COMPARISON OF AGRICULTURAL FARM EFFICIENCY IN SLOVAK REGIONS BEFORE AND AFTER EU ACCESSION

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Abstract:
This paper presents results of stochastic parametric approach used in estimation of farm technical efficiency. The estimation of output oriented technical efficiency was based on Stochastic Frontier analysis with Cobb-Douglas production function. Model specification for empirical application were employed Battese and Coelli 1995 model specification, where technical inefficiency effects are explicitly expressed as a function of a vector of firm-specific variables and random error and integrated in the stochastic frontier model. Model also included dummy variable which expressed production conditions in which Slovak farms are operating. We divided farms into two groups of production conditions: productive regions (PR) and less favorable area (LFA) regions. Data set included 79 Slovak farms operating in different regions in 2003-2005 time periods. Following input variables are included in the model: capital, material, labour and agricultural land according to LPIS system. Total product was used as output variable. Our analyses show that farms operated in 2004 achieved significantly highest level of technical efficiency in comparison with year 2003 in both groups of production condition, due to good weather condition in this year and due to increasing subsidy system. From the achieved results we can conclude that the significant statistical differences in average technical efficiency, was detected only in year 2005 between the farms of mentioned production conditions. Higher level of variability, in technical efficiency was detected in farms operating in productive regions compared to technical efficiency of farms in LFA regions.

Key words: less favorable area (LFA), subsidy, stochastic production frontier, panel data, output – oriented technical efficiency, Cobb-Douglas production function

1. Introduction

The terms productivity and efficiency, have been used frequently in the media over the last ten years by a variety of commentators. They are often used interchangeably, but this unfortunate because they are not precisely the same things. The production frontier represents the maximum output attainable from each input level. Hence it reflects the current state of technology in the industry. Firms in that industry operate either on that frontier, if they are technically efficient or beneath the frontier if they are not technically efficient. Productivity of a firm is the ratio of the output(s) that it produces to the input(s) that it uses. When one considers productivity comparisons trough time, an additional source of productivity change, called technical change, is possible. When we observe that firm has increased its productivity from one year to the next, the improvement need not have been from efficiency improvements alone, but may have due to technical change or the exploitation of scale economies or from some combination of these tree factors. The gradual increase of agricultural production in CEE countries was partially caused by adaptation process of farms on rules of market economy and creation of new institutions which would provide efficient distributional channels in agricultural inputs. The level of support in creation of these institutions, dealing with exchange of inputs and outputs within agricultural market, was reflected in different efficiency in agricultural production (Gow, Swinenn, 1998). It is evident, that only provided improving conditions in which agricultural subjects are producing and we could expect positive trends in efficiency development. As one of the possible approaches in efficiency measurement is technical efficiency developed by Koopmans and Farell[1]. The selection of suitable functional form of stochastic frontier production model is one of the most important steps for the specification of econometric model. In the empirical studies of production frontiers, two forms of production frontier Cobb-Douglas and translog

[1] KOOPMANS, T. C.(1951): Analysis of production as an efficient combination of activities. In: T. C. Koopmans (ed.): Activity analysis of production and allocation, NewYork: Wiley, 1951, 210 s
FARRELL, M.J. (1957): The measurement of productive efficiency. In: Journal o f the Royal Statistical Society, Series A, Vol.120, Part 3, 1957, 253-290 s.

function were the most frequently used. The usage of Cobb-Douglas form of production frontiers in the agricultural of the developing countries and transitive economies could be found in the empirical studies of Sotnikov (1998), Murova, Trueblood and Coble (2001). The nonparametric approach of the measuring of technical efficiency was applied by Fandel (2003), Bielik and Rajčániová (2004), Bielik P., Pokrivčák J., Jančíková V., Beňo M. (2002) in Slovak agricultural. Sojková (2001) applied another approach on the cross-sectional data of 61 Slovak agricultural cooperatives. Output-orientated technical efficiency measures were estimated through the use of parametric stochastic production frontier model. Covaci, Sojková (2006) focused on two main tasks: verifying the suitability of using stochastic frontier analysis on a transforming sector, and providing empirical evidence to explain the technical efficiency structure among 24 Slovak farms in the time period 2000 – 2004. The usage of mentioned estimated functions could be found in the several empirical studies (e.g. Pitt and Lee, 1981). They were devoted in estimating stochastic frontiers and predicted firm-level efficiencies using Cobb-Douglas estimated functions on the basis of firm-specific variables (such as managerial experience, ownership characteristics, etc). The authors have tried to identify the reasons for differences in predicted efficiencies between firms in an industry.

