



**SZENT ISTVÁN UNIVERSITY, GÖDÖLLŐ**  
**PhD School on Management and Business Studies**

THESES OF DOCTORAL (PhD) DISSERTATION

ANALYSIS OF FACTORS AFFECTING  
THE ARABLE LAND PRICES IN HUNGARY

Written by: Ágnes Kapusztá

Gödöllő  
2011

**THE PHD SCHOOL**

**TITLE:** PhD School on Management and Business Studies

**AREA OF SCIENCE:** management and business administration

**HEAD:** **Dr. István Szűcs**  
professor, doctor of Hungarian Academy of Sciences  
Szent István Univ., Faculty of Economics and Social Sciences  
Institute of Economics and Methodology

**SUPERVISOR:** **Dr. István Szűcs**  
professor, doctor of Hungarian Academy of Sciences  
Szent István Univ., Faculty of Economics and Social Sciences  
Institute of Economics and Methodology

.....  
Approved by the Head of School

.....  
Approved by the Supervisor

## 1. INTRODUCTION

The topic of land evaluation has been widely discussed by theoretical and practical experts both in Hungary and abroad.

The evaluation of land as a concept can mean several activities. On the one hand, it can be the determination of habitat (ecological) value of the soil, on the other hand it can mean the (economic) limitation or estimation of the market value, the price of agricultural land, as well as the evaluation of the interior zone land. These problems differ from each other both in theory and in practice. The determination of the capital value of land is a very complex problem regarding its economic nature as well as its methodological questions.

People have been dealing with the determination of the land value and revenue since the 17th century, the beginning of capitalized production. Not by chance, because the problem of distributing the produced income among the production factors is partly connected to this era. The importance of land evaluation and the significance of knowing the real market prices is highlighted by the permanent efforts to implement responsible farm management, improve environmental protection and upgrade the land use system. New processes and estimation methods are implemented day by day that use increasingly complicated algorithm and consider more and more aspects to determine the land value more and more precisely.

This question is especially important in Hungary because the arable land is an extremely important production factor in the country. In Hungary, the ratio of areas used by the agricultural sector is above 60%, in contrary to the 40% average of the other EU countries. The quality of Hungarian arable land is also highly ranked within Europe. These relatively good conditions are coupled with very unfavourable land use and fragmented land ownership structure, which can considerably hamper the utilization of favourable qualities.

The arable land market in Hungary has not been developed yet – due to several reasons – thus there are not any statistics dealing with real market values. That's why the research projects connected with economic land evaluation are becoming increasingly important.

The market price of land is closely related with its ecological features. The methodology of determining land prices start from the fact that the value of the agricultural land is determined by the demand-supply conditions of products produced on it. Therefore mostly not the analysis of ecological factors but the behaviour of land rent and capital value is in the focus of research [SZÚCS 1998].

There are two large groups of economic evaluation of land. One of the groups includes the land evaluation by returns and the other big group is the estimation of

land value on the basis of the market price of land. The two approaches are closely related to each other. In general, the market price of the land is around the land value based on returns in relation to the demand and supply.

There are three main objectives of my research work:

- Firstly, I intend to analyze the most important factors affecting the land prices because It would provide reliable information for the decision-makers dealing with land issues.
- Secondly, I want to examine the differences regarding land prices between the regions and the role of individual factors causing these differences.
- Thirdly, I want to analyze the land market trends in Hungary during the recent years and whether the land market impacts stimulated the development of optimal combination between production factors.

My hypotheses are as follows:

1. The impact of the main factors affecting the land prices can be quantified and classified according to their weight and – with the help of these tools - the land prices can be forecasted with due precision.
2. There are significant differences between the Hungarian regions concerning the average size of land prices and the role of individual factors significantly differ in the development of land prices.
3. There have not been any considerable changes in the Hungarian land market during the last two decades. The land market has not really helped the development of the real estate structure and the shift towards the size-efficient enterprise structure.

My research is connected with the different research projects going on at the Szent István University. The research work was enhanced by my participation in the research project No. NKFP-2004-4/014 which dealt with the Hungarian adaptation of foreign land evaluation methods.

It was a difficulty in my research work that in Hungary there are only a few or hardly accessible information on land market for the appropriate implementation of quantitative methods. Therefore – in addition to the data collected in the Research Institute of Agricultural Economics - I found it necessary to compile a questionnaire according to my own systematization. I am sure that I can draft well-utilizable research outputs for the experts at the different decision-making levels.

## 2. DATABASE OF RESEARCH AND THE APPLIED METHODOLOGY

The database for verifying my first and second hypothesis was provided by the Enterprise Analysis Department of the Research Institute of Agricultural Economics (AKI) from its test farm system. My data concern only the field crop production farms.

The database consists of average data calculated from the data of the AKI test farm system for the years of 2003, 2008 and 2009. The averages were formed separately by each size category (small, medium and large), microregion and form of business organization (private farms, corporate enterprises).

The size category of farms was determined on the basis of KESZTHELYI and PESTI [2009]. According to this, three size categories (small, medium and large) were defined both in case of private farms and corporate enterprises (Table 1).

Table 1

*Limiting the economic size of farms*

Form of business	Farm size (1000 HUF SFH)	Farm size (EUME)	Size category
private	<= 5000	<=15	Small
	> 5000 - 10000	> 15 -30	Medium
	> 10000	> 30	Large
corporate	<= 20000	<= 60	Small
	> 20000 - 80000	> 60-240	Medium
	> 80000	> 240	Large

Source: own work on the basis of KESZTHELYI-PESTI [2009]

In the first part of the Results chapter I examine the impact of factors influencing the land prices according to my first and second hypothesis. The influencing factors were as follows:

- land quality measured in gold crown (AK/ha),
- wheat yield (t/ha),
- net value added (thousand HUF/ha),
- rental price of arable land (thousand HUF/ha),
- value of fixed assets (thousand HUF/ha), and
- the sectoral revenue from wheat (HUF/ha).

I considered these factors because in the long run the rental price reflects the return-making ability of land, and - through this - its quality and the differences in quality. In spite of the fact that the AK value is still used for expressing the quality differences of plots of land, the AK value as land quality index and the land evaluation system based on this is outdated. The yield of wheat usually shows the

potential fertility of land. The value of fixed assets refers to the production technology applied within the given period. The net value added is suitable for the assessment of income producing capability of farms dealing with field crop production.

The database provided by the Research Institute of Agricultural Economics (AKI) formed the basis of analysis by Cobb-Douglas functions with which I examined the changes of each impact factor involved.

I used the correlation matrix of SPSS program package in order to prove the correlation between the land price and the factors involved in the examination.

The regional differences concerning the average size of land prices were analyzed by one-way analysis of variance (ANOVA). The identity of variance by groups was checked by Levene test. I had to choose post-hoc test (test that serves the definition of groups showing significant deviation). The result of Levene test was significant therefore I used Games-Howell test due to the different variances.

I used the SPSS statistical software package for my investigations. The regression models were performed by applying the Enter method, the essence of which is that all the observation variables are entered into the model in one single step.

The screening of strong linear correlations (multicollinearity) exerted by the explanatory variables on each other is very important in case of multivariate regression models. I used the Variance Inflation Factor (VIF) and the tolerance index to measure the multicollinearity.

The separation of impact factors to direct and indirect impacts is an important addition to the examination of multivariate correlations. The multiple determination coefficient can be divided in a sense that the individual factors affect the land prices directly or indirectly. The distribution of influencing factors was made by the so-called path analysis.

In Hungary there is only little or hardly accessible land market information for the appropriate implementation of quantitative methods. Therefore I made questionnaire survey among the heads of agricultural enterprises in order to prove my third hypothesis. The results after processing the collected data are introduced in part three of Results chapter. The questionnaires were completed partly through internet connections – via email – partly through mailed data collection. I received the data through the agricultural extension agent network.

The objective of the questionnaire survey performed in 2009 was to collect data from the farms dealing with agricultural production concerning the title of land use, the land turnover and its changes. Data were provided by the heads of farms, practical

experts. The empirical size of sample was 428 farms, out of them 299 private farms and 129 corporate farms.

The land turnover was qualified by the respondents for the periods before and after the EU accession. The change of pace of land turnover between the two periods was analysed with the help of Wilcoxon test. Box-plot graphical method was used for excluding the peak values.

When compiling the questionnaires I also tried to collect some quantity data with the help of which the correlation investigations could be performed. The relations between land quality measured in gold crown, rental prices and land prices were analyzed by regression analysis and correlation analysis. I performed association calculations in order to analyze the relation between the business organization form of the enterprise and the ban on land purchase. The calculations were confirmed on the basis of Chi-squared test.

