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SCIENTIFIC PAPER

THE INVESTIGATION OF FACTORS INFLUENCING THE MARKET PRICES OF AGRICULTURAL LAND IN HUNGARY

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Abstract: *The role of land (as the basis and the resource of agricultural production) is the most significant among the resources of production. The ownership of land, its use, the issue of its price and value, they have been key problems of political, social, legal and economic decisions. There were theoretical and practical experts throughout the world, and we intensively have to deal with the issue of land evaluation. In our research using empirical data collection and statistical methods, we examined not only the factors have influenced on land prices, but its effect as well. We have proven that the „golden crown"-based land evaluation system (golden crown is a measurement unit of the quality of agricultural land in Hungary) can show the land quality differences even today, but in spite of this, the results of calculations (and also the practice) increasingly justify and urge the necessity of the introduction of a modern land evaluation system.*
namese professionals graduated in Hungary, the reputation and popularity of Hungarian agricultural products and technologies, the achievements of R&D in the field of agriculture – could not be utilized from Hungarian side. Vietnam, however still preserved its socialist political establishment, but in terms of its economic development strategy and economic policy has gradually been standing on the basis of market orientation. Vietnam, with its population of ninety million shows a rapid and successful development and it means good opportunities even for Hungarian entrepreneurs. It would be a mistake to leave these potentials unused.

Keywords: *agricultural land, market price, land evaluation system, „golden crown"*
(JEL Classification: *Q10, Q24, Q30*)

Introduction

In our days the issue of land evaluation (responsible farming, environmental aspects, and fierce competition) has also gained importance both in developed or transition countries. In Hungary – because of the lack of an operating land market, the emergence of the real market value has been hindered by. That is why the land cannot be used as a collateral security. The research on the economic value of the land has been made by many factors.

The significant importance of land and cost-effective utilization of productivity are important in land evaluating. Land evaluation is important not only on the national economy level, but on the level of individual firms as well.

The transition to a market-oriented economy is a new challenge to the determination of the value of land. The value of land, taxation, credit protections, ownership and leasing are important elements not only in terms of inheritance but also in the agricultural support system as well. In agricultural policy decisions, these factors are necessary to determine the different types of utilization and the efficient allocation. The importance of the topic is also proved by the sustainable strategy of the EU promoting the more responsible utilization of natural resources.

Hungary has one of the lowest prices of arable land in the European Union (Figure 1). The EU can be divided into two groups in respect of agricultural property. The first group comprises the "old" EU countries (e.g. Denmark, Netherlands, Luxembourg, United Kingdom) where average arable prices have remained high for many years. The second group covers the "new" EU Member States, among them Lithuania, Latvia, Estonia, Bulgaria, Romania, Czech Republic, Poland, Croatia, Slovakia and Hungary where the prices of arable land are much lower.

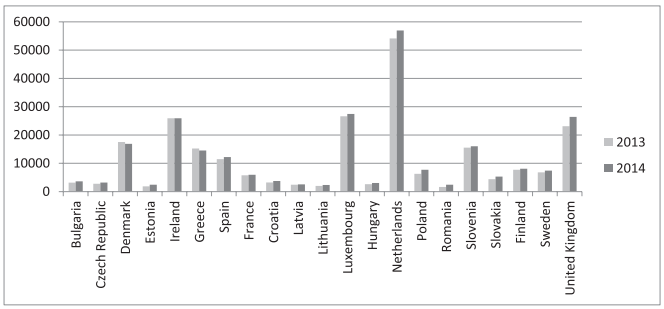

Figure 1: Average prices of arable land in selected European Union countries (EUR per ha) in 2013 and 2014
Source: EUROSTAT (2016), Hungarian data: Hungarian Central Statistical Office (2017)

The average price of arable land approached to € 3,500 per hectare in Hungary in 2015 (Table 1). During the period of 2012 and 2015 the arable land price increased by 13.37% on average per year and its rental rate by 11.15%. The rational decision between land purchase and rent of land is the result of comparing land prices and rents of land. As the land prices are growing more quickly compared to the rent of land in Hungary, the ratio of rent of land to land prices is decreasing in Hungary. The 4.56% ratio as national level equals to 22 years of capitalization. According to STŘELEČEK et al. (2011) the capitalization period in the range of 52–69 years corresponds to the standard of developed European states.