2. Methodology and Material

Based on neo-classical production theory, the dependent variable of the production function should by expressed as the quantity of a given output produced in a given time period as a result of a production transformation of a given input quantity. This definitions is followed by the first endogenous variable specification of the stochastic frontier production model, namely the output is the amount of a produced commodity in a farm (farm enterprises production), expressed in tons. By using this production definition, we assume that the production quantity is homogenous when comparing the analyzed farms.

Constructing a production functions requires further information about inputs equipment in quantity references. Because only cost data is available for production factors, no breakdown between quantity and prices is possible. Since the agricultural production process is a complex activity where not only inputs quantity, but also input quality and functionality have a significant impact on input performance.

The data set was obtained from the Information Reports submitted by Slovak agribusinesses according to the Slovak accounting regulations and presents the panel data of 79 Slovak farms in the time period 2003 – 2005. These farms were divided into two groups based on the different production conditions: the farms operating in the productive regions – 54 Slovak farms (PR) and the farms operating in the LFA regions (LFA) – 25 farms. The observed Slovak farms were geographically differential situated and differences between the regions are significant from the tillage coefficient and land quality point of view which is projected into differences in fertility of investigated regions.

To keep the indication of inputs equipment comparable over time and thus to capture technical changes, the cost data expressed in value terms have to be transformed to a constant price basis.

In our analysis are used four inputs variables and one output of the stochastic frontier production models for selected Slovak farm enterprises:

- Capital – C, in thousand SKK
- Materials – Mat, in thousand SKK
- Labor - L
- Agricultural land, according to LPIS[2], in ha
- Total production – TP, in thousand SKK

The sample summary statistics for these variables are presented in Table 1.The descriptive statistics of the sample are categorized on the basis of the individual year and the different production condition.

[2] The Ministry of Agriculture in Slovak Republic has started carrying out the establishment of the Land Parcel Identification System (LPIS).

The last variable integrated in the stochastic frontier production function is the time variable T.

Table 1 Summary statistics for variables of the stochastic frontier production model

Year - regions	Variable	Mean	Median	Maximum	Minimum	SD	CV	N
2003 LFA	Total production	25043.31	14659.00	125936.00	2136.00	28552.00	1.14	25
	Capital	71989.24	70187.00	181039.00	3947.00	42214.20	0.59	25
	Material	71989.24	70187.00	181039.00	3947.00	42214.20	0.59	25
	Labor	57.80	44.00	172.00	4.00	38.75	0.67	25
	LPIS	2028.57	1752.00	6317.00	560.10	1329.22	0.66	25
2004 LFA	Total production	20878.46	14475.00	107214.00	1703.00	21073.19	1.01	25
	Capital	69561.24	66832.00	177523.00	3948.00	41006.57	0.59	25
	Material	33.05	33.23	50.91	21.97	6.76	0.20	25
	Labor	45.32	36.00	152.00	3.00	32.53	0.72	25
	LPIS	1259.51	1054.30	2952.60	323.00	738.58	0.59	25
2005 LFA	Total production	20761.32	14204.00	104161.00	1259.00	20978.13	1.01	25
	Capital	68447.80	66853.00	183421.00	3966.00	39537.21	0.58	25
	Material	31.65	30.34	46.59	19.82	7.15	0.23	25
	Labor	42.12	34.00	138.00	4.00	29.47	0.70	25
	LPIS	1252.66	1070.17	2952.60	320.83	737.91	0.59	25
2003 PR	Total production	40791.30	21602.50	325811.00	1835.00	56742.54	1.39	54
	Capital	73081.48	36224.50	383246.00	2457.00	85152.37	1.17	54
	Material	43.97	44.80	61.66	28.90	6.99	0.16	54
	Labor	62.39	36.00	372.00	2.00	75.83	1.22	54
	LPIS	1247.83	945.05	5902.00	1.20	1174.96	0.94	54
2004 PR	Total production	45239.43	23773.50	331209.00	1491.00	59980.52	1.33	54
	Capital	76547.56	38337.50	412984.00	3327.00	88195.49	1.15	54
	Material	43.34	44.59	60.44	22.28	8.20	0.19	54
	Labor	56.46	32.50	368.00	2.00	71.72	1.27	54
	LPIS	1262.56	958.24	6484.00	1.20	1184.19	0.94	54
								54
2005 PR	Total production	40648.93	21313.50	319459.00	1389.00	57528.48	1.42	54
	Capital	80517.43	44360.00	416183.00	2141.00	92930.89	1.15	54
	Material	43.34	43.19	68.73	22.11	8.25	0.19	54
	Labor	53.30	28.00	364.00	2.00	68.42	1.28	54
	LPIS	1238.65	924.71	6450.00	1.20	1153.01	0.93	54

