation in the Common Agricultural Policy (CAP), and the availability of various rents. European integration and the implementation of Common Agricultural Policy instruments have led to changes in the structure of farms and prices of agricultural property

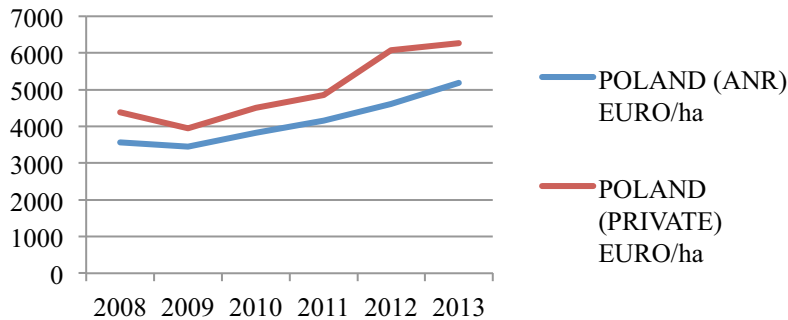*Corresponding author : katarzyna.kocur@uwm.edu.pl

Fig. 1. Average prices of agricultural land in the primary market (ANR) and secondary (private) market in Poland (EUR/ha). Source: own elaboration based on data from the Central Statistical Office.

Fig. 1. *Prix moyens des terres agricoles sur le marché primaire (ANR) et secondaire (privé) en Pologne (EUR/ha). Source : courbes élaborées par l'auteur sur la base des données de l'Office central de la statistique.*

(Latruffe and Le Mouël, 2006; Latruffe *et al*., 2008; Střeleček *et al*., 2010).

The Polish market of agricultural property is subdivided into the primary and secondary markets. The primary market covers farmland sold by the Agricultural Property Agency (ANR), whereas the secondary market is a trading platform for private owners. The average property prices differ between the two markets (Fig. 1) and are approximately 20% higher on the secondary market. In 2016, the Polish farmland market will be opened to foreign clients, and all restrictions on foreign ownership will be eliminated. Those measures are likely to bring sudden changes on the market of traded agricultural property.

The aim of this study was to identify the attributes of agricultural property after Poland's accession to the European Union and to determine whether those factors affect the prices of farmland.

2 Materials

The analyzed region is a part of the Euroregion Baltic (Region of Warmia and Mazury), and it is situated within the Baltic shorelands and lake districts that stretch from Scandinavia, across north-western Russia, Estonia, Latvia, Lithuania, northern Belarus, northern Poland to northern Germany. The region, referred to as the Baltic Green Belt, is an important part of the European system of interconnected natural areas. It spans the area of 241.73 km^2 and occupies 7.7% of Poland's territory. Population density is 59 persons/km^2, 40.1% of the region's population inhabit rural areas, and 15.9% of residents work in agriculture (CSO, 2008). The region is situated in northern Poland. In 2007, the Euroregion Baltic had the following land-use structure: agricultural land: 55.1% (arable land: 36.9%, permanent meadows[1]: 6.9%, permanent pastures[2]: 9.6%, other: 1.7%), forests and wooded land: 32.1%, water bodies: 5.7%,

urbanized and developed land: 3.6%, other land: 3.5% (CSO, 2008). Legally protected areas of high natural value occupy 46.3% of the region. Natural conditions (short growing season, landform and soil differentiation) increase the costs of agricultural production and decrease profitability in comparison with other Polish regions. 83.25% of agricultural land in the region is located in less-favored areas[3] where agricultural production is more difficult due to natural handicaps such as difficult climatic conditions, steep slopes in mountainous areas, or low soil productivity.

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. Transaction prices of property with the area of up to 2 ha were also removed from the database because land plots of this size are often purchased for non-farming purposes. Property intended for other types of land use (industrial, recreational, residential) in the local zoning plan were also removed. The final database (504) comprised 54% transactions conducted in less-favored areas and 46% transactions conducted outside those areas. The average unit price in the database was 3021 EUR/ha, and the median was 3004 EUR/ha. Poland has one of the lowest prices of farmland in the European Union (Fig. 2). The EU can be divided into two groups in respect of agricultural property. The first group

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[1] Permanent meadows: land long covered with vegetation, consisting of numerous species of grasses, legumes and herbs, making meadow sward, regularly mowed.