### 3. RESULTS

#### 3.1. Analysis of factors affecting the price of arable land with multiple linear regression model

##### 3.1.1. Nationwide investigations

The object of the analysis was to determine the quantifiable impact of the investigated factors of production on the land prices in order to prove my hypothesis number one. My aim was to achieve to make it possible for the land market players to realistically assess the factors that are particularly affect the land prices.

I fitted a multivariate linear function estimation to the available data set separately for the individual and the corporate farms as well as for national and regional levels. The function is described in the following equation:

$$\hat{y} = a + b_1 \cdot x_1 + b_2 \cdot x_2 + b_3 \cdot x_3 + b_4 \cdot x_4 + b_5 \cdot x_5 + b_6 \cdot x_6$$

where:

$\hat{y}$  = the price of arable land per hectare (HUF / ha);

a = constant;

$x_1$  = rental price of arable land (in thousands of HUF / ha);

$x_2$  = AK value per hectare (AK / ha);

$x_3$  = yield of wheat (t / ha);

$x_4$  = the value of fixed assets (in thousands of HUF / ha);

$x_5$  = net value added (in thousands of HUF / ha);

$x_6$  = the result of the wheat sector (HUF / ha);

$b_1, b_2, b_3, b_4, b_5, b_6$  = coefficients.

It is a methodological feature of matching the function by using the SPSS program that the program identifies the empirical level of significance of the impacting factors making it possible to select those factors which significantly affect the dependent variables. From that point onward in my paper I will only present those function values and variables which have significant impact on the dependent variables.

### **Analysing the private farms**

The fitted linear function in case of private farms and at the national level is the following:

$$\hat{y} = 4528 \cdot x_1 + 5404 \cdot x_2 + 35896 \cdot x_3 + 87 \cdot x_4 - 35278$$

where:

$\hat{y}$  = the price of arable land per hectare (HUF / ha);

$x_1$  = the rental price of arable land (in thousands of HUF / ha);

$x_2$  = the AK value per hectare (AK / ha);

$x_3$  = the yield of wheat (t / ha);

$x_4$  = the value of fixed assets (in thousands of HUF / ha).

The multivariate linear equation can be used to examine how the land prices develop under the impact of different combinations of the individual factors of production. For example the various combinations of the yield of wheat and the AK value resulted the following land prices (assuming all other factors are average):

- wheat yield: 4 t / ha, the AK value: 15 AK / ha → 326 703 HUF
- wheat yield: 4 t / ha, the AK value: 30 AK / ha → 407 763 HUF
- wheat yield: 6 t / ha, the AK value :15 AK / ha → 398 495 HUF
- wheat yield: 6 t / ha, the AK value: 30 AK / ha → 479 555 HUF

According to these calculations, the land price is less dependent on the current equipment supply, which is explained by the fact that the land quality and the yield of wheat take over its role.

On the basis of  $R^2$  (29,3%) it can be declared that the influencing factors have medium explanatory power.

Multicollinearity means linear correlation relationship between two or more independent variables and its measure shows the strength of non-separable impacts of these explanatory variables (SZUCS, 2002). One of the metrics used to measure multicollinearity is the Variance Inflation Factor (VIF), which graphically shows the effects of multicollinearity.

Its value varies between 1 and  $\infty$ , its low value (close to 1) shows weak multicollinearity, and when the value is above 5 it indicates a strong multicollinearity [TALK HUNYADI 2008]. VIF values calculated based on regression models of the

SPSS statistical software package as independent variables were between 1.144 and 1.833, so a weak multicollinearity is indicated what was confirmed by the calculated tolerance indicators too (ranged between 0.545 and 0.874). The reciprocal of the VIF index is called the tolerance index. The tolerance index shows the proportion of the square variance of the explanatory variables which cannot be explained by the other variable factors. Its value is between zero and one. The greater the degree of multicollinearity the closer is the index value to zero. If the tolerance index - rule of thumb – is less than 0.2, then the multicollinearity is significant [KOVÁCS-PETRES-TÓTH 2004].

Table 2

*Multivariate linear estimation function coefficients at national level in case of private farms*

<b>Factors</b>	<b>B parameters</b>	<b>Standardized coefficients</b>
1. Rental price of arable land	4528	0,230
2. AK	5404	0,207
3. Yield of wheat	35896	0,190
4. Value of fixed assets	87	0,123

*Source:* own calculations

As per the table of standardized regression coefficients (Table 2) among the explanatory variables, the impact of the rental price of arable land proved to be the most significant. Other factors that have significant impact on the price of land are: soil quality measured in gold crowns (AK), the wheat yield and the value of fixed assets. Examination of the regression coefficients (Table 2) reveals that HUF1,000 rise in rental price of arable land results an average of HUF 4,528 rise of the land price, when the quality of the land is higher by one AK it means an average of HUF 5,404 higher land price and when the yield of wheat is higher by one tonne per hectare it results an average of HUF 35,896 higher land price while increasing the value of fixed assets by HUF1,000 it makes the land price rise by HUF87.

It is also worth mentioning that the relationship between the price and the rental price of arable land can be reversed: that is, not only the higher rents lead to higher land prices, but the rise of the arable land prices resulting from changes in market conditions can also cause an increase in rental prices. FERTŐ and BAKUCS (2006) investigated the impact of price subsidies on land prices and they found that the increase of the subsidies will also make the land rents more expensive through the increase of land prices.

My opinion is that the relatively high rental prices of arable land compared to the land prices are the result of the strong separation of land ownership and use. MOLNAR (2000) found that the rental system is strengthening in the developed countries. He highlights the following factors which stimulate the strengthening of

the rental system: increase of the economic farm sizes, market, economy and political effects (grants, rental assistance legislation) and modern technology.

### **Analysing the corporate farms**

For the corporate farms I fitted the same multiple linear estimation function to the data set like in the case of individual farms. The fitted linear estimation function regarding corporate farms at national level is the following:

$$\hat{y} = 82951 + 8409 \cdot x_1 + 1348 \cdot x_5$$

where:

$\hat{y}$  = the price of arable land per hectare (HUF / ha);

$x_1$  = rental price of arable land in thousands of HUF / ha);

$x_5$  = net value added (in thousands of HUF / ha).

On the basis of  $R^2$  (38,7%) it can be concluded that the explanatory power of the model is low-medium.

I tested the multicollinearity and the VIF values (1.526 and 1.949) were low enough to avoid the distorting effect on results. That was confirmed by the tolerance indicators (0.513 and 0.655) too.

The separation of impacts of production factors into direct and indirect impacts is an important addition to the examination of multivariate correlations. The multiple determination coefficient can be divided in the sense that the individual production factors exert their impact on the land price (output variable) directly or indirectly. The division of multiple determination coefficient comes out as follows in case of corporate enterprises at national level:

$X_1$	indirect impact:	0,1505 ( $p_1^2$ )
$X_5$	direct impact:	0.1119 ( $p_5^2$ )
$X_1 X_5$	joint impact:	0,1362 ( $2p_1 p_5 r_{x_1 x_5}$ )

$$R^2 = 0,3986$$

$$X_E^2 = 0,6014$$

The rental price and the net value added determined the land price directly in 26% and the joint impact had a share of 14%.

Table 3

*Coefficients of the multivariate linear estimation function at national level regarding corporate farms*

<b>Factors</b>	<b>B parameters</b>	<b>Standardized coefficients</b>
1. Rental fee of arable landj	8409	0,388
2. Net value added	1348	0,334

Source: own calculations

As per the value of the standardized regression coefficients the rental price of arable land and profitability of crop production measured by the net value added was approximately equal weight in the model. The rental price of arable land – like in case of the individual farms – determines the land prices (Table 3).

It is interesting to compare the results with VINOGRADOV's [2009] results, it must be noted however, that in my analysis the private and corporate farms were tested separately, while Vinogradov set up one single model for all farm types. Vinogradov concluded that there is only one single index – the rental price – which has significant impact on the price of arable land, rental prices explained 15.8% of the dispersion of the arable land prices. In my models it was also the rental price that proved to have the strongest effect regarding both the private and corporate enterprises. That is consistent with the nationwide research of Vinogradov. Regarding the quality of land in compliance with the results of NAÁRNÉ [2006] the AK value showed significant effect on the price of land in case of the individual farms, but Vinogradov not detected significant effect of soil quality in relation to land prices.