Mean = arithmetic mean, SD = standard deviation, CV = coefficient of variation, N = number of observation
Source: authors ´ calculations

Using a time variable (1, 2, and 3 for the years 2003, 2004, and 2005, respectively) in these models allows for frontier shifts over time, which represents technical change.
The choice and definition of the variables for the inefficiency effect model are complicated by methodological requirements as well as by data availability. The important methodological requirement

linked to variable specification is the elimination of potential specification problems such as multicollinearity, heteroscedasticity and omitted variable problems. We concentrate on preventing estimation inconsistencies which could be caused by multicollinearity between the inputs variables of the production frontier model and inefficiency determinants included in the second part, the inefficiency effect model, of the Battese and Coelli 1995 (Coelli, Rao and Battese, 1998) specification. Regarding this issue, variables such as size will have to be omitted from one-stage efficiency analysis since it always correlates with the input variables of the production frontier.

To avoid specification errors, when using the variable data, the set of explanatory variables of the inefficiency effect model of the Battese and Coelli 1995 stochastic frontier model specification is contracted to only one variable groups: general market and economic conditions.

The general economic and market conditions are defined by the help of two dummy variables: Z_1 is a dummy variable taking value 1 in the year 2004, and 0 otherwise; Z_2 is a dummy variable taking value 1 in the year 2005, and 0 otherwise;

There are several effects which may be captured in these time dummy variables. These are, for instance, effect caused by the macro-economic environment, and general tendencies of efficiency change over time. When interpreting these parameters, it must be kept in mind that these variables might capture the weather effects on annual yields.

For our analysis we have chose the one-stage model specification of Battese and Coelli 1995, where technical inefficiency effects are explicitly expressed as a function of a vector of firm-specific variables and random error and integrated in the stochastic frontier model. This one-stage model is recognized as one which provides more efficient estimates than those which could be obtained using the two-stage estimation procedure. Another reason for estimating all parameters in one stage is that, in general, it is hard to distinguish between a variable that belongs to the production function and the explanatory variables of the inefficiency model. In the one-stage model, explanatory variables directly influence the transformation of inputs and efficiency is estimated, controlling for the influence of explanatory variables of technical inefficiency. This reduces the omitted variable problem in the two-stage estimation. However, it does not solve the problem of multicollinearity, which can cause bias in the estimates of β and TE_i in both approaches of TE explanation (Sotnikov, 1998).

Selected Battese and Coelli 1995 model specifications will be completed by setting a concrete functional form and supplementing it with informational substance. The choice of the functional form of the stochastic production frontier is a serious task of econometric model specification. The translogarithmic function and the Cobb-Douglas functional form are the two most common functional forms which have been used, not only in empirical studies on frontier productions, but in studies on production behavior in general. In the efficiency analysis, it is of interest which effect the choice of functional form has on empirical measures of technical efficiency.

The Cobb-Douglas function is the simpler and less flexible form, carrying with it more theoretical curvature restrictions, and imposing more restrictions on the elasticity of substitution between factors than translog function does. The advantage of this functional form is that it allows an examination of economic efficiency because it meets the requirements of self-duality. The Cobb-Douglas form has been used in many empirical studies, particularly those related to agriculture in developing countries, but it also in studies on transitional agriculture (Sotnikov, 1998). However, in the most recent studies, the translog functional form has been used more often for modeling the agricultural frontier production function. The preferential characteristic of this functional form is first of all its flexibility.