[2] Permanent pastures: land covered similar to the meadows vegetation, with usually grazing animals; the differences between meadows and pastures are at a level of ground water; this division is used in government registers – the real estate cadastre.

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[3] Less-favored areas: areas where agricultural production or activity is more difficult because of natural handicaps, e.g. difficult climatic conditions, steep slopes in mountain areas, or low soil productivity in other less favored areas. The aid to farmers in Less Favored Areas (LFA) provides a mechanism for maintaining the countryside in areas where agricultural production or activity is more difficult because of natural handicap. Since 1975, it has been a long-standing measure of the Common Agricultural Policy but in Poland the name appeared together with accession to EU.
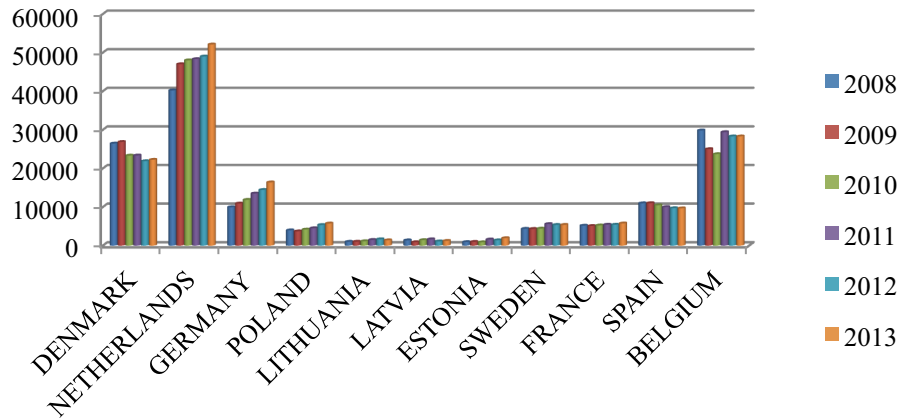
Fig. 2. Average prices of agricultural land in selected European Union countries (EUR/ha). Source: own elaboration based on EUROSTAT data.
Fig. 2. *Prix moyens des terres agricoles dans les pays de l'Union européenne sélectionnés (EUR/ha). Source : étude de l'auteur basée sur les données d'EUROSTAT.*

comprises the "old" EU countries (*e.g.* Denmark, Netherlands, Germany, Belgium) where most transactions take place on the private market, and where average farmland prices have remained high for many years. The second group covers the "new" EU Member States, among them Lithuania, Latvia, Estonia and Poland, where the prices of agricultural property are much lower.

Data for research were obtained from notarial deeds, orthophotomaps, the Ministry of Agriculture and Rural Development, Ministry of the Interior and Administration, Central Statistical Office, the Land and Property Register and GIS.

3 Methods

The experimental data were processed by the hedonic technique which is based on the premise that goods traded in the market are made up of different bundles of attributes or characteristics (Baranzini *et al.*, 2008; Bastian *et al.*, 2002; Combris *et al.*, 1997; Khalid, 2015; Malpezzi, 2003). The hedonic price theory provides little guidance on the appropriate functional relationship between prices and attributes in the hedonic price function (Rosen, 1974). Three kinds of functional forms are frequently adopted in empirical estimations of hedonic price models: linear, logarithmic and logarithmic-linear (Wen *et al.*, 2005). Many researchers prefer to use the so-called semi-log model for various reasons (Malpezzi, 2003; Sopranzetti, 2010). One of the reasons is that the coefficients of a semi-log model can be interpreted as a percentage change in prices (Kolbe and Wüstemann, 2015).

These models can be written in the following form:

$$\ln P_i = a_0 + a_j z_{ij} + \varepsilon_i, \tag{1}$$

where P_i is the price of property i, z_{ji} is the vector of property characteristics, a_{ij} is the vector of the associated coefficients to be estimated, and ε_i is the vector of error terms. Property attributes were selected based on an analysis of the literature and the results of a survey conducted on farmers. The analyzed variables are described in Table 1.

4 Results

In the first stage of the study, the changes in agricultural property prices were analyzed over time between 2008 and 2010. In Figure 3, points reflect transaction prices averaged over subsequent months. The scale of the coordinate axes shows the percentage change in average transaction prices in a given month against the average price in the first month of the examined period. In the analyzed years, property prices remained stable in the Region of Warmia and Mazury. Transaction prices were stabilized after a considerable increase in the first years of EU membership. The slope indicating the percentage change in prices is close to zero (0.0003) because the changes did not occur in the analyzed period.