### **3.1.2. Analysis at regional level**

#### **Tests for private farms**

In case of four regions (Southern Transdanubia, Northern Hungary, Northern Great Plain and Southern Great Plain) the explanatory power of the model is moderately strong. For three regions (Central Hungary, Central Transdanubia, Western Transdanubia) the model proved to have weak explanatory power.

I tested all the developed models for multicollinearity, the possible close interrelation between impacting factors and the VIF values were sufficiently low ( $VIF < 2,3$ ) therefore the multicollinearity did not distorted the results of the models. It was also verified by the sufficiently high values ( $T > 0,44$ ) of the calculated tolerance indices (T).

Table 4

*Coefficients of the multivariate linear estimation function at regional level in case of private farms.*

Regions	Factors	B parameters	Standardized coefficients
Southern Transdanubia	AK	13552	0,555
Northern Hungary	Yield of wheat	105088	0,396
Northern Great Plain	Fixed assets	288	0,411
Southern Great Plain	1. Rental price of arable land	9507	0,544
	2. Value of fixed assets	141	0,281
	3. AK	4307	0,240

Source: own calculations

In case of Southern Transdanubia only the effect of the land quality measured in gold crown proved to be significant (Table 7). Increasing the gold crown value by one unit results an average rise of HUF 13,552 in the expected land price. The wheat yield is a major factor in shaping the land price in the Central Hungarian region. One tonne rise of the wheat yield per hectare increases the expected average land price by HUF 105,088. In the Northern Great Plains region the value of fixed assets proved to be a significant factor in shaping the land price. A thousand HUF higher fixed asset value results an average of HUF 228 higher land prices. In this region the land prices are low and farming is uneconomic. The production quality is determined not only by the yield but also by the supply of fixed assets. The value of fixed assets impacts land prices in the long term through the sector results. Regarding the Southern Great Plains – almost perfectly in accordance with the results of the national-level research - the value of the rental price proved to be the major factor based on the standardized regression coefficients. When the land rent goes up by one thousand HUF it induces an average of HUF 9,507 rise of the land prices. Other factors that have significant impact on the land price development in this region: the value of fixed assets and soil quality measured in gold crowns. Regarding Central Hungary, Central Transdanubia and Western Transdanubia none of the factors proved to be significant.

Analysis of variance was used for investigating the differences between the Hungarian regions regarding the average size of land prices. For the analysis I used data of years 2008 and 2009 from the Research Institute of Agricultural Economics. The significant result of Levene test used for examining the similarity of variances of groups proved that the square variances are not homogenous. The Levene F test is a very robust test which means that the failure of homoscedasticity does not necessarily leads to distorted F values [SAJROS-MITEV 2007]. I had to choose post-hoc test (test for defining groups which show significant deviation) for the examination. The result of Levene test was significant ( $p < 0,01$ ) therefore I picked Games-Howell test due to the different variances.

There are significant differences in the average sizes of land prices among the Hungarian regions. In 2008 there were considerable deviations among the regional average values, except for the average arable land prices in Southern Transdanubia and Northern Hungary, Central Transdanubia and the Northern Great Plain as well as the Northern Great Plain and Northern Hungary, since there was no significant difference between these regions. In 2009, however, great difference could not be seen but in case of Central Hungary and Northern Hungary pair of region. It can be concluded that in 2008, the average land price in the Southern Transdanubian region was higher by 113,92 thousand HUF/ha compared to the land prices in Northern Hungary, by 111,49 thousand HUF/ha compared to the Northern Great Plain, by 157,6 thousand HUF/ha compared to the Southern Great Plain. It is interesting to put these results next to the data of 2009, because the difference decreased by 7,86 thousand HUF/ha between the average land price of the Southern Transdanubian region and the land price of the Northern Hungarian region. The average land price in the Southern Transdanubian region, however, increased in comparison to the Northern Great Plain and the Southern Great Plain (by 45,66 thousand HUF/ha and 21,77 thousand HUF/ha respectively).

Comparing all the regional average prices by pairs, the greatest difference in 2008 could be seen between Southern Transdanubia and the Southern Great Plain - 157,6 thousand HUF/ha to Southern Transdanubia. In 2009, the average land price was higher by 179,37 thousand HUF/ha in Southern Transdanubia than in the Southern Great Plain. It was the greatest difference between the regional land prices.

### Testing the corporate farms

The models have medium explanatory power. Regarding the North Great Plain region, the model has a very strong explanatory power.

The models were tested for the possible multicollinearity between impacting factors and based on the VIF values ( $VIF < 2,8$ ) the multicollinearity had not distorting influence on the results. That was also reaffirmed by the values of the calculated tolerance indices ( $T > 0,36$ ).

Table 5

*Coefficients of the multivariate linear estimation function at the regional level regarding corporate farms*

Regions	Factors	B parameters	Standardized coefficients
Southern Transdanubia	Rental price of arable land	12386	0,672
Northern Hungary	Rental price of arable land	27038	0,876
Northern Great Plain	Rental price of arable land	16242	0,443

Source: own calculations

In Southern Transdanubia, Northern Hungary and Northern Great Plains regions the rental price of arable land proved to be the major factor shaping land prices (Table 5).

The results of the tests carried out at regional level are showing diversity. Regarding the changes of land prices there are different factors which come into prominence at different regions and also by different organizational forms. The land quality had significant impact on land prices in case of individual farms only in the South-Transdanubian region and it also had detectable effect on land prices in the Southern Plains region. While for the corporate farms the rental price uniformly proved to be a significant factor in shaping the land price, regarding the individual farms it only had a significant impact on land prices in the Southern Great Plains.

The regional analysis of VINOGRADOV (2009) confirmed my results that the quality of land has significant impact on the land prices in the Southern Great Plains region. I also detected the significant impact of the land quality on land prices in the South-Transdanubian region, while Vinogradov detected the same in the Central Transdanubian region. According to Vinogradov regarding the Northern Great Plains region there is only one major factor, the rental price which explained almost 53% of all the land price changes, that is in compliance with my results of the corporate farms showing that the rental price has a significant impact on land prices.

### **3.2. Analysis of factors affecting the price of land with Cobb-Douglas functions**

I made examinations concerning private and corporate farms in two regions of Hungary. Small-scale farming is typical in one of the regions – Northern and Southern Great Plain – while the large-scale farming is prevailing in the other region – the Central, Southern and Western Transdanubia. Hereinafter in the paper I refer to these regions as Great Plain and Transdanubia.

I defined these regions according to DÖMSÖDI [2006]. He said that the geographical ratio of small-scale farming is the highest in the Northern and Southern Great Plain due to its stronger agricultural nature and the more widespread traditions of private farming. The geographical „advantage” of large-scale farming remained rather in the Transdanubian region.

I extended my analysis on these area units because I wanted to reveal the possible differences between small and large-scale farming in the factor system affecting the arable land prices. Thus I intend to prove the impact of non-quantifiable factors on the prices of arable land, e.g. the tie to land is stronger where the small-scale farming is more popular. The impact of non-quantifiable factors is also confirmed by the emotional attachment that is often mentioned in the questionnaire among the reasons for selling or buying land.

I matched Cobb-Douglas function with my data set, the formula of which is as follows

:

$$\hat{y} = a \cdot x_1^{b_1} \cdot x_2^{b_2} \cdot x_3^{b_3} \cdot x_4^{b_4} \cdot x_5^{b_5}$$

where:  $\hat{y}$  = price of arable land per hectare (thousand HUF/ha);

a = constant;

$x_1$  = rental price of arable land (thousand HUF/ha)

$x_2$  = AK value per hectare (AK/ha);

$x_3$  = yield of wheat (t/ha);

$x_4$  = value of fixed assets (thousand HUF/ha);

$x_5$  = net value added (thousand HUF/ha);

$b_1, b_2, b_3, b_4, b_5$  = exponents.

I constructed three models in the calculations. Model 1 involved all the above listed factors. The rental price of arable land, the AK value per hectare, the yield of wheat and the value of fixed assets was put in Model 2. In Model 3 I put net value added instead of the yield of wheat. My objective with the three models was to eliminate the interrelations between the individual factors. Later on this approach is valid for the constructed models.

The calculation of parameters of Cobb-Douglas function was made with the help of Solver software of Microsoft Excel program. The target function is the minimum standard error of matching. The variable cells are the constant and the  $b_1, b_2, b_3, b_4, b_5$  parameters. Limiting condition for the parameters:  $\sum_{i=1}^5 b_i = 1$ .