The drawback of the translog functional form is that it often does not yield coefficients of plausible sign and magnitude, possibly due to degrees of freedom. However Curtiss (2002) argues that in TE studies, the estimates of TE are of more importance that the statistical properties of the estimated coefficients. She also states that the most preferred property of the estimation of TE is consistency, while, in general, the most efficient estimator is chosen for the parameters of the production function, β.

Based on the above argumentation, the Cobb-Douglas functional form was chosen for the description of the production frontier behavior of the Slovak farm enterprises. The stochastic frontier production function employing the defined variables has the following form:

$$ln\,(y_{it}) = \beta_0 + \sum_{j=1}^{N} \beta_j\, x_{jit}\, v_{it} - u_{it} \qquad i=1,...,N,\ t=1,...,T, \qquad (1)$$

where y_{it} represents the outputs for i- th Slovak farms (i = 1,2, … 79) in T time period (T = 1, 2, 3 and correspondents to 2003, 2004, 2005)

x_{jit} the j – th input of the i – th Slovak farm in the T –th time period (year)

β = parameters to be estimated by the Battese and Coelli stochastic frontier model

v_{it} are random variables which are assumed to be iid. N $(0,\sigma_V^2)$, and independent of the U_{it}

u_{it} which are non-negative random variables which are assumed to account for technical inefficiency in production and are assumed to be independently distributed as truncations at zero of the $N(\mu_{it},\sigma_U^2)$ distribution;

where:

$$\mu_{it} = z_{it}\delta, \qquad (2)$$

where z_{it} is a p×1 vector of variables which may influence the efficiency of a firm; and

δ is an 1×p vector of parameters to be estimated.

Subsequently, u_{it} is

$$u_{it} = z_{it}\delta + w_{it} \qquad (3)$$

where

w_{it} is a random variable truncation of the normal distribution with zero mean and variance σ^2 such that the point of truncation is $- z_{it}\delta$, i.e. $w_{it} \geq - z_{it}\delta$.

Individual firm TE derived from model 2 and 3 in the t-th time period is defined by the following equation:

$TE_{it} = \exp(-z_{it}\delta + w_{it})$.

This definition of the stochastic frontier production is identical for both the monotonically time-varying inefficiency model and the non-monotonically time-varying model specification. As defined by Battese and Coelli 1992, the non-negative inefficiency effect, u_{it} is an exponential function of time. Considering the condition of the analyzed time period, the systemically time-varying inefficiency model can be written into an equation,

$$u_{it} = u_i \exp\left(-\eta\left(t-T\right)\right)$$

The inefficiency effect model defined by selected farm-specific variables of a form as proposed by Battese and Coelli (1995) is specified as follows:

$$u_{it} = \delta_0 + \sum_{n=1}^{3} \delta_n Z_{nit}$$

Where u , is the firm-specific mean of a truncated normal distribution

δ are parameters to be estimated, and indices, *I* and *t*, are as defined earlier

Z_n is the *n*-th independent variable of the *i*-th farm expected to determine the level of technical inefficiency in *t*-th time period ($n = 1,2,3$), where

Z_1 up to Z_3 are the time dummy variables associated with the years 2003 up to 2005.

3. Results and Discussion

3.1. Specification of model and variables

In the paper, the one-stage classical (Cobb-Douglas) stochastic frontier model with the implementation of dummy variable for different production regions and interactive terms considering the different elasticity of inputs in the different conditions was used.

The all variables incoming to the model have been log transformed considering the character of Cobb-Douglas function. The data set was divided to the two groups of farms: the farms operating in productive regions (PR) and the farms operating in a less favorable area (LFA). Production conditions were expressed by dummy variable D (D=0 for LFA and D=1 for PR) which was defined according to the land quality. The first group LFA regions (D=0) is created by 25 Slovak farms and the second group of PR region (D=1) by 54 Slovak farms.

The final estimated log-linear Cobb-Douglas model of the stochastic production frontiers has the following form:

$$ln\ TP = b_o + b_1\ ln\ C + b_2\ ln\ Mat + b_3\ ln\ L + b_4\ lnLPIS + b_5.D + b_6\ lnC \times D + b_7\ lnMat \times D + b_8\ lnL \times D + b_9\ lnLPIS \times D + (v_{it} - u_{it})$$

where TP represents the outputs (total production) for Slovak farm i (i = 1, 2….., 79). In the model, four independent variables are included: logs of capital (C) and materials (Mat) in the thousand SKK, labor (L) in and agricultural land according to LPIS[3] (LPIS) in hectares.