Price distribution was examined by the Kolmogorov-Smirnov test which makes the assumption that the analyzed variables have normal distribution (Singh and Masuku, 2014). The tested distribution was not statistically significant ($P > 0.05$), and the null hypothesis was confirmed. The F-test for nine independent variables and 494 (N-m-1) cases equaled F = 239.79 (Fcrit. = 1.89), therefore, the hypothesis that regression coefficients are not statistically significant was rejected, and an alternative hypothesis was adopted. The log-linear model explained 70% of total variance in the dependent variable ($R^2 = 0.7036$), therefore, the model was well fitted to the data. Five of the nine independent variables describing agricultural properties were statistically significant: soil quality (SQL), location in less-favorable areas for agricultural production (LFAs), fragmentation of land plots (FRAG), location (DIST) with the significance level of $\alpha = 0.05$, and forest cover in the country (FCOV) with the significance level of $\alpha = 0.10$. The remaining variables – landform, area, population density and the percentage of agricultural land in the country – were not statistically significant in the analyzed market of agricultural property. The coefficients of the hedonic regression model after the elimination of collinear variables and the statistical significance of regression coefficients are shown in Table 2. The variables were interpreted by Cebula (2009) who determined the influence of each attribute according to the below formula:

Table 1. Description of nominal data.

Tableau 1. Description des données nominales.

Attribute	Description	Aver.	Min.	Max.
TIME	Month of transaction between 1 January 2008 and 31 December 2010	19.00	1.00	36.00
AREA	Area of property (ha)	10.1704	2.0000	49.0200
FRAG	Number of land plots per transaction	1.7976	1	14
DIST	Location (distance in kilometers from compact settlements: close: up to 2 km, medium: 3–6 km, far: more than 6 km)	1.5952	1.0	3.0
LFA	Location in and outside less-favored areas with natural handicaps	0.5615	0.00	1.00
SQL	Soil quality[a]	0.7539	1.00	3.00
FCOV	Percentage of forest cover in the respective municipality	25.99%	4.00%	63.00%
ALAN	Percentage of agricultural land in the respective municipality	59.26%	20.00%	82.00%
PDEN	Population density (persons/km^2) in the respective municipality	33.06	12.16	80.50
SLOP	Landform (flat terrain–the average slope of the land to 8°, non-flat terrain)	0.5357	0.0000	1.0000

Source: own elaboration.

Source : étude de l'auteur.

[a] Soil science classification of land in Poland is determined on the basis of the official table of land defining the quality of the soil in terms of its value in use; high soil quality–arable land of class I, II, IIIa (all rich in plant nutrients, are a good natural structure, even at considerable depths, they are easy to grow, permeable, breathable), and pastures and meadows of class I and II (permanent grassland on mineral soils, rich in humus with a permanent structure, airy, permeable and rich in nutrients); medium soil quality–arable land of class IIIb, IVa and IVb (generally obtained on their average yields, even if you are using a good agronomical practice, crop yields largely depend on the amount and distribution of precipitation, especially during the growing season, soil, they often are in worse positions in the terrain, over larger falls and often are exposed to water erosion), pastures and meadows of class III and IV (permanent grassland on mineral soils and silty-peat of the physical and chemical properties worse than in Class I and II, and peat-muck, produced with peat low of regulated water relations); low soil quality – arable land of class R V, VI (light soils and dry, poor water conditions and low level of culture of the soil), and pastures and meadows of class V and VI (permanent grassland on mineral soils, low humus, poor in nutrients, too dry or too humid for most of the growing season, silty-peat and peat, too wet; have an uneven surface, a lot of stones and tree trunks, so their use is difficult).
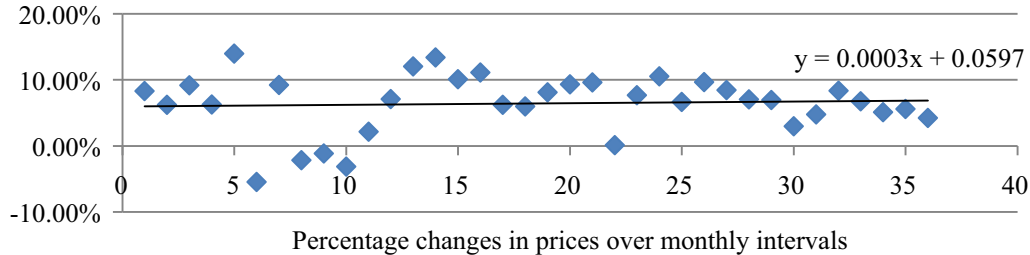

Fig. 3. Trend line showing percentage changes in farmland prices over monthly intervals. The trend index is the slope of the regression line. Source: own elaboration.

