Factors affecting the price of agricultural land in Slovakia

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Abstract

Land as a significant natural resource becomes an object of competition on the agricultural land market. The price of agricultural land plays an important role in its acquisition. The process of price formation is influenced by many factors. The aim of the paper is to identify the most significant of them by the econometric model applied on data from the Register of Offers of Agricultural Land. The most significant factors are proportion of the offered area on the total area of the plot and the location of agricultural land with the positive effect on the land price as well as the offered plot area and the distance of the offered plot from a district city with the negative impact on the land price. However, the verification of the correctness of this assumption remains questionable for the present as it is not resolved how to measure and quantify the landowner's subjectivity.

Keywords: agricultural land, land market, land price, land size

Introduction

In classical economics, the price of land is defined as a capitalized rent. However, in the case of agricultural land which is, according to the European Soil Charter (1972), one of humanity's most precious assets, this starting formulation is emended by several factors. The price of land is formed on the land market and thus it depends on the demand and the supply. Šlosár (2004) points out that while the demand for agricultural land is derived from the final products produced on agricultural land, the supply of agricultural land is to some extent influenced by its specific characteristics – limitedness, immobility and abrasion of land (Lazíková and Takáč, 2010).

The issue of agricultural land prices in Slovakia is still topical. It is attested by the fact that the price of agricultural land is in the centre of attention of a number of authors, especially Spišiak and Švoňavec (1999), Duke et al. (2004), Pavličková and Spišiak (2007), Bandlerová (2011), Buday and Grausová (2012), Takáč and Lazíková (2013). There are many publications that analysed the dependence of land prices on political, economic, legal, geographic, environmental and social factors such as farm income, population, credit availability and property tax rates (Devadoss and Manchu, 2007), land type (Feichtinger and Salhofer, 2013), productivity, parcel size, distance

to large cities, population density and income (Huang et al., 2006), plot size, interest rate and the support payments (Latruffe et al., 2008), land quality, infrastructure and structural changes in agriculture (Pyykkönen, 2005), growing housing demand and infrastructural expansion (Swinnen et al., 2009), government payments (Vyn, 2006), farm production and government subsidies (Weersink et al., 1999).

In general, there are two types of agricultural land prices – market prices and administrative prices. The market prices of agricultural land are not surveyed in Slovakia. The Research Institute of Agricultural and Food Economics has been selectively surveying the market prices of agricultural land since 2002 (Buday, 2015). Bandlerová (2011) emphasizes that the problem of the administrative prices lies in the fact that these prices are determined in dependence on the purpose for which they should be set. There is currently no uniform price regulation which would establish a uniform level of agricultural land prices (Lazíková and Bandlerová, 2006). Dirgasová (2016) underlines the fact that nowadays the only relevant source of information on the agricultural land prices is the Register of Offers of Agricultural Land (hereinafter referred to as the Register of Offers), which was created by the Act no. 140/2014 Coll. on acquisition of ownership to agricultural land (hereinafter referred to as the Act on Acquisition of Ownership of Agricultural Land). The Register of Offers is administrated by the Ministry of Agriculture and Rural Development of Slovak Republic. Since 1 June 2014, all landowners (with the exception of cases defined by the legal regulation) have an obligation to publish the offer for the transfer of ownership of agricultural land, including the price required for agricultural land, via the Register of Offers (Lazíková et al., 2015). Drábik and Rajčániová (2014) pointed out that the prices published in the Register of Offers cannot be considered as the market prices since they represent just the supply side of the land market equation. Apart from that, it is not certain whether the potential acquirer will be found and moreover, it is not sure whether he/she will be willing to accept the price requested by landowner. For the purpose of this paper, these prices will be referred to as supply prices.

Materials and methods

The aim of the paper is to map and to identify factors affecting the price of agricultural land in Slovakia (hereinafter referred to as regressors). Within the main objective, three partial objectives were formulated. They include (1) an overview of the issue from the perspective of different authors dealing with the price of agricultural land and factors affecting it, (2) a quantification and verification of selected regressors on the supply price of agricultural land (3) and, finally, an evaluation of the impact of the selected regressors on the supply price of agricultural land.