Table 2 Maximum likelihood estimates of parameters of the Cobb-Douglas stochastic frontier function of Slovak farms

		Parameters	Coefficients	Standard error	t ratio
Intercept	I	beta 0	0.760	1.536	0.495
Capital	ln C	beta 1	0.269	0.154	1.742
Material	ln M	beta 2	1.140	0.201	5.661
Labor	ln L	beta 3	0.710	0.181	3.922
LPIS	ln LPIS	beta 4	-0.047	0.114	-0.415
Dummy	D	beta 5	-1.206	1.719	-0.702
D * Capital	D * ln C	beta 6	0.266	0.161	1.651
D * Material	D *ln M	beta 7	-0.288	0.270	-1.066
D * Labor	D * ln L	beta 8	-0.428	0.188	-2.281
D* LPIS	D * ln LPIS	beta 9	0.180	0.119	1.511
Inefficiency model					
		delta 0	-4.688	12.604	-0.372
		delta 1	-2.115	5.420	-0.390
		delta 2	0.096	0.918	0.104
Log likelihood function	-1.14E+02			LR. Test	1.34E+01

Source: authors´ calculations

[3] The Ministry of Agriculture in Slovak Republic has started carrying out the establishment of the Land Parcel Identification System (LPIS).

Table 2 shows maximum likelihood methods estimations. The maximum-likelihood estimates of the parameters in the Cobb-Douglas stochastic frontier production function models defined by (1), given the specifications for the technical inefficiency effects defined in (3), were obtained using FRONTIER 4.1 (Coelli, 1994).
The parameters of the final production frontier model are introduced in the first part of Table 2. In the second part of table presents three additional parameters associated with the distribution of the overall random effect. The negative value of inefficiency coefficient (delta 1) which represents dummy variable for time period 2004 indicates a significant positive effect on the improvement of technical efficiency. On the other hand, the positive value of inefficiency coefficient (delta 2) indicates an increasing affect of time period on the inefficiency level.

From the final estimated stochastic frontier model, it could be possible to derive two models, one for the Slovak farms operating in the productive regions and one for the Slovak farms operating in the LFA regions.

Productive regions (D = 1)
ln TP = - 0.447 + 0.534 ln C + 0.852 ln Mat + 0.283 ln L + 0.133 ln LPIS

LFA regions (D = 0)
ln TP = 0.760 + 0.269 ln C + 1.114 ln Mat + 0.710 ln L – 0.047 LPIS

The coefficients of elasticity's are represented by the parameters of individual variables for the Slovak farms operating in different regions. If we look at the comparative analysis of the coefficients for the farms of productive regions and of LFA regions, it could be said that the increase of inputs by 1 % would lead to the more increasing of the total production of farms in productive regions. While the input increasing of capital usage of by 1 % would lead to the increase of the total production by 0.534 % in the productive regions, in the LFA regions it would denote the smaller increase of total production (by 0.269 %).
Material increase would probably lead to different influences on measures of total production in surveyed regions. It is probable that one percent increase in material would lead to increase of level of total production by 1.114 percent in farms operating in LFA region. Productive region would achieve increase of total production by 0.852 percent raising material input by one percent. This fact could lead to conclusion that farms operating in LFA have deficits in material inputs. Results from this model advise the farms in LFA regions to increase material usage, which would lead to greater increase of total production that the mentioned input.
Labor influence on the level of total production is highly tied to overall production conditions in which investigated Slovak farms are operating. This fact could be reflected by 0.428 percent difference between the productive and LFA regions in the total production increase caused by the one percentage increasing in labor inputs. A greater increase in total production according to the estimated model would be achieved in farms operating in LFA regions. As a possible cause for this difference is intensity of labor and capital usage in surveyed regions. Economic theory suggests inverse relationship between capital and labor usage. This fact could be supported by estimated parameters of model which suggest that farms operating in productive region are more capital intensive and farms operating LFA region are more labor intensive.
From the agricultural land point of view, the influence of agricultural land on total production was closely correlated with quality of land in selected production region. It could be noticed that the one percentage increasing of agricultural land has a different impact on the total production of Slovak farms. Estimated of model has showed that there is negative relationship between increase of agricultural land and the level of total production in LFA region. Farms operating in LFA regions would slightly benefit in technical efficiency from the reduction of agricultural land. While the one percentage increasing of agricultural land of farms in the LFA regions would lead to the decrease in total production by 0.047 percent, different

tendencies could be observed in the productive regions. The one percentage increase would lead to increase of total production by 0.133 percent.