### 3.2.1. Tests for private farms

On the basis of calculated Cobb-Douglas functions I received the following exponents for private farms in case of Northern and Southern Great Plain:

Table 6

*Cobb-Douglas function exponents concerning land price and its affecting factors in case of private farms in the Northern and Southern Great Plain*

	exponents		
	(1.)	(2.)	(3.)
$x_1$ (rental price of arable land)	0,4718	0,4738	0,4846
$x_2$ (AK)	0,3177	0,3175	0,3537
$x_3$ (yield of wheat)	0,0587	0,0586	
$x_4$ (value of fixed assets)	0,1322	0,1501	0,1387
$x_5$ (net value added)	0,0197		0,0231

Source: own calculation

\* (1.) = Model 1, (2.) = Model 2, (3.) = Model 3; here and hereinafter I use these marks for identifying the models.

Examining the individual impact of factors from Cobb-Douglas functions on the basis of Table 6, the impact of rental fee is the most significant regarding the price of the arable land. The exponent belonging to the given factor indicates that 1% higher rental fee will probably be paired with 0,47% higher land price (Model 1.) The individual impact of factors is similar in Models 1, 2 and 3. The rental fee and the AK have the most considerable impact on arable land price in the model. When AK is 1% higher, the land price is expected to rise by 0,3%. The value of exponents belonging to the net value added and the yield of wheat is very low in these models therefore their explanation can be left out.

Table 7

*Cobb-Douglas function exponents regarding the land price and affecting factors in case of private farms in the region of Transdanubia*

	exponents		
	(1.)	(2.)	(3.)
x <sub>1</sub> (rental price of arable land)	0,1646	0,1549	0,2472
x <sub>2</sub> (AK)	0,2827	0,2617	0,5649
x <sub>3</sub> (yield of wheat)	0,5755	0,5366	
x <sub>4</sub> (value of fixed assets)	0,0631	0,0468	0,2183
x <sub>5</sub> (net value added)	-0,0859		-0,0303

Source: own calculation

Examining the individual impact of factors in Cobb-Douglas functions on the basis of Table 7, the impact of the yield of wheat was the most determinant. The exponent belonging to the given factor indicates that 1% higher yield of wheat will probably result 0,58% higher land price (Model 1). The individual impact of factors is similar in Models 1 and 2. In both models the rental fee and the AK has almost the same impact on the price of arable land. The exponents belonging to the fixed assets in these models are so small that their explanation can be left out. As regards Model 3 - compared to the above described two models – the order of importance is the following: the first is AK, the next is the rental fee of arable land the value of fixed assets. When the AK is higher by 1%, the land price is expected to rise by 0,25%.

Comparing the individual impacts of factors on land price from Cobb-Douglas functions concerning the Great Plain and Transdanubia, it can be seen that in case of the Great Plain, the rental fee of arable land is the most significant factor in all the models, while in case of Transdanubia, the yield of wheat is the most determinant factor. The land quality measured in gold crown (AK) is ranked the second most important in the models regarding the Great Plain and Transdanubia – except for Model 3 regarding Transdanubia. It is worth noting, that the yield of wheat is the most determinant factor in the models regarding Transdanubia, while in case of the Great Plain, the exponent belonging to this factor is so small that can totally be disregarded.

### 3.2.2. Tests for corporate enterprises

On the basis of Cobb-Douglas functions, I got the following exponents for corporate enterprises in case of the Northern and Southern Great Plain:

Table 8

*Cobb-Douglas function exponents regarding the land price and affecting factors in case of corporate farms in the region of Northern and Southern Great Plain*

	exponents		
	(1.)	(2.)	(3.)
x <sub>1</sub> (rental price of arable land)	0,2537	0,2505	0,5025
x <sub>2</sub> (AK)	0,0006	-0,0015	0,3763
x <sub>3</sub> (yield of wheat)	0,8353	0,8867	
x <sub>4</sub> (value of fixed assets)	-0,1424	-0,0136	-0,0108
x <sub>5</sub> (net value added)	0,0528		0,2294

Source: own calculation

Examining the individual impact of factors in Cobb-Douglas functions on the basis of Table 8, the impact of the yield of wheat was the most determinant (Model 1 and 2). The exponent belonging to this factor indicates that 1% higher yield of wheat will probably result 0,84% higher land price (Model 1). The individual impact of factors is similar in Models 1 and 2. In these models, the rental fee of arable land – in addition to the yield of wheat – proved to be significant, too. When the rental fee of arable land is 1% higher, the land price will increase by 0,25%. Compared to the previous models, Model 3 results different order of importance: the first is the rental price of arable land and the second is the land quality measured in gold crown. When the rental price of the arable land is higher by 1%, the land price is expected to rise by 0,5% (Model 3).

Table 9

*Cobb-Douglas function exponents regarding land price and affecting factors in case of corporate farms in the region of Transdanubia*

	exponents		
	(1.)	(2.)	(3.)
x <sub>1</sub> (rental price of arable land)	0,1447	0,1896	0,2862
x <sub>2</sub> (AK)	-0,0142	-0,0125	0,4844
x <sub>3</sub> (yield of wheat)	0,9433	0,9458	
x <sub>4</sub> (value of fixed assets)	-0,0167	-0,0102	0,1719
x <sub>5</sub> (net value added)	0,0706		0,0575

Source: own calculation

Examining the individual impact of factors in Cobb-Douglas functions on the basis of Table 9, the impact of the yield of wheat was the most significant (Model 1 and 2) regarding the land price. The exponent belonging to this factor indicates that 1%

higher yield of wheat will probably result 0,94% higher land price (Model 1). The individual impact of factors is similar in Models 1 and 2. Compared to the previous models, in Model 3 the order of importance is the following: the first is AK, the second is the rental price of arable land and the third in rank is the value of fixed assets. When AK is higher by 1%, the land price will increase by 0,48% (Model 3). The exponents belonging to AK in Models 1 and 2, the exponents regarding the value of fixed assets in Models 1 and 2, and the exponents regarding the net value added in Models 1 and 3 are too small, therefore they are not explained.

Comparing the impact of factors in Cobb-Douglas functions concerning the Great Plain and Transdanubia, the order of importance in Models 1 and 2 are the same both in case of the Great Plain and Transdanubia, that is the yield of wheat is the most determinant and the next is the rental price of the arable land. In case of Model 3, there are some deviations: while in the Great Plain the rental price is the most significant factor and AK is ranked the second, the ranking is the just the reverse in the model regarding Transdanubia: here the AK is the most determinant and the rental price is the second among the factors.

### **3.2.3. Comparing the Cobb-Douglas functions regarding private farms and corporate enterprises**

As regards the Great Plain, when comparing the individual impact of factors in Cobb-Douglas functions regarding private farms and corporate enterprises, it can be concluded that the rental price of arable land is the most determinant factor in land prices, while in case of corporate farms, the yield of wheat is the most significant. The second in ranking for the private farms was the land quality measured in gold crown, while for the corporate farms, the rental price of arable land is the second most important factor in the land price. It is clear that AK is a considerable factor in case of private farms while in case of corporate enterprises the exponent belonging to this factor is so small that its explanation can be left out. There is an exception: Model 3 concerning the corporate farms, where the land quality measured in gold crown is ranked the second in the order of importance among the factors. Two factors proved to be significant in case of corporate enterprises, while in case of private farms the third factor – the value of fixed assets – was also considerable.

In case of Transdanubia, when comparing the individual impact of factors in Cobb-Douglas functions regarding private and corporate farms, the most important factor in land price is the yield of wheat in Models 1 and 2, both in case of private farms and corporate enterprises. AK was the most considerable factor in Model 3, both in case of private and corporate farms. While AK is ranked te second in the order of importance concerning private farms, this factor has no impact on land price at all in case of corporate enterprises, because its exponent is insignificant. As regards corporate enterprises, the second is the rental price of arable land. The order and weight of factors is identical in Model 3 regarding both the private farms and corporate enterprises.

In order to prove my first hypothesis I also examined the role of individual factors in land price concerning all the farms in national level. For this purpose I transformed Cobb-Douglas functions into logarithmic form. The results are summarized in Table 10.

Table 10

*Percentage distribution of impact of individual factors concerning all the farms at national level*

Influencing factors	Percentage distribution of impact of factors
Rental fee (thousand HUF/ha)	49,04
Land quality (AK/ha)	13,46
Yield of wheat (t/ha)	36,19
Value of fixed assets (thousand HUF/ha)	0,44
Net value added (thousand HUF/ha)	0,87
Price of arable land (thousand HUF/ha)	100

Source: own calculation

According to the calculations, the price of arable land depends the most on rental fee (49,04%), then the yield of wheat (36,19%), and land quality (13,46%).