Fig. 3. Tendance d'évolution des prix des terres agricoles en pourcentage, à des intervalles mensuels. L'indice de tendance est la pente de la droite de régression. Source : étude de l'auteur.

$$Wa_{ij} = (\exp. a_{ij} - 1) \times 100, \qquad (2)$$

where Wa_{ij}: importance of an attribute, and a_{ij}: regression coefficient.

5 Discussion

Location (DIST) was the most robust predictor of agricultural property prices. 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 kilometer 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. The location-independent variable (DIST) influences transaction prices in 44% on average (holding other things constant). Agricultural properties located up to 2 km from compact rural settlements fetch the highest prices on the analyzed market. Properties located 4 km from compact rural settlements are cheaper by 15%. Properties situated more than 6 km from compact rural settlements fetch the lowest prices and are cheaper from the most expensive plots by 30% (holding other things constant). Soil quality (SQL) was positively correlated with land price as found by Nickerson *et al.* (2012). This attribute was divided into three quality categories: soils of high, medium and low quality. Soil quality influenced transaction prices of agricultural properties in 16%. The prices of land with medium-quality soils were ~5% lower in comparison with high-quality soils and ~5% higher in comparison with

Table 2. Significance of the coefficients of hedonic regression.
Tableau 2. Signification des coefficients de régression hédonique.

	Log-linear model			
Independent variable	Coefficients	SDEV.	*t*-Student	*P*
CONST.	9.1486	0.0172	532.0606	0.0000
LFAs	0.0309	0.0074	4.2021	0.0000
SQL	0.1439	0.0166	8.6804	0.0000
FRAG	−0.0718	0.0278	−2.5774	0.0102
DIST	0.3630	0.0110	32.9477	0.0000
FCOV	−0.0249	0.0134	−1.8526	0.0645
ADJUSTED R^2	0.7036			
SDEv.	0.0635			
Number of observations	504			

Source: own elaboration, data were processed in Statistica v.10.
Source : étude de l'auteur, les données ont été traitées dans l'application v.10 Statistica.

low-quality soils (holding other things constant). Farmland prices were also influenced by land fragmentation (FRAG) as found by Cotteleer *et al.* (2007). This attribute was analyzed based on the number of land plots traded in one notarial deed. Land fragmentation (FRAG) has a negative impact on property prices. It decreases the price of 1 ha by ∼7%. Market prices of farmland situated in less-favorable areas for agricultural production (LFAs) were 3% higher in comparison with plots located outside such areas. The above increase was noted after Poland had joined the European Union (Źróbek, 2014). The LFAs 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. In Poland, agricultural property situated in less-favored areas (LFAs) is classified under 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 (Ministry of Agriculture and Rural Development, 2013). The smallest farming unit in LFAs is a cadastral unit in a municipality. 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 unfavorable conditions for agricultural production, and lowland zone II with highly unfavorable conditions for agricultural production (both zones cover 52.3% of Polish farmland). The new system of LFAs classification is scheduled for introduction in Poland in 2018.

The last statistically significant determinant of agricultural property prices is forest cover (FCOV). This attribute decreases the price of agricultural property by ∼2.5% per unit of area (hectare) when forest cover in a county reaches ∼60%. A 10% decrease in forest cover index increases property prices by ∼0.5%. 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 Polish Academy of Sciences confirmed the hypothesis that the influence of forest cover on the yield of primary Polish crops can be diverse and difficult to quantify (Koreleski, 2006). 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 (Flinn *et al.*, 2005; Koreleski, 2006). Polish farmers are generally of the opinion that direct vicinity of forests has a negative effect on agricultural production, and the results of our survey confirm this observation. Several studies have demonstrated that crop yields are 60–92% lower in fields located in direct proximity of forests (Woch *et al.*, 2011). 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).