3.2. Analysis of technical efficiency

Table 3 Descriptive statistics of technical efficiencies

LFA			
	2003	**2004**	**2005**
Mean	0.746	0.818	0.797
Standard deviation	0.117	0.066	0.101
Minimum	0.416	0.631	0.558
Maximum	0.877	0.895	0.912
PR			
	2003	**2004**	**2005**
Mean	0.747	0.807	0.731
Standard deviation	0.142	0.107	0.168
Minimum	0.253	0.442	0.253
Maximum	0.932	0.935	0.914

Source: authors´ calculations

The descriptive statistics of technical efficiency which were estimated by Battese and Coelli (1995) model are presented in the Table 3. It is evident that the selected farms operating in the LFA regions achieved a higher level of average technical efficiency. The significant differences in the average technical efficiencies between productive and LFA regions are observed only in 2005. The Slovak farms in both production regions accomplished the significant increase in average technical efficiency level in 2004 in compare with 2003. The LFA regions achieved a higher increase in average technical efficiency (9.65 %) in compare with productive regions (8.03%).

Table 4 Testing of significant differences of average technical efficiencies

Within group differences			Between group differences		
	Mean	t-test p-value		Mean	t-test p-value
LFA 2003	0.746	1.844E-05	LFA 2003	0.745606	0.958
LFA 2004	0.818		PR 2003	0.747337	
LFA 2004	0.818	0.108	LFA 2004	0.817819	0.568741413
LFA 2005	0.797		PR 2004	0.806572	
PR 2003	0.747	6.642E-06	LFA 2005	0.797295	0.032542062
PR 2004	0.807		PR 2005	0.730805	
PR 2004	0.807				
PR 2005	0.731	9.345E-07			

The mentioned increase in the technical efficiency of Slovak farms in both production regions, could probably be caused by the changes in subsidy system and by the better climatic conditions in 2004. In 2005, the decrease of average technical efficiency of Slovak farms was noticed in both production regions. The decrease in average technical efficiency was different in the investigated regions. While the LFA regions achieved only 2.57 % decrease in average technical efficiency, the productive regions were typical by the 9.42 % decrease in 2005.

These facts could lead to conclusion that the technical efficiency of LFA regions were less influenced by climatic conditions and changed subsidy system.

The verification of significant differences in the level of average technical efficiencies is presented in the Table 4.

From the Table 3 we can notice that there are significant differences in average technical efficiency in time period except for the Slovak farms in LFA region in 2004 – 2005. From the production condition point of view, it is evident that there are not significant differences in average technical efficiency. The significant differences in technical efficiency between both production regions are evident only in 2005. This situation could be explained by the substantial decrease of technical efficiency in productive regions.

The interval distribution of efficiency measures of productive and LFA regions are shown in Figure 1 and Figure 2.