On the basis of calculations and analyses it can be concluded that the impact of factors influencing land price is provable through regression calculations and the analysis of variance helps to reveal that there are significant differences among the Hungarian regions concerning the average size of land prices. Moreover, the influencing factors can be ranked on the basis of Cobb-Douglas functions, therefore my first and second hypothesis is proved.

### **3.3. Analysis of changes on the land market**

#### **3.3.1. Changes on land market in Hungary, following the EU integration**

As the result of the compensation and land privatization processes that were started in the early 1990s, the private ownership of arable land was restored in Hungary. The reformed land ownership system was very fragmented, the average size of land owned by one person was hardly 2 ha. As opposed to this, the land use system was strongly concentrated: the average size of agricultural area cultivated by private farms increased by 54% between 2000 and 2010 and reached 4,6 ha, while the corporate farms had 337 ha agricultural areas on average in 2010 (ÁMÖ, 2010). In general it can be stated that the arable land in Hungary is not owned by those who cultivate it, that is the land ownership and land use is clearly separated.

The restructuring of land ownership system is hampered by the currently valid legal restrictions. Following the EU accession, Hungary can extend the ban on land purchase by foreign private and legal entities for ten years (until 2014). Hungary got

this temporary derogation from the EU regulation concerning free movement of capital –first for seven years, then for another three years – in order to ensure more advantageous conditions for the Hungarian producers to purchase land, thus improving the heavily fragmented land ownership system and enhancing the increase or concentration of farms with competitive size. The incomplete privatization and compensation processes also justified the necessity of derogation.

### Land turnover in Hungary

The land turnover in the two periods – for ten years before the EU accession and six years following the accession – was qualified by the respondents on the basis of four categories: not at all, slow, increasing pace and quick (Figure 1). I examined the significance of land turnover speed between the two periods with Wilcoxon test. The result of the test is not significant, therefore it cannot be statistically proved whether the respondents experienced some changes in the land turnover following the EU accession. More than 60% of the respondents considered the land turnover slow in both of the two examined periods.

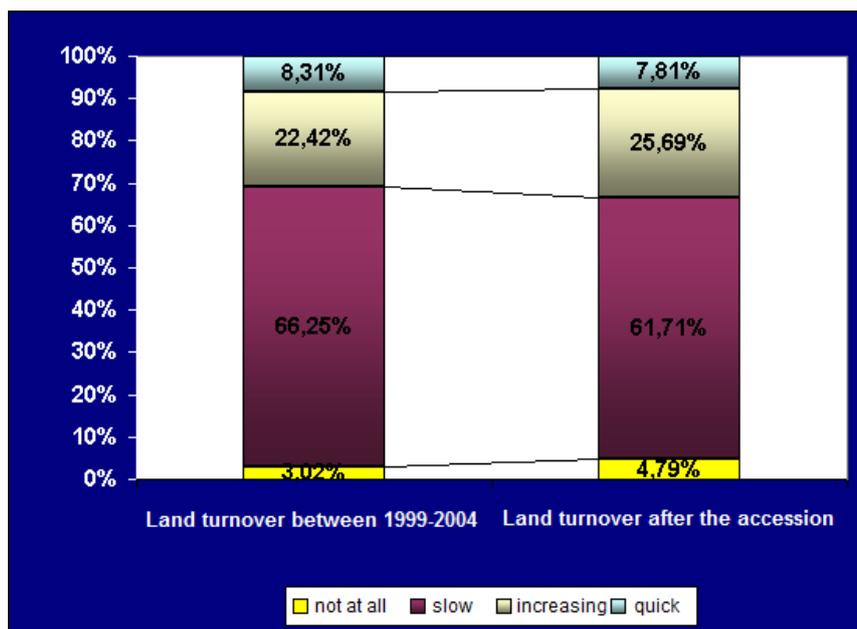


Figure 1. Land turnover in Hungary in the 10-year period prior to the EU accession and in the years following the accession

Source: on the basis of own data

More than half of the private farms (173 farms) participating in the survey has recently bought arable land. The average size of the purchased land was 16,8 ha. 63% of farmers bought arable land from the lessor.

I got the following order of importance concerning the objectives of land purchase when I examined the reasons given by the responding private farms:

1. land speculation;
2. reaching a competitive farm size;

3. better utilization of assets and labour capacities;
4. utilizing the favourable land purchase possibility;
5. preserving the assets (investment);
6. fodder supply for the animal stock;
7. using land-based subsidy.

### 3.3.2. Changes of returns on land and land rental fees in Hungary

Figure 2 demonstrates the differentiation of arable land prices by each Hungarian region. The significance of relations between region and land price was statistically proved with the help of one-way analysis of variance (ANOVA). The received p-value = 0,001.

