materiały z badań

OLGA MUROVA[1]

LAND POLICY IN UKRAINE AND ITS IMPACT ON TECHNICAL EFFICIENCY[2]

Abstract. This study investigates the impact of land policy on the technical efficiency (TE) of the Ukrainian crop sector for the year 2010. Two approaches are used to estimate TE scores: stochastic frontier analysis (SFA) and data envelopment analysis (DEA). Regions with high TE are examined in terms of land policies. Current analysis shows that overall, lease of land by all types of agricultural enterprises contributes to the increase of TE and lease of land by farming enterprises decreases efficiency. Comparison of current TE scores with TE scores estimated sixteen years ago shows differences in regional progress but the overall increase of TE in Ukraine.

Key words: technical efficiency, Ukrainian crop sector, stochastic frontier analysis, data envelopment analysis, land lease, land policy

BACKGROUND

Ukraine is the second largest country in Europe land-wise, with a population of 44.85 million people. The majority of the Ukrainian landscape consists of steppe and semi-steppe, with mountainous regions in the west and on the Crimean peninsula. In Ukraine around 70 percent of total land is devoted to agriculture. In 2011 agriculture accounted for 9.3 percent of gross domestic product (GDP) and in 2009 it provided 16.7 percent of employment in Ukraine [United Nations 2011].

Ukraine was a major food producer within the Soviet Union; it accounted for a quarter of all agricultural output. Ukraine produced over half of the sugar beets and one-fifth of all grains grown in the former USSR. Since Ukraine's independence in 1991, total agricultural production has declined dramatically. During the 1990s

[1] Current author is serving as Assistant Professor at the Department of Agricultural & Applied Economics at Texas Tech University, USA (e-mail: olga.murova@ttu.edu).
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the rate of decline slowed, however yearly declines still prevail. The average annual decline from1990–2000 was 5.8 percent. By 1999 the Ukrainian agricultural sector was producing only 47 percent of what it had produced in1990.

Since the early 2000s Ukraine has exhibited positive growth in gross domestic product (GDP). The growth in GDP was steady for several years, but declined in 2009. In 2009 GDP fell 14.8 percent from the previous year [State Statistics… 2011]. The Ukrainian economy was showing signs of depression around 2009, but fully recovered the next year and has continued positive growth since then.

Since the year 2000, general growth in the Ukrainian economy has been supported by positive growth in agricultural production. Figure 1 shows the overall increasing trend in total agricultural production, accompanied by small yearly fluctuations. 2011 turned out to be a record year in terms of agricultural production. The State Statistics Service of Ukraine reported an estimated growth in the volume of agricultural production of 17.5 percent during 2011 [Worldwide News… 2012]. In the same year Ukraine harvested the largest amount of grain in the twenty years since its independence. This put Ukraine among the world's top three grain exporters [Worldwide News... 2012].

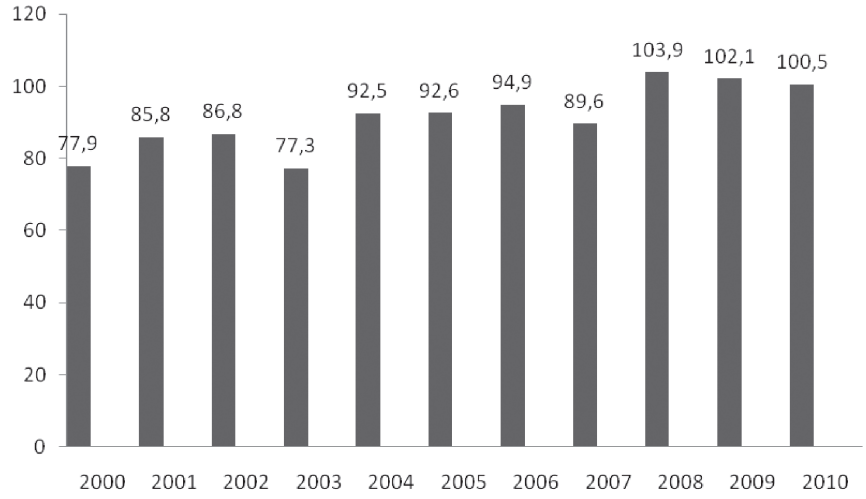

FIGURE 1. Gross agricultural output, bln. hryvnia (in 2005 prices)
RYSUNEK. 1. Globalna produkcja rolnicza w miliardach hrywien (w cenach z 2005 roku)
Source: Ministry of Agrarian Policy of Ukraine.
Źródło: Ministerstwo Polityki Rolnej Ukrainy.