The impact of the regressors on the supply price of agricultural land was analysed by using an econometric model, the parameters of which were estimated by the least squares method (OLS). The other authors (Morris, 1979; Plantinga and Miller, 2001; Bandlerová et al., 2005; Huang et al., 2006; Lazíková, Takáč and Buday, 2012; Copenheaver et al., 2014; Grausová et al., 2014) used this method for the analysis of the factors affecting the agricultural land as well.

The dependent variable in the econometric model was the supply price of agricultural land. The independent variables entering the model involved: offered plot area (i.e. the size of the plot offered for the sale), coefficient of proportion of the offered plot area, type of parcel in register, type of soil, administrative price of the plot offered, distance of the offered plot from a district city, distance of the offered plot from a regional seat, type of tourism region and, finally, region in which the offered plot is located (Table 1).

Table 1. Overview of variables tested in the econometric model

Variable	Description (assumed impact on the level of price)	Source of data
Supply price	Dependent variable	Register of Offers of Agricultural Land
Offered plot area	Size of the plot offered for the sale in m^2 (+)	Register of Offers of Agricultural Land
Coefficient of proportion of the offered plot area	Coefficient of the proportion of the offered area on the total area of the plot (+)	Own elaboration based on the data from the Register of Offers of Agricultural Land
Administrative price	Administrative price of agricultural land according to the Act no. 582/2004 Coll. (+)	Annex I of the Act no. 582/2004 Coll. on Local Taxes and Local Fee for Municipal Waste and Minor Construction Waste
Distance from a district city	Distance of the offered plot from a district city in km (-)	Website www.vzdialenosti.sk
Distance from a regional seat	Distance of the offered plot from a regional seat in km (-)	Website www.vzdialenosti.sk
Type of soil	Type of soil according to the Decree of the Ministry of Agriculture of the Slovak Republic no. 508/2004 Coll. (-)	Annex VIII of the Decree of the Ministry of Agriculture of the Slovak Republic no. 508/2004 Coll.
Type of parcel register	Categorisation of parcel in register C (+)	Register of Offers of Agricultural Land
Type of tourism region	Location of the plot within tourism regions in Slovakia (-)	Regionalization of Tourism in the Slovak Republic
Region	Location of the plot within regions in Slovakia (-)	Act no. 302/2001 Coll. on Self-Government of Higher Territorial Units

(+) the increasing impact on the supply price of agricultural land is expected with increasing value of the variable,

(-) the decreasing impact on the supply price of agricultural land is expected with increasing value of the variable.

The verification of the presumption that the supply price of agricultural land is affected particularly by the location of agricultural land (Deaton and Norris, 2001; Hopfer and Żuk, 2002; Pavličková and Spišiak, 2007; Tan, 2008; Bański, 2011; Buday, 2011; Marks-Bielska, 2013) was confirmed by two econometric models. The independent variable determining the location of the agricultural land plot was represented by the typology of regions based on the regionalisation of tourism regions (see Equation 1) in Model 1 and the administrative division of regions into NUTS III regions (see Equation 2) in Model 2.

The impact of the selected regressors was analysed based on the data from the Register of Offers during the period from 1 June 2014 to 31 May 2015. There were a total number of 5,811 observations for constructing of the econometric models. The coefficients of the models (Model 1 and Model 2) were estimated by using the STATA 13. This software was used for the verification of the models (Model 1 and Model 2) as well.

The following tests were applied:

- White's test and Breusch-Pagan test for heteroskedasticity,
- Variance Inflation Factor for multicollinearity,
- Ramsey's RESET as a specification test.