The evaluated attributes have influenced the prices of agricultural property. The LFAs criterion is a new attribute, but it exerts a minor impact on farmland prices. As of 2016, foreigners will be able to buy agricultural property in Poland, which could influence farmland prices. In 2008–2013, the prices of agricultural property clearly increased on both the primary and the secondary market. According to statistical data (Fig. 4), foreign buyers do not have a growing interest in Polish agricultural property, although such fears exist among farmers. A number of EU Member States have adopted internal regulations which enable them to control and limit farmland ownership by foreigners. In France, Germany and Sweden, all transactions on the market of agricultural property have to be approved by the responsible authority regardless of the buyer's country of origin. Hungary and Lithuania imposed limits on the size of agricultural holdings that can be purchased by a single buyer. In France, farmland transactions are supervised by local land development and rural establishment agencies (SAFER), whereas in Sweden, agricultural property can be purchased only by individuals. In
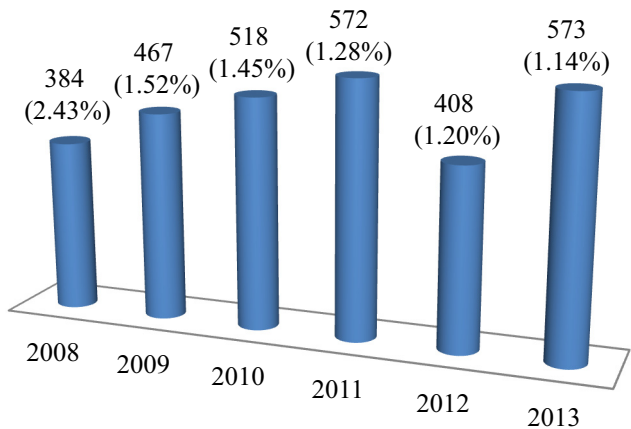
Fig. 4. Land purchased by foreigners in 2008–2013 (in hectares and percentage in the total number of transactions). Source: own elaboration based on the report of the Ministry of the Interior and Administration.

Fig. 4. Superficie des terres achetées par des étrangers de 2008 à 2013 (en hectares et en pourcentage du nombre total de transactions). Source : étude de l'auteur basée sur le rapport du ministère de l'Intérieur et de l'Administration.

Lithuania, legal entities can acquire farmland only if minimum 50% of their revenues are generated by agricultural production, and purchases are limited to 500 ha. In Belgium, Italy and France, farmers leasing agricultural land have a pre-emptive right to buy that land when it is put up for sale (Nurm, 2015). Certain limitations will also be introduced in Poland after the end of the protective period. Farmland will be available only to buyers who intend to use it for agricultural purposes and who have been registered in the municipality (or a neighboring municipality) where the land plots are located for 5 years. The funds allocated to farmland purchases will be scrutinized. The new regulations will be introduced to prevent concentration of farmland, and individuals and legal entities who own more than 300 ha will be prevented from buying more land. The sale of farmland purchased from State agencies within the first 10 years of ownership will be subject to high penalties. Limitations will also be imposed on the number of shares in foreign-owned companies that can be purchased by foreigners. Foreign buyers will have to apply for permission from the Minister of the Interior and Administration to complete such transactions.

6 Conclusion

After Poland joined the EU, Polish farmers began to regard agricultural land as their homestead, work place and investment opportunity. The empirical results of this study indicate that prices on the market of agricultural property in the Region of Warmia and Mazury are influenced by distance, soil quality, location in less-favorable areas for agricultural production, land fragmentation and forest cover. Location and soil quality were the key price drivers. Agricultural properties located up to 2 km from compact rural settlements fetch higher prices than plots located at a distance of more than 6 km due to higher cost and longer time of transport to farmland. High-quality soils also drive up land prices. Plots located in less-favored areas for agricultural

production are also more expensive, and our results revealed that farmers are willing to pay 3% more for such property.

The continued increase in property prices poses a problem for farmers. Polish farmland is attractive for foreign buyers due to its location in the center of the European continent, favorable climate, high scenic value and low prices relative to other EU Member States (Fig. 2). At present, foreign ownership of Polish farmland is very low, and new regulations will provide State authorities with greater control over the market of agricultural property. It should be noted that most EU Member States have introduced internal regulations to better protect national farmland.

This study did not identify all factors that drive the prices of agricultural property, it shed new light on the factors responsible for Polish farmers' changing perceptions of agricultural land after Poland joined the EU. Such analyses should be always performed on a global scale because factors that are directly linked to land value are not always responsible for changes in property prices.

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