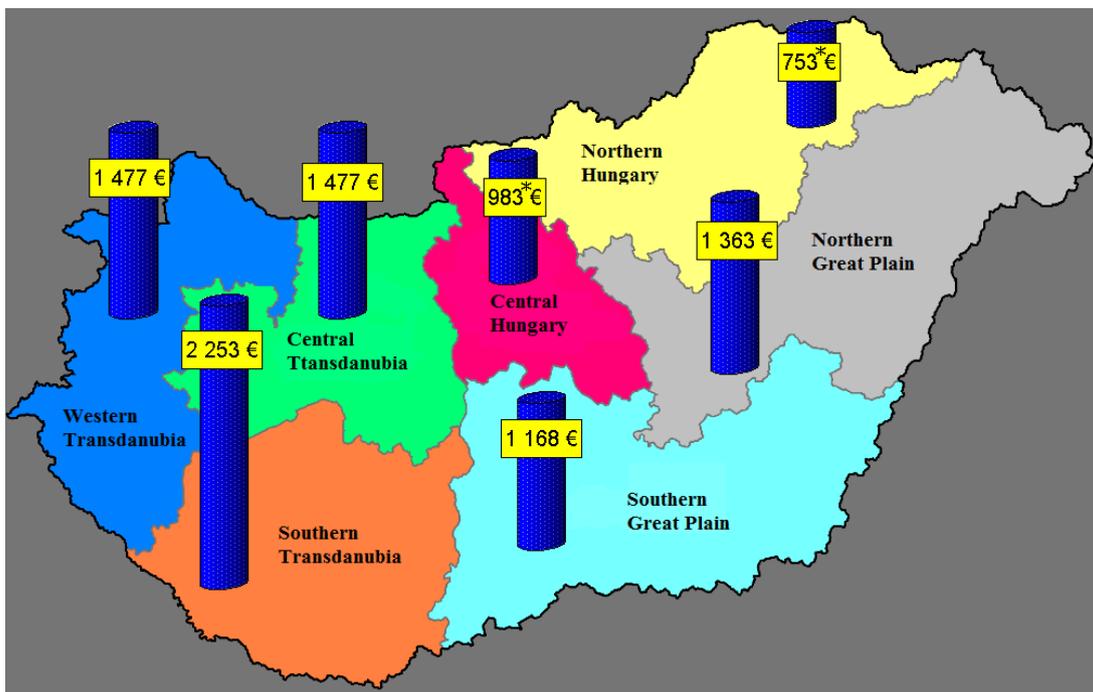


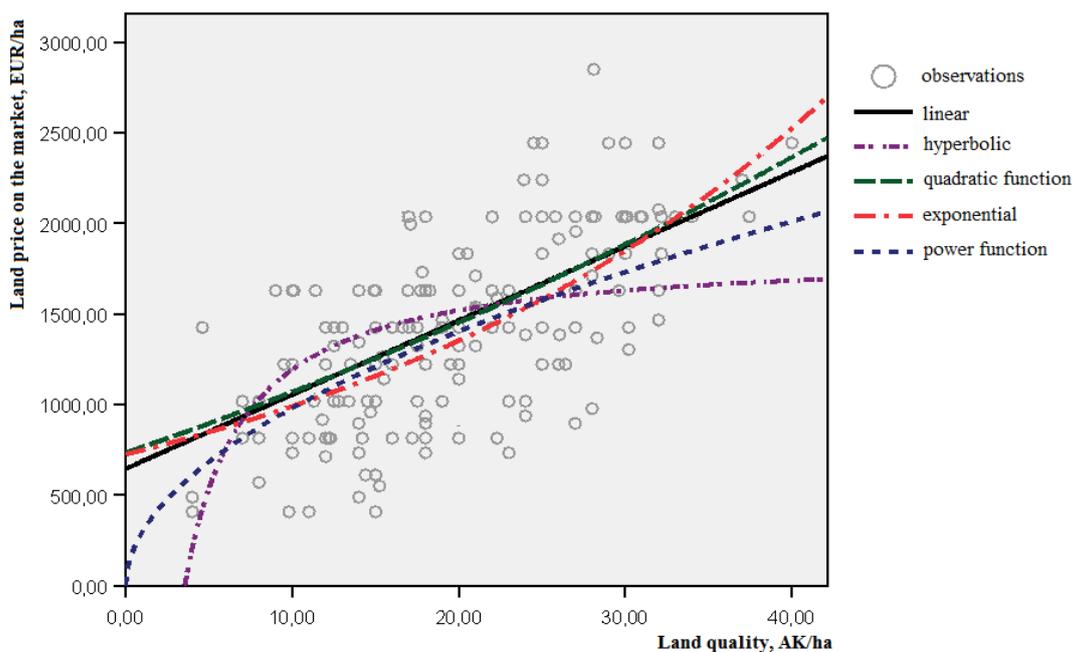
Figure 2. Current arable land prices on average by Hungarian regions, EUR/ha

Source: own data

\*size of empirical sample is small

I used Box-plot graphical method in the further examinations in order to exclude peak values. I determined the maximum level of land prices in 3000 EUR, higher land prices could be observed mostly in case of land purchases with speculative purpose, when the arable land was to be classified as interior zone property. The prices of arable land could have reached 1-2 million HUF per hectare since the beginning of the analysis.

I tried to analyse the relation between the land price on the market and the land quality by using linear and non-linear (hyperbolic, second-degree parabola, exponential and index) function (Figure 3).



*Figure 3.* Land market prices (EUR/ha) in relation to land quality measured in AK

*Source:* on the basis of own data

The relation in all the types of functions is significant but the model based on exponential function matching has the strongest explanatory power ( $R^2=27,0\%$ ). When the land quality measured in AK is increased by one unit, the land price on the market grows by 3,2%. Although the relation can be regarded significant, the land quality gives only one-fourth explanation for the arable land prices, the impact of other factors here is 73%. The result of the examination shows that the „euro-rate” of gold crown cannot be regarded constant, otherwise the arable land price would be the linear function of land quality. The outcome of ANOVA analysis ( $p<0,01$ ) proves that the arable land prices given in euro AK show significant differences between the regions in Hungary.

The results of my examination were also confirmed by Naárné, who reached the same outcomes during her examinations made on her own database. According to her calculations there is no strong relation between AK and land price on the market [NAÁRNÉ 2006].

Analysing the relations between the land quality measured in gold crown and the rental fees, all – but hyperbolic – types of relations were proved to be significant in case of arable land. Although the highest explained ratio ( $R^2= 8,9\%$ ) in case of second-degree polynomial refers to the fact that land quality affects the rental fees only to a small extent.

The results of other research [SZÚCS 1999] indicate that there is not always close correlation between land quality and rental fee. In my opinion, it can also be due to

the fact that in many cases the profitability of farming is not so important in land rental fees, but rather the bargaining position of lessor and tenant: the bigger land users of a neighbourhood can join forces against the large number of land owners in order to keep the rental fees low. The rental fees are greatly affected by the direct land-based subsidies, too: the lessors want to have shares from the subsidies given to land users, and, last but not least, the size of the rental fee depends on the accessibility, irrigation possibilities on the land, etc.

Data of Table 11 demonstrate that following the EU accession the pace of price increase considerably declined from an annual average of 25-28% to an annual average of 8-11% in case of arable land. The growth of rental fees also decreased: from an annual average of 8,1-9,5% between 1994-2004 to an annual average of 6,9-9,1% during the period following the EU accession. As it is obvious, in the period following the accession the pace of price growth was close to that of rental fees. It means that the ratio of land rental fees to land price can be regarded almost constant at present, while during the 10-year period before the accession, the ratio of rental fee considerably declined. .

Table 11

*Changes of market prices and rental fees in case of arable land sector in the 10-year period before the accession and during the years following the accession*

Changes of land prices on the market			Changes of land rental fees		
between 1994-2004	since the accession		between 1994-2004	since the accession	
%	%	EUR/ha	%	%	EUR/ha
810,71-1058,38	26,78-34,71	173,24-277,30	118,06-148,24	22,11-29,69	8,14-14,70

Source: on the basis of own data

The rational decision between land purchase or land rent is the result of comparing land prices and land rental fees. The ratio of land rental fees to land price is high in Hungary, the 6,5% ratio at national level corresponds to 15 years of capitalization. The return time on capital invested in land purchase is shorter, it can be expected in 15 years, which encourages the farmers to buy land, and the lessors are interested in keeping their land properties. If the land prices grew more quickly compared to the land rental fees, this situation would change. It can be achieved only by the intensification of the turnover and higher profitability of agricultural production.

It is important to note that in spite of the fact that the land prices and land rental fees grow at a slower pace, the real price growth is positive in case of both land market value-categories, which is due to the fact that the average annual pace of growth is above the pace of inflation growth in the given year.

At the beginning of the 1990s, there was an almost function-like, deterministic relation between the quality of arable land measured in AK and its price, because – according to the Act of 1991 – the size of compensation was fixed on the basis of cadastral net income: 1 AK corresponded to 1000 HUF (Act No. XXV of 1991, 13. §), and the minimum auction price for land was 500 HUF/AK.

In spite of the fact that the land prices and land rental fees are still given for one AK, the „rate” of one AK in HUF or EUR is very varying. As the result of this – in case of arable land sector - a weak correlation was revealed between the land quality measured in AK and the arable land prices on the market. In my opinion, it refers to the fact that on the one hand, AK does not always properly reflects the quality of land and, on the other hand, the impact of other factors, e.g. accessibility, irrigation possibilities on the land, etc. is also considerable.

### **3.3.3. How the legal restrictions on land turnover affected the market of arable land in Hungary**

I was investigating whether the agricultural producers consider the ban on land purchase necessary or not and what are the reasons for their opinion.

#### **Legal restrictions on land turnover in Hungary**

In order to forecast the possible impacts of withdrawing the legal restrictions first I examined the farms participating in the survey according to their approach to the land purchase ban imposed on foreigners. Regarding the association connections between the farm's form of business organization and the attitude to the ban (Figure 4) the result of Chi-square test was strongly significant ( $p < 0,01$ ). However, the value of Cramer coefficient (0,171) indicating the power of the relation referred to a weak relation. There was a statistically weak relation between the business organization form of the enterprise and the contribution to the land purchase ban concerning the foreigners. Most of the executive heads in both of the farm groups agree with the ban, but in case of corporate enterprises the ratio of those „disagreeing” is relatively higher (14,5%) compared to the private farms (4,6%). It can be explained with the fact that the private farmers have stronger affection for the land, which is also proved by their responses: the heads of private farms often reacted to the question with strong emotions.

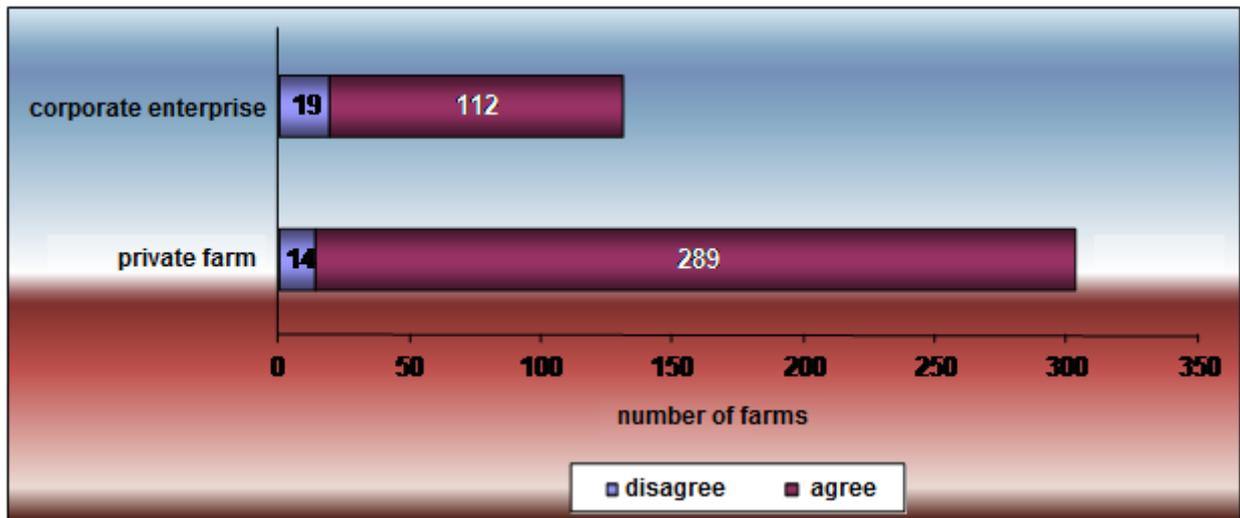


Figure 4. Number of farms on the basis of their attitude to land purchase ban concerning the foreigners, by farm categories