Results and discussion

Factors affecting the price of agricultural land

There are many publications dealing with the mutual dependence between the price of agricultural land and various factors – political, economic, legal, geographical, environmental and social. Many authors have tried to map these factors and to quantify the strength of their impact on the price formation. Deaton and Norris (2001), as well as Bański (2011), state that the price of agricultural land depends primarily on the quality, size and location of agricultural land. Another factor added by Buday (2011) is the purpose of the use of agricultural land. One of the important uses of agricultural land is the competitive one. Together with changes in agricultural productivity and speculative influences they are highlighted by Ciaian et al. (2012). Hopfer and Żuk (2002) agree and, at the same time, point out that the price of agricultural land is, apart from the traditional factors (demand, supply, production value and location of the land plot), also affected by the intention of a buyer. He/she perceives the agricultural land as an investment; therefore he/she often supposes that shortly after the purchase the purpose of the acquired agricultural land will be changed from agricultural to non-agricultural. Schwarcz et al. (2013) provides a high land fragmentation, which is typical for Slovakia, as an example of an unusual factor affecting the agricultural land market and the price of agricultural land as well.

One of the authors dealing with the issue of regressors is Marks-Bielska (2013) who identifies location, accessibility, utility, spatial arrangement, level of agricultural development, growing problems, level of pollution, presence of irrigation systems and presence of infrastructure preventing agricultural machinery to access the land as factors that affect the price of agricultural land the most. The author also points out

that a family relation is important regressor in the intention of inheritance. It indicates a tendency of parents to bequeath the agricultural land to young generation – children and grandchildren. Similarly, Copenheaver et al. (2014) points out that the significant determinants that have a decisive impact on the price of agricultural land are not only the total offered plot area and access to water but also family relationships between the seller and the buyer.

The importance of this issue is confirmed by Lazíková (2010) and her research. The author emphasizes the impact of subjective factors on the formation of the agricultural land prices. These factors comprise spatial planning including the risk of expropriation, change of land type, access to water, distance from economic centres, distance from business partners and competitors, and other factors depending on individual preferences. One of the important factors is the price of the especial interest. According to the author, the especial interest means an entirely subjective factor dependent on the subjective preferences of an individual. An example is if the agricultural land is situated in a dream location of the individual and he/she is willing to pay for it a much higher price than the actual price. Blažík et al. (2014) agrees with that and he states that a sale within a family or a speculative sale as one of the forms of subjectivity has a great impact on the formation of agricultural land prices.

Kurowska and Kryszk (2015) state that the price of agricultural land is affected mainly by the limited quantity of the supply. Buday and Bradáčová (2007) agree with that and they see the cause of the big differences in agricultural land prices between the countries in the total area of individual countries. Each agricultural land plot has a different price. Tan (2008) points out that even a similar agricultural land plots may have significantly different prices depending on their location, production potential, artificial fertility resulting from mechanical and capital investment, access to water, connection to irrigation systems, and labour inputs.

Huang et al. (2006) tried to examine the dependence of agricultural land prices on the size and the type of agricultural land plots, their productive potential, urban-rural index, population density, income of farms and the distance of agricultural land plots form the town. The author's research subsequently confirmed that the productivity of the land plot, the type of land, the density of population and income cause the increase in agricultural land price and the size of land parcel, the rurality of the area and the distance from town cause its decline. Similarly, Blažík et al. (2014) defines a relevance of the size of the land plot and the population density in the cadastre as factors with an evident impact on the formation of the price of agricultural land. Grausová et al. (2014) adds that the distance of the land plot from a larger city and the average market price of agricultural land play a significant role as well. Sklenička et al. (2013) identified the distance to built-up areas as a factor with an immense impact on the agricultural land price since the research proved that the agricultural land prices are higher near settlements. Other important factors include the number of inhabitants in municipality, the distance to the capital city, the availability of the land and natural fertility of land. Popelková (2013) points out that the price of agricultural land is not affected just by agronomic indicators (soil quality), but there is also an evident impact of economic, demographic and social indicators (direct payments, distance from the nearest municipality, number of inhabitants in municipality and declining dynamics of the land market caused by the inheritance of agricultural land in families).

Analysis of selected factors affecting the supply price of agricultural land

The econometric model allows the identification and the analysis of the impact of the selected regressors on the supply price of agricultural land in Slovakia.

Model 1:

$$y_i = \beta_0 + \beta_j x_{ki} + \beta_j z_{li} + u_i \quad (1)$$

i= 1,…, 5,608; j=1,…,10; k=1,…,7; l=1,2,3

In Table 2, there is a descriptive characteristic of constituent variables.