Table 1: Average annual arable land prices and rental rates in Hungary in 2012 and 2015

	Market price for arable land, EUR per ha			Rental price for arable land, EUR per ha		
County (NUTS3)	2012*	2015*	2012-2015** (average annual rate of change, %)	2012*	2015*	2012-2015** (average annual rate of change, %)
Bács-Kiskun	2419	3681	15,02	124	177	12,59
Baranya	2520	3378	10,26	125	183	13,37
Békés	2887	4600	16,80	131	180	11,36
Borsod-Abaúj-Zemplén	1684	2182	9,02	87	114	9,44
Csongrád	2251	3656	17,55	138	166	6,43
Fejér	2872	4289	14,30	125	159	8,14
Győr-Moson-Sopron	2814	4494	16,89	107	165	15,32
Hajdú-Bihar	2827	4479	16,58	130	204	16,14
Heves	1672	2558	15,22	85	127	14,26
Jász-Nagykun-Szolnok	2097	2792	10,02	94	124	9,59
Komárom-Esztergom	2263	3291	13,29	101	142	12,07
Nógrád	1131	2256	25,90	51	74	13,00
Pest	2164	3219	14,16	86	121	12,17
Somogy	2172	3352	15,57	122	173	12,49
Szabolcs-Szatmár-Bereg	1937	3211	18,36	141	190	10,53
Tolna	3007	4048	10,42	166	209	7,95
Vas	2152	3588	18,57	103	140	10,86
Veszprém	2154	2873	10,08	78	105	10,55
Zala	1792	2860	16,86	87	133	15,02
Hungary total	**2379**	**3466**	**13,37**	**115**	**158**	**11,15**

Source: *Hungarian Central Statistical Office (2017), ** author's calculations based on the data from the Hungarian Central Statistical Office (2017)

However, it is important to mention that there are significant differences in prices and price changes, not only between counties, but also within counties as well.

The land prices and rents are influenced by number of factors. The price of a specific arable land is determined by the quality of the soil, the terrain, the size and shape of the board, the properties of the nearby tables, accessibility, distance from the inhabited area and local supply and demand conditions.

An overview of the literature (Latruffe Et Al. 2008, Duvivier Et Al. 2005, Ciaian-D'artis Kancs 2012, Van Herck-Vranken 2013, Swinnen-Vranken 2003) shows that the government support policies have a significant impact on agricultural land prices. MAGDA (2012: 44. p.) notes that „because the supply at a given location is fixed, the price of land depends entirely on the level of demand at that location and governmental subsidies". According to FEKETE-FARKAS et al. (2005) land prices in Central and Eastern European countries have increased at a high rate after the EU Accession because of land market liberalisation and the increasing demand for land for non-agricultural use (transport, industrial green-field investment, urbanisation, increasing demand for recreation areas). Results of meta-regression analysis based on 242 observations from 26 articles reported by FEICHTINGER AND SALHOFER (2013) have shown that, on average, a 10% decrease of agricultural support would decrease land prices by 3.3% to 5%.

According to FEICHTINGER AND SALHOFER (2013) there are two groups of factors determining the prices of agricultural lands: agricultural (internal) factors, which include returns from agricultural production and government payments as well as external factors (variables describing the market, macroeconomic factors and urban pressure indicators).

In this research, we examine the effect of land quality and rent of land on prices of land, and indicators of the demographic (population density) and macroeconomic (unemployment rate, GDP per capita), and as indicators of the input- and output-intensity of arable crop production (organic and fertilizer use, crop yields of major crops) and access conditions (the shortest distance to the county seat, to Budapest, to the railway station, to the highway node). We also analyzed the effect on the price of arable land by analyzing the aggregated data at NUTS3 level.

MATERIAL AND METHOD

Calculations based on the data of the Hungarian Central Statistical Office (2017). Data were aggregated by counties (NUTS3) from the period of 2012-2015.

Land prices and rents of land have been reported by Hungarian Central Statistics Office in HUF, which were converted into euros on average with annual exchange rate of HUF 289.42 per EUR 1 issued by MNB (Hungarian National Bank) in 2012. The use of unified exchange rate was necessary to exclude the distorting effect of changing exchange rate.

The golden crown value is a measurement unit of the quality of arable land in Hungary. The golden crown values were calculated based on the data provided by the Enterprise Analysis Department (operator of Test Farm System – FADN) of Hungarian Research Institute of Agricultural Economics.