Source: on the basis of data from own survey

I also examined how the regional location of respondents affect their relation to the legal restrictions on land purchase by foreigners. According to my hypothesis, the representatives of the economically more backward regions (Northern Hungary, Northern Great Plain, Southern Great Plain) were more liberal concerning the question, because the land purchase could be an important – if not only - form of foreign capital investment. I could not prove this hypothesis on the basis of sample data (Figure 5): the result of the Chi-square test ( $p\text{-value} = 0,753$ ) does not offer a statistically proved relation between the regional location and the attitude to the ban.

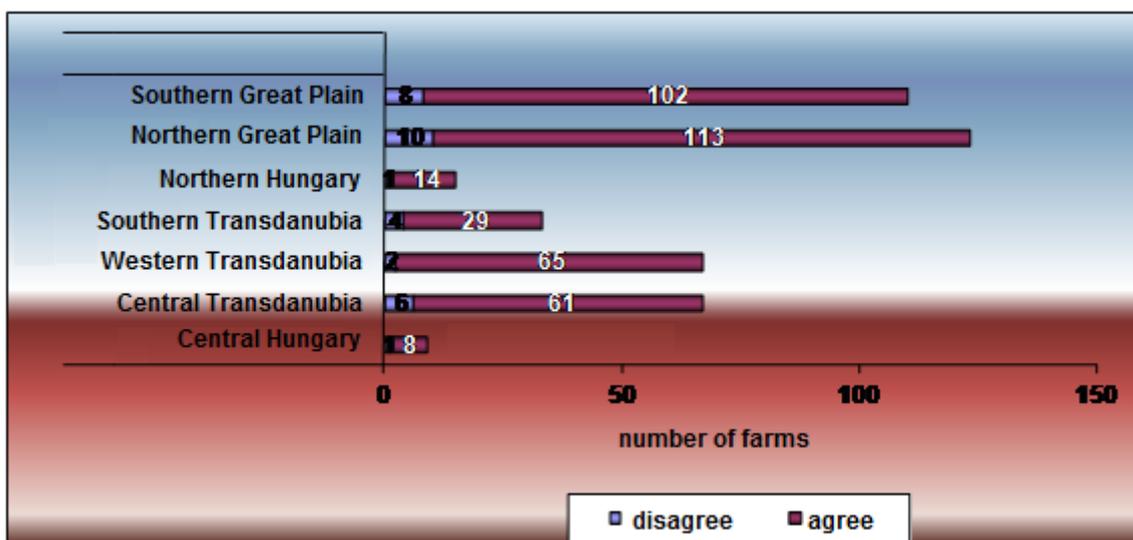
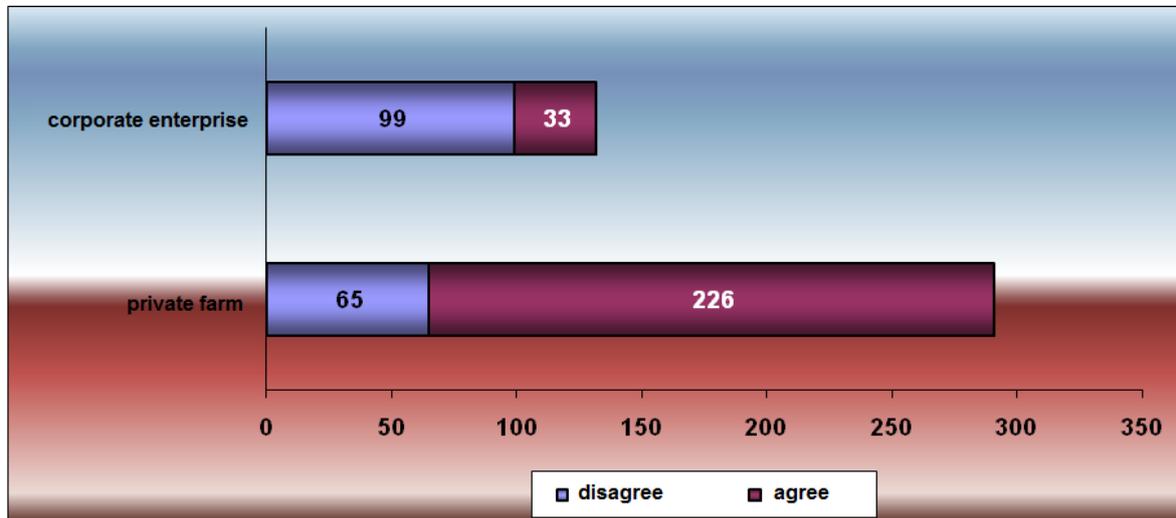


Figure 5. Number of farms on the basis of their attitude to the land purchase ban concerning the foreigners, by regions

Source: on the basis of data of own survey

I analysed the opinion about the legal regulations banning the land purchase of legal entities on the basis of the business organization forms of ventures (Figure 6). I saw a medium-strong relation (Cramer coefficient=0.501) between the opinion about the ban and the business form: three-fourth of heads of corporate enterprises do not agree with the ban while in case of private farms the situation is the just the opposite, because the ratio of those „disagreeing” was only 22%.



*Figure 6.* Number of farms on the basis of their opinion on the land purchase ban concerning legal entities, by regions  
*Sources:* on the basis of data of own survey

### 3.4. New and novel scientific achievements

The new scientific achievements are summarized according to my hypotheses as follows:

1. With the help of modern mathematical-statistical methods I revealed that a number of factors affected the price of arable land during the examined period. These factors are: rental fee, land quality, value of fixed assets, yield of wheat and the net value added. The power of the impact of factors was different at national level, regional level and macro-regional level. According to the calculated results of the multivariate non-linear regression function, the greatest share in the arable land prices was given to the rental fee (49,04%), the yield of wheat (36,19%) and the land quality (13,46%). The average size of arable land of field crop farms has not any statistically proven impact on the market prices of arable land, so there is not any significant relation between the size of arable land and the market price of arable land. At national level, on the basis of the regression model run for private farms – including the average size among explanatory variables of the model – I could demonstrate that there is not any statistically proven impact of the examined factor on the land price ( $p=0,132$ ). I got similar results concerning the corporate enterprises (the  $p$ -value belonging to the examined factor: 0,247)

2. I have proved with my research that the group of factors affecting the arable land prices and their partial impact is different among the Hungarian regions. The impact of land quality affecting the price of arable land could be clearly demonstrated only in the Southern Transdanubian and Southern Great Plain regions. I have proved that there are significant differences between the Hungarian regions as regards the average size of land prices. On the basis of post-hoc tests used for comparing the group averages, there were considerable deviations between the regional averages in 2008, except for the average arable land prices between Central Transdanubia and Northern Hungary, Central Transdanubia and Northern Great Plain, as well as between the Northern Great Plain and Northern Hungary. There were not any significant difference between these latter listed regions. In 2009, however, there were considerable differences in case of all but two region pairs.
3. I have also proved that the acceptance of legal restrictions concerning the land purchase and land use is different among the heads of private and corporate farms. By the evaluation of data from the questionnaire survey I proved that there were not any signs of boom on the Hungarian land market following the accession to the EU. Most of the land transactions concerned the purchase of formerly rented land. The average size of arable land purchased was 16,8 ha. According to the survey, the first three places among the objectives of land purchase are given to the land speculation, aim to achieve competitive estate size and the better utilization of assets and labour capacities. Following our accession to the European Union, the prices of arable land as well as the land rental fees slowly increased. The pace of price growth significantly declined after the accession, from an annual average of 26,5% to an annual average of 9,5% in case of arable land. The pace of growth in case of rental fees also decreased, but not so drastically: from an annual average of 8,8% to an annual average of 7,5%, thus approaching the growth rate of arable land prices. Currently the ratio of land rental fees to land price is almost constant, while in the 10-year period before the accession the ratio of rental fees strongly decreased.