Table 2. Descriptive characteristic of quantitative variables entering the Model 1

Variable	N	mean	min	max	p 50	sd
Offered plot area	5,608	4,662.316	0.3043	2,000,000	609	44,959.63
Coefficient of proportion of the offered plot area	5,608	0.298258	0	1.05	0.12	0.361487
Administrative price	5,608	0.248394	0	1.1123	0.1669	0.238223
Distance of the offered plot from a district city	5,608	17.00942	0	62.9	16.1	10.35877
Distance of the offered plot from a regional seat	5,608	61.35961	0	140	57.3	29.85351

N = number of observations; min = minimum; max = maximum; p 50 = median; sd = standard deviation.

The econometric model, which includes all of the above mentioned variables, explains 6.59% of the total variability of the dependent variable. The low coefficient of determination (R2 = 0.0659) may indicate that the independent variables are relevant with statistically significant impact on the dependent variable, but their cumulative impact is relatively low in comparison with the impact of residuals. The increase in the coefficient of determination can be achieved by adding other variables to the model; however, there is a risk that the new variables could not be significant for the model.

Out of all variables that entered the econometric model, the variables of the offered plot area, the administrative price, the distance of offered plot from a district city, the

type of soil and the type of parcel in register are statistically insignificant. Because of that variable – the offered plot area was transformed into the function of hyperbole. After the transformation of the variable and subsequent reinstatement of all variables in the econometric model, the coefficient of determination increased to 0.0677. It means that the econometric model explains 6.77% of variability. The transformation of the variable and its reinstatement to the econometric model also cause that two (heretofore statistically insignificant) variables become statistically significant. After the removal of statistically insignificant variables, the final model is presented in Figure 1.

Source	SS	df	MS
Model	2174.52936	7	310.647052
Residual	29970.136	5600	5.35181
Total	32144.6654	5607	5.73295263

Number of obs	= 5608
F(7, 5600)	= 58.05
Prob > F	= 0.0000
R-squared	= 0.0676
Adj R-squared	= 0.0665
Root MSE	= 2.3134

supply_price	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
transformed_offered_plot_area	-.5469159	.1658133	-3.30	0.001	-.8719742	-.2218576
coefficient_of_offered_plot_area	.7928356	.0890864	8.90	0.000	.6181916	.9674795
distance_from_district_city	-.0073459	.0033463	-2.20	0.028	-.013906	-.0007858
distance_from_regional_seat	-.0054244	.001108	-4.90	0.000	-.0075964	-.0032524
region_with_national_importance	-1.27068	.1595819	-7.96	0.000	-1.583522	-.9578374
region_with_overregional_importa	-1.57133	.1243014	-12.64	0.000	-1.815009	-1.327651
region_with_regional_importance	-1.852498	.1189369	-15.58	0.000	-2.085661	-1.619336
_cons	2.42215	.1354558	17.88	0.000	2.156605	2.687696

Figure 1. Model 1 for dependent variable supply price

Based on the results of Figure 1, it can be concluded that the only factor with a positive impact on the price of agricultural land is the coefficient of the proportion of the offered plot area. All other factors (the offered plot area – as a transformed variable), the distance of the offered plot from a district city, the distance of the offered plot from a regional seat and the type of tourism region) have a negative impact on the formation of the agricultural land price, i.e. the supply price of agricultural land decreases with the increasing value of the variable.

Model 2:

$$y_i = \beta_0 + \beta_j x_{ki} + \beta_j z_{li} + u_i \qquad (2)$$

i= 1,…, 5,356; j=1,…,13; k=1,…,7; l=1,..,7

In Table 3, there is a descriptive characteristic of constituent variables.

Table 3. Descriptive characteristic of quantitative variables entering the Model 2

Variable	N	mean	min	max	p 50	sd
Offered plot area	5,356	4,530.154	0.3043	2,000,000	569	45,797.5
Coefficient of proportion of the offered plot area	5,356	0.283856	0	1.05	0.11	0.353361
Administrative price	5,356	0.244785	0	1.1123	0.12025	0.235307
Distance of the offered plot from a district city	5,356	17.20207	0	62.9	16.1	10.43929
Distance of the offered plot from a regional seat	5,356	62.38574	3.5	140	58.6	29.71189

N = number of observations; min = minimum; max = maximum; p 50 = median; sd = standard deviation.