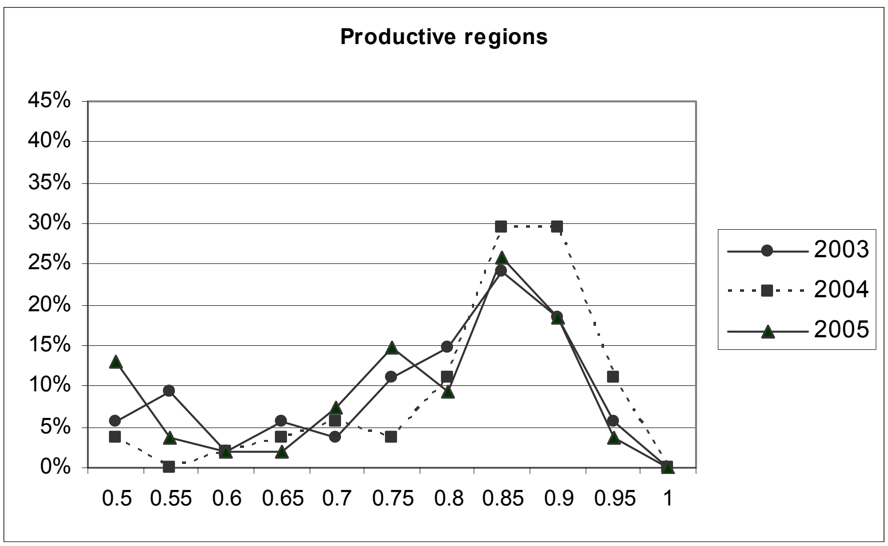

Figure 1 Distribution of technical efficiency of Slovak farms operating in productive regions

The Figure 1 illustrates the interval distribution of the technical efficiency of Slovak farms in productive regions. It could be observed that the most of the Slovak farms in productive regions have achieved around 85 % level of technical efficiency. It could be noticed that there are differences in technical efficiency between investigated time periods in productive regions.

From the Table 3 and Figure 1 and 2, there is evident that a higher variation of technical efficiency is characteristic for the Slovak farms operating in productive regions compared with the farms in LFA regions.

The farms operating in LFA regions are typical by a lower level of efficiency variability compared with the farms in productive regions. This fact is confirmed by the Table 3 and Figure 2, from which we can see that the most of the Slovak farms in LFA regions are concentrated in the interval of the technical efficiency from 80 % to 90 %.

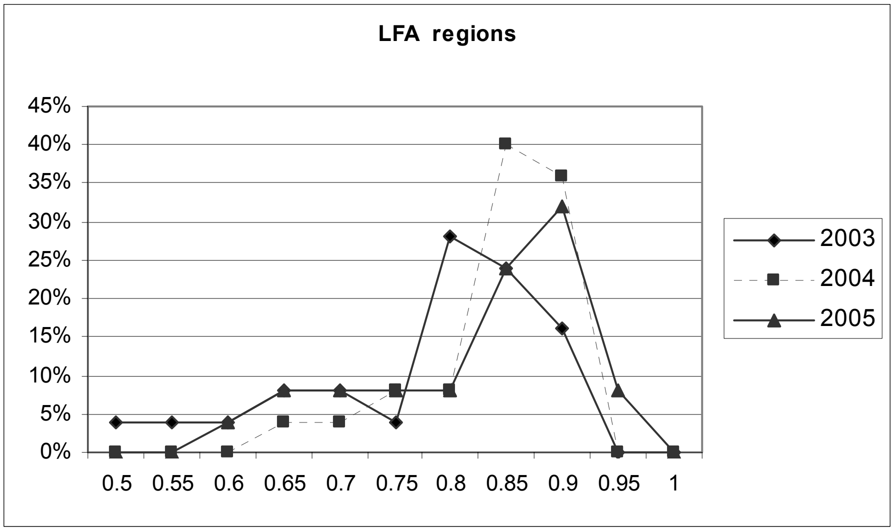

Figure 2 Distribution of technical efficiency of Slovak farms operating in LFA regions

4. Conclusion

The presented empirical study utilized the stochastic parametric approach for measuring of technical efficiency of the Slovak farms operating in different production regions and time periods. From the methodological point of view, the one-stage model Battese and Coelli (1995) with explaining technical inefficiency based on the farm- specific variable was used. This study is empirically implemented by using a panel data set of the 79 Slovak farms operating in the different production regions over the time period of 2003-2005.

The empirical findings indicate that the average technical efficiency of Slovak farms is different over the investigated time period. From the results of this study, the increase in the technical efficiency of Slovak farms in 2004 within both production regions is evident. It could be caused by the changes in subsidy system and by the better climatic conditions in 2004. In 2005, the decrease of average technical efficiency of Slovak farms was noticed in both production regions. The decrease in average technical efficiency was different in the investigated regions. There was not observed significant differences in average technical efficiency between the different production regions. The noticeable difference in average technical efficiency of Slovak farms was evident only in 2005. We aware of the low number data set which could have influence on the empirical results and the quality of input data determinates the predictive power of results. It may be interesting to compare the results of this study with non- parametric approach in efficiency measurement (DEA).

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