#### **4. CONCLUSIONS AND RECOMMENDATIONS**

The analysis of the special literature led me to the conclusion that the price of the arable land is determined mainly by the supply and demand concerning the land, the general interest rate level, government interventions, the applied production technology, inflation and population density. Of course, the impact of some other factors should also be considered. In the long run, the impact of these factors – by increasing the profitability of agricultural production – is capitalized in the arable land prices. I have also concluded that the profitability and the relative shortage of land significantly affects the actual local land market prices.

I have introduced the widely used land evaluation systems and highlighted that the land evaluation on return and market principles has the same roots, namely the annuity-producing ability of land. The methodological analysis proves that the current land information systems are generally not suitable for tracking the net annuity, because the product-level cost-income relations by habitat categories are missing. Therefore I suggest to improve the statistical registration system in this direction.

The impact of factors affecting the land prices were analyzed by matching multivariate linear functions at national level and by regions. I have proved that in case of private farms, the rental fee of arable land, the land quality, yield of wheat, the value of fixed assets, net value added and the sectoral results altogether determine the land price in about 30%. In case of corporate enterprises, the explanatory power is almost 40%. It is mainly due to the fact, that the rental fee and the role of fixed assets is more important regarding the impacting factors in case of corporate enterprises. The impact of individual factors appeared in an aggregated way in many cases – depending on the level of examination – therefore the forecasts concerning the land price estimations can be more precise and reliable in regard to microregional units.

As regards the regional examinations, the key role in land prices in case of private farms was played by the gold crown in the Southern Transdanubia, the average yield of wheat in Northern Hungary, the fixed assets in Northern Great Plain, while the rental fee of arable land in Southern Great Plain. In case of corporate enterprises, the rental fee proved to be the most important in the examinations.

I demonstrated on the basis of the data collected through a questionnaire survey that the approval of legal restrictions concerning the purchase and use of land is different among the heads of private and corporate farms. I suggest to solve this contradiction in the updating of the Act on Land with appropriate special justification. Concerning the land market and land turnover I would like to highlight the following:

- Boom on the Hungarian land market could not be observed even after the EU accession. The owners are still waiting probably until the withdrawal of the extended land purchase moratorium.
- The sales and purchases of arable land dominate the land turnover. 63% of the purchased land was rented area earlier. The main objective of purchases is to improve size efficiency

The separation of land owners and land users is still a problem in Hungary. Therefore I suggest the government to take different measures (estate reorganization, continuing the annuity for arable land project, etc.) in order to help the development of a boom on the land market, thus improving the conditions for more efficient land use.

## AUTHOR'S PUBLICATIONS RELATED TO THE DISSERTATION SUBJECT

### Books and chapters

**Agnes Kapuszta** (2011): Analysis of factors affecting the price of arable land in Hungary. Economics of sustainable agriculture. Szent István University, Gödöllő, (megjelenés alatt).

### Scientific articles

#### *Scientific articles in English language*

1. Sergey Vinogradov-**Kapuszta Ágnes** (2008): Main socio-economics indicators of the development of the competitive agricultural land market in Hungary. XV Congress of SERiA, ANNALS of The Polish Association of Agricultural and Agribusiness Economists, Lublin, Poland. ISSN 1508-3535
2. M. K. Singh, **A. Kapuszta**, M. Fekete-Farkas (2008): Analyzing agriculture productivity indicators and impact of climate change on CEEs agriculture. AgEcon Search, Research in Agricultural & Applied Economics, Bulletin of Szent Istvan University. ISSN 1586-4502
3. **Á. Kapuszta**, S.A. Vinogradov (2009): Changes in agricultural land use in Hungary. 8th International Symposium „ECONOMY & BUSINESS”. 1-5 September 2009. Sunny Beach, Bulgaria. *Journal of International Scientific Publications: Economy and Business*. Vol. 3. On-line: <http://www.sciencebg.net/download/economy.html> ISSN 1313-2555
4. S.A. Vinogradov, **Á. Kapuszta** (2009): The changes in the agricultural land market in Hungary. 8th International Symposium „ECONOMY & BUSINESS”. 1-5 September 2009. Sunny Beach, Bulgaria. *Journal of International Scientific Publications: Economy and Business*. Vol. 3. On-line: <http://www.sciencebg.net/download/economy.html>. ISSN 1313-2555

### Lectures delivered on scientific conferences, published in conference proceeding

#### *In a foreign language*

1. M. K. Singh, **Á. Kapuszta**, E. Dobó, J. Villanyi (2007): FINANCIAL ANALYSES OF SUSTAINABLE AGRICULTURE PRODUCTION IN

HUNGARY: A MODEL APPROACH, 4th AFE-QASS Samos 2007, Greece, CD Publication

2. M. K. Singh, **A. Kapusztá**, M. Fekete-Farkas (2007): Analyzing agriculture productivity indicators and impact of climate change on CEEs agriculture. Tradition and Innovation International Conference, Szent István University, 3-5 December, 2007, Gödöllő, Hungary. Book of Abstract, ISBN 978-963-9483-84-2
3. M. K. Singh, **A. Kapusztá**, H. Nagy, J. Káposzta (2007): Assessing the Environmental Impacts of Current Policies affecting the Agricultural sectors in the Visegrad Countries. MendelNET 2007, European Scientific Conference of PhD Student, 30<sup>th</sup> Nov 2007, Brno, The Czech Republic. ISBN: 978-80-903966-6-1, Article in Proceedings, Publisher: Mendlova zemědělská a lesnická univerzita v Brně
4. S.A. Vinogradov – **Á. Kapusztá** (2007): Analysis of the impact of transitional restrictions on the evolution of market values and rents of the agricultural land in Hungary. 6<sup>th</sup> International Symposium „ECONOMY & BUSINESS”. 10-14 September 2007. Sunny Beach Bulgaria. Conference CD: full\_paper\vinogradov-kapuszta.pdf. ISBN 978-954-9368-27-7
5. **Ágnes KAPUSZTA** – Sergey A. VINOGRADOV (2008): Review of the laws with regard to the land rental and sales markets in Hungary. 7<sup>th</sup> ALPS-ADRIA SCIENTIFIC WORKSHOP 28 April - 1 May, 2008. Stará Lesná, Slovakia
6. **Agnes Kapusztá** – Tamas Toth – Jozsef Kaposzta (2008): Measuring the Agricultural Land Market and Policy in CEECs after Joining EU: Case Study of Hungary. Fourth International Conference on Business, Management and Economics. 5-7. June 2008. Cesume, Izmir, Turkey. Conference CD

### *In Hungarian language*

1. **Kapusztá Ágnes** (2006): A földpiacot meghatározó néhány tényező elemzése a főkomponens analízis módszerével. XLVIII. Georgikon napok, Keszthely 2006. szeptember 21-22.
2. Fehér I. – **Kapusztá Á.** – Vinogradov Sz.(2007): A földpiac változásai Magyarországon az EU-csatlakozás után. Földminőség, földértékelés és földhasználati információ a környezetbarát gazdálkodás versenyképességének javításáért c. országos konferencia. (Szerk.: Tóth T. et al.) Keszthely, 2007. november 22-23. In: Közgazdasági földértékelés. 225-232 p. ISBN: 978-963-87616-3-7

3. S.A. Vinogradov – **Á. Kapusztá** (2007): A földforgalom törvényi korlátozásának a hatása a termőföld piac alakulására Magyarországon. Tradíció és Innováció. Nemzetközi tudományos konferencia. In: Mezőgazdasági vállalatok és ágazatok ökonómiája II. Gödöllő, 2007. december 3-5. Konferencia CD: proceedings\Contributed papers\\ Vinogradov Szergej – Kapusztá Ágnes.pdf. ISBN 978-963-9483-85-9

### **Researches**

1. István Fehér – Szabolcs Bíró – **Ágnes Kapusztá** – Vinogradov Szergej – Madarász István (2007): „Review of the transitional restrictions maintained by new Member States with regard to the acquisition of agricultural real estate in Hungary” című az Európai Politikai Tanulmányok Intézete (CEPS) részére készített tanulmány.
2. Szűcs István, Farkasné Fekete M, **Kapusztá Ágnes**: A hatékonyság javításának feltételei a mezőgazdaság erőforrásának hasznosításában: optimumok és gyakorlati alkalmazások. NKFP-2004-4/014. sz., 1. részjelentés, Gödöllő (2005)