We used forward multiple regression analysis to determine the impact of increasing direct payments on land rents.

To econometrically quantify the effect of investigated factors on the market prices of arable land, we estimate the following linear regression model (Equation 1.):

$$LP_{i,t} = a + b_1 Rent_{i,t} + b_2 PopDensity_{i,t} + b_3 Unemp_{i,t} + b_4 GDP_{i,t} + b_5 GC_i + b_6 OrgFert_{i,t} + +b_7 ManufFert_{i,t} + b_8 WheatY_{i,t} + b_9 CornY_{i,t} + b_{10} BarleyY_{i,t} + b_{11} DistSeat_{i,t} + b_{12} DistBud_{i,t} + b_{13} DistRail_{i,t} + +b_{14} DistHighw_{i,t} + \varepsilon_{i,t} \quad (1)$$

where:

$LP_{i,t}$= the estimated price of arable land expressed in euros per hectare in case of the i-th county in year t;

t= 2012, 2013, 2014, 2015;

a= the regression constant;

$b_1, b_2, \ldots b_{14}$= the unstandardized regression coefficients;

$Rent_{i,t}$= the rental price of arable land expressed in euros per hectare in case of the i-th county in year t;

$PopDensity_{i,t}$= the value of population density for the i-th county in year t, measured by the number of human inhabitants per square kilometer;

$Unemp_{i,t}$= the value of unemployment rate for the i-th county in year t, %;

$GDP_{i,j}$= the value of GDP per capita expressed in euros for the i-th county in year t;

GC_i= the average value of the quality of arable land in case of the i-th county, measured in golden crown (GC);

$OrgFert_{i,t}$= the level of the organic fertilizer consumption in case of the i-th county in year t, measured as kilograms per hectare of arable land;

$ManufFert_{i,t}$= the level of the manufactured fertilizer consumption in case of the i-th county in year t, expressed in kilograms per hectare of arable land;

$WheatY_{i,t}$= average wheat yield in the i-th county in year t, expressed in kilograms per hectare of arable land;

$CornY_{i,t}$= average corn yield in the i-th county in year t, expressed in kilograms per hectare of arable land;

$BarleyY_{i,t}$= average barley yield in the i-th county in year t, expressed in kilograms per hectare of arable land;

$DistSeat_{i,t}$= averagae distance to the county seat, in case of the i-th county in year t, km;

$DistBud_{i,t}$= averagae distance to Budapest, in case of the i-th county in year t, km;

$DistRail_{i,t}$= averagae distance to the railroad, in case of the i-th county in year t, km;

$DistSeat_{i,t}$= averagae distance to the highway-node, in case of the i-th county in year t, km;

$\varepsilon_{i,t}$ = error term.

The investigations were continued by fitting the modified Cobb-Douglas function with 14 predictor variables according to Equation 2.

$$LP_{i,t} = a \cdot Rent_{i,t}^{b_1} \cdot PopDensity_{i,t}^{b_2} \cdot Unemp_{i,t}^{b_3} \cdot GDP_{i,t}^{b_4} \cdot GC_{i,t}^{b_5} \cdot OrgFert_{i,t}^{b_6} \cdot ManufFert_{i,t}^{b_7} \cdot WheatY_{i,t}^{b_8} \cdot CornY_{i,t}^{b_9} \cdot Barley_{i,t}^{b_{10}} \cdot DistSeat_{i,t}^{b_{11}} \cdot DistBud_{i,t}^{b_{12}} \cdot DistRail_{i,t}^{b_{13}} \cdot DistHighw_{i,t}^{b_{14}} \quad (2)$$

where the set of variables is the same as in the equation (1). The data processing and statistical analyses were made with the help of IBM SPSS Statistics 23.0 for Windows statistical software package.

RESULTS AND DISCUSSION

The final forward model included 4 explanatory variables (Table 2.).

The land quality value and the population density were not proven to be a significant factor in respect to the arable land price. As regards the other three explanatory variables, the impact of the rental price was the strongest (Beta=0.698). In case of those counties where the rental price is higher by one euro, the market price is higher by 14.8 euro on average.