The econometric model, which includes all of the above mentioned variables, explains 17.76% of the total variability of the dependent variable. Out of 14 variables that entered the econometric model, only three variables are statistically insignificant – the type of parcel register, Trnava region and Nitra region.

The variable of the offered plot area was again transformed into the function of hyperbole. After the transformation of the variable and subsequent reinstatement of all the variables in the econometric model, the coefficient of determination increases to 0.2142. It means that the econometric model explains 21.42% of variability. Analogously, as in the case of Model 1, the adjusted coefficient of determination is higher in the modified model.

The transformation of the variable did not cause any significant change in the statistical significance of the variables. The statistically insignificant variables (the type of parcel register, Trnava region and Nitra region) were removed from the econometric model. The final model is documented in Figure 2.

Source	SS	df	MS
Model	66.3511444	11	6.03192222
Residual	243.892656	5344	.045638596
Total	310.2438	5355	.05793535

Number of obs	= 5356
F(11, 5344)	= 132.17
Prob > F	= 0.0000
R-squared	= 0.2139
Adj R-squared	= 0.2122
Root MSE	= .21363

supply_price	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
transformed_offered_plot_area	-.2718896	.0168638	-16.12	0.000	-.3049495	-.2388296
coefficient_of_offered_plot_area	.0368534	.0089805	4.10	0.000	.019248	.0544588
administrative_price	.2534471	.022453	11.29	0.000	.2094302	.2974641
distance_from_district_city	-.0009477	.0003927	-2.41	0.016	-.0017175	-.0001778
distance_from_regional_seat	.0006288	.000125	5.03	0.000	.0003839	.0008738
type_of_soil	-.0713294	.0091942	-7.76	0.000	-.0893539	-.053305
trencin_region	-.0853313	.0119874	-7.12	0.000	-.1088314	-.0618311
zilina_region	.2505183	.0164705	15.21	0.000	.2182294	.2828072
banska_bystrica_region	-.1048489	.0111474	-9.41	0.000	-.1267024	-.0829954
presov_region	-.1938151	.0124486	-15.57	0.000	-.2182194	-.1694107
kosice_region	-.0549649	.014792	-3.72	0.000	-.0839633	-.0259664
_cons	.3391868	.0122805	27.62	0.000	.3151119	.3632616

Figure 2. Model 2 for dependent variable supply price

Based on the results of Figure 2, it can be concluded that the coefficient of the proportion of the offered plot area, the administrative price of agricultural land and the distance of the offered plot from a regional seat represent factors having a positive impact on the price of agricultural land, therefore the supply price of agricultural land increases with the increasing value of the variable. On the other hand, the offered plot area (as a transformed variable), the distance of the offered plot from a district city, the type of land and the region (there was just one exception, namely Žilina region, where with the price of agricultural land is higher than in the Bratislava region (the reasons and interpretations are described below)) represent factors with a negative impact on the price of agricultural land.

Impact of selected regressors on the supply price of agricultural land

Based on their research, any authors (Tanner, 1968; Gardner and Nuckton, 1979; Deaton and Norris, 2001; Buday and Bradáčová, 2007; Tan, 2008; Bański, 2011; Sklenička et al., 2013; Grausová et al., 2014; Kurowska and Kryszk, 2015) found out that the price of agricultural land is affected by many factors. The creation of the econometric model enables the identification of factors influencing the price of agricultural land in Slovakia. The Model 1 proves that the offered plot area, the coefficient of the proportion of the offered plot area, the distance of the offered plot from a district city, the distance of the offered plot from a regional seat and the type of tourism region play an important role in the formation of the supply price of agricultural land. In the case of Model 2, in addition to the above mention variables, the administrative price, the type of soil and the administrative division of country into administrative regions are also statistically significant variables. It is just Trnava

region and Nitra region that are statistically insignificant. This can be explained by the fact that the quality of soil in those regions is much higher than in the Bratislava region and therefore the price of agricultural land objectively higher there.