Explanatory variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	1635,3	252,818			
Rental price for arable land [EUR/h]	14,8	1,052	,698	6,468	,000
Unemployment rate [%]	-87,0	11,314	-,390	14,049	,000
Average Distance to the railroad [km]	-68,5	19,482	-,176	-7,689	,000
Organic fertilizer [kg/ha]	27,5	8,851	,152	-3,518	,001

Dependent Variable: Market price for arable land, EUR/ha; n=76, R2=0.8341, p<0,01

Table 2: Estimation results for Linear Regression Model

Dependent Variable: Market price for arable land, EUR/ha; n=76, R2=0.8341, p<0,01

Source: authors' calculations based on the constructed sample

Unemployment rate is found to have a medium negative impact (the value of the partial correlation coefficient is -0.667) on land prices. One percentage point of growing of unemployment rate on average has led to 87.0 euros decrease of land prices. When the organic fertilizer consumption is higher by one kilogram per hectare it results an average of 27.5 euros higher land price.

There is a negative correlation between land price and the distance to the railroad. If the distance to the railroad is one kilometer longer, it means 68.5 euros lower land price on average.

The correlation analysis showed that at a 95 percent confidence level, there is a weak positive correlation between the Land quality measured in golden crown (GC) and the wheat yield (r=0.228, p=0.048) and barley yield (r=0.313, p=0.006) per hectare. There is no significant relationship between the land quality value (GC) and the corn yield (p=0.225). Land quality (GC) was medium-positively correlated with arable land price (r=0.595, p<0.01).

In addition to a linear model, a following nonlinear model has been elaborated on the basis of the fitting of modified Cobb-Douglas functions (Equation 3).

$$LP_{i,t}=116.2 \cdot Rent_{i,t}^{0.679} \cdot Unemp_{i,t}^{-0.233} \cdot GCt_{i,t}^{0.220} \cdot DistRail_{i,t}^{-0.151} \quad (3)$$

The coefficient of determination, $R^2 = 0.8380$ and the relative standard error, RSE=10.81% meaning that the Cobb-Douglas model is well fitted to the data.

The function exponents (Equation 3) show how land price reacts in percent to one percent change (increase) in predictor variables. One percent rising of rental rate means 0.679 percent increasing rate of land price. Rising of one percent of golden crown value means 0.220 percent increasing rate of land price, one percent rising rate of the distance from the railroad results in a decrease of 0.151 percent of land price. One percent growth of unemployment rate on average means 0.233 percent decrease in land prices.

CONCLUSIONS

At NUTS3 level, the effects of the unemployment rate and the accessibility (average distance to the railway station) on the prices of arable land have been statistically detectable. Based on the results of research the lower aggregate – micro region (LAU 1) – data derived from 2007 (VINOGRADOV 2009), the unemployment rate and the accessibility conditions did not prove to be significant factors in the development of arable land prices. It means that „global" factors (macroeconomic elements, demographic characteristics, infrastructure factors) on land prices should only be set at higher aggregation levels as leverage variables for model estimation of arable land prices. Significant differences in these factors can only be detected on higher aggregation levels.

The review of the Hungarian land evaluation system definitely proved the necessity for replacing the golden crown system, which is more than 100 years old, but still plays a very significant role in the determination of land price because of the lack of better system. Concerning counties there were only rather weak correlations between the golden crown value and the average yield of wheat and barley. There is no significant correlation between the quality of land expressed by golden crown and the yield of corn. Test results suggest that golden

crown values should not be reliably used to signal fertility differences between arable lands. However, it is important to mention that the development of yields is not only determined by the quality of land, but the applied cultivation technology greatly influences the utilization of natural resources as well. The land quality effect on the price of arable land is proved to be significant only in the Cobb-Douglas model. In linear regression model the effect of it was not significant compared to other explanatory variables.

The results of examination were also confirmed by NAÁRNÉ, who reached the same outcomes during her examinations made by own database. According to her calculations there is no strong relation between „golden crown" and land price on the market (NAÁRNÉ 2006).

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.

According to KOCUR-BERA (2016) 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.

SUMMARY

The results of empirical research based on the land market data for Hungarian counties lead to the conclusion that the price of the arable land is determined mainly by the local supply and demand concerning the land. On the higher aggregation level (NUTS3) the impacts of unemployment and accessibility have been also revealed on the price of arable land. Land quality (GC) was positively correlated with land price as found by KOCUR-BERA (2016), NICKERSON et al. (2012), KAPUSZTA (2011).

The rental rate has a significant effect on land price, although the rate of rent and price of the arable land is decreasing in Hungary.

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