Based on the Model 1, it should be concluded that the only regressor that causes an increase in the unit supply price of agricultural land (it means the price which the landowner is willing to accept when selling the land plot) is the coefficient of the proportion of the offered plot area. In other words, the unit supply price of agricultural land is higher if the plot is sold as a whole and not in pieces. However, as a result of fragmentation of agricultural land in Slovakia, it is not possible to demand higher price of agricultural land. The fragmentation of ownership leads to the fact that the price of agricultural land in Slovakia will remain low at least until the land consolidation is be finished in the whole country.

In Model 2, a positive and therefore an increasing impact on the unit supply price of agricultural land was caused by the coefficient of the proportion of the offered plot area as well as by the administrative price and the distance of the offered plot from a regional seat. The model also shows that the unit supply price of agricultural land is higher in the Žilina region than in the Bratislava region. If the results of Model 1, in which it was proved that the location of the land plot within tourism regions in Slovakia has an impact on the price of agricultural land, are taken into account, it can be argued that the higher unit supply price in the Žilina region was greatly influenced by the fact that the area of Žilina region overlaps with the area of tourism regions with the international importance (Liptov region and Severné Považie region) and the area of the tourism regions with the national importance (Orava region and Turiec region).

Due to the applied test, the presence of heteroscedasticity was identified in both econometric models, thus the modification of both models is necessary. It should be useful to add other statistically significant variables – new regressors – to both econometric models. Based on the knowledge acquired both in theory as well as in practice, it can be assumed that the variable that is lacking in the models is the subjectivity of the landowner. Other authors (Hopfer and Żuk, 2002; Pavličková and Spišiak, 2007; Lazíková, 2010; Ciaian et al., 2012; Marks-Bielska, 2013; Popelková, 2013; Blažík et al., 2014; Copenheaver et al., 2014) also state that the subjectivity is the cause of the inaccuracy of their estimates in results of econometric modelling focusing on identification of regressors. The subjectivity and therefore the decision of a landowner on what price he/she wants as the seller of the agricultural land plot may be influenced by the fact whether he/she needs or does not need finances, whether he/she has or does not have any emotional relationship with the offered agricultural land, whether the agricultural land plot would be sold to a close relative or an unknown person, or by personality traits of the individual (e.g. a speculative sale). The correctness of the assumption about the subjectivity as of a missing regressor is confirmed by the fact that the model was applied to data from the Register of Offers and therefore to the supply prices of agricultural land. As it was explained in introduction, the supply price reflects just one side of the land market equation, since due to the Act on Acquisition of Ownership to Agricultural Land, the buyer does not have a chance to bargain for better price of agricultural land and the landowner has an option to set a price that suits him/her.

Conclusions

The aim of the paper was to map and to analyse regressors in the agricultural land market in Slovakia. The application of the econometric model on data from the Register of Offers of Agricultural Land proved that the price of agricultural land is affected by several factors. The most significant from the selected regressors in both models is the coefficient of the proportion of the offered plot area, and therefore the size of the plot offered for the sale. Both econometric models proved that this factor has a positive impact on the supply price of agricultural land and therefore increases the supply price of agricultural land. Despite the fact that each of the econometric models involves a different variable determining the location of agricultural land, both models proved that the location of agricultural land plays an important role in the formation of agricultural land prices in Slovakia. The highest prices are in the regions with the international importance for the tourism (Model 1) or in the most developed regions – Bratislava region and Žilina region (Model 2). Factors having a negative impact on the prices of agricultural land are mainly the offered plot area and the distance of the offered plot from a district city. It is likely that the subjectivity of the landowner is a significant but often neglected regressor. However, the verification of the correctness of this assumption remains questionable for the present as it is not resolved how to measure and quantify the landowner's subjectivity.

Acknowledgements

Results of the paper are based on the research tasks of the Jean Monnet Networks project No. 564651-EPP-1-2015-1-SK- EPPJMO-NETWORK "Sustainable Land Management Network".

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