Statistics show that Ukrainian agriculture continues to gain strength, but at a very slow pace. There are still many policy areas, like agricultural labor, rural development, environmental policy, and food safety, which are in need of re-examination in order to improve operating and living environments in the Ukrainian agricultural sector. In this paper the author focuses on the land market in Ukraine by providing a detailed description of current land laws. The main objective of this paper is two-fold: to provide a descriptive analysis of current land legislation and policies in

Ukraine and to investigate how current land policies impact the technical efficiency of agricultural production in Ukraine.

LAND POLICY

Prior to the dissolution of the USSR, 98 percent of all Ukrainian land was managed in large scale collective and state farms and 2 percent was cultivated in the small-scale individual sector. Ukraine legalized private ownership of land in 1991, shortly after declaring its independence. However, despite the new laws landowners could not sell or buy land due to a moratorium imposed on the sale of land.

Between 1998 and 2000 Ukraine implemented several legislative decrees allowing new forms of legal landownership, such as partnerships and cooperatives. Agricultural land started to change hands, and by January of 2002 only 4 percent of the arable land in the country remained in state hands. At that same time, about 30 percent of land was privately owned and members of the former collective agricultural enterprises owned about 65 percent [Liefert and Liefert 2008]. Ukrainian citizens own approximately 30 million hectares of Ukraine's agricultural land and 12−13 million hectares are owned by the state [Fedorchenko and Lapa 2011].

The Land Code Law in Ukraine was signed by the President of Ukraine in 2001. This legislation gave citizens the right to own and lease agricultural land. However, it did not stipulate conditions for the sale of land. In 2002, two other legislative decrees came into law, the Law on Land Protection and Law on the State Control over Use and Protection of Land. Both documents were aimed at establishing the legal, economic and social bases for carrying out state control over land tenure and the protection of land. However, no structure was created and no agency was put in place to insure proper implementation of these laws. Another law regarding subsidiary farms came out in 2003. A subsidiary farm was defined in the legislation as a "business activity, conducted without creating a legal entity, by a physical person individually or persons" that are family or relatives, or living together with the purpose of producing, processing, consuming or selling agricultural products [Kuchma 2003]. Since the term "subsidiary farm" was defined very broadly in the legislation, it includes the majority of farms in Ukraine. This law determines the legal, organizational, economic and social principles for farm operation.

The Law on Lease of Land came into effect on October 2, 2003. It regulates the issues of land lease. Land plots under state and communal ownership are leased out on the basis of a decision by the state executive body or local government by signing a lease agreement for a land plot. Individual citizens lease out on the basis of a lease agreement between the landowner and a lessee. Lease agreements are required to follow a specific format and are to be notarized. After that they must be registered with the local district department of land resources.

Collective agricultural enterprises (CAE), as the organizational form, dominated the farm structure in Ukraine between 1992 and 1999. CAEs completely disappeared after 1999. Since then three main forms of farm ownership have developed: corporate farms, peasant farms, and household plots. According to a 2006 survey of 1,400 rural households, peasant farms, and corporate farms, the average size of

a corporate farm is 1,700 hectares, the average size of a peasant farm is 140 hectares, and the average size of a household plot is 1.7 hectares [Lerman et al. 2006]. There is a great deal of variability in farm income in Ukraine. Farm incomes of household plot owners and peasant farmers depend on farm size. Households with 1−2 hectares of land make around 5,000 hryvnia ($625) a year per household; farms larger than 50 hectares make from 20,000 hryvnia ($2,500) and up [Lerman et al. 2006]. Families of peasant farmers enjoy much larger incomes than other rural households: 54,500 hryvnia ($6,813) for farming households and 9,750 hryvnia ($1,218) for employee households [Lerman et al. 2006]. The same survey shows that peasant farmers, to enlarge the area they cultivate, lease in land, while most rural households lease out land that they cannot cultivate. Corporate farms rely primarily on land leased from individuals. According to the State Agency of Land Resources, during nine months of 2011 owners of land shares signed over 4.61 million contracts for lease. The aggregate rent on all leases amounted to 0.71 billion US dollars in the same year. Tenants use agricultural output to pay for utilization of the land; in 2011 approximately sixty five percent of land rental was paid in kind [State Agency… 2012].

The average payment for leasing land is around 100 hryvnia ($12) per hectare per year [Lerman et al. 2006]. Even though the lease market is very active in Ukraine, there has been no development of a market in land sales. The moratorium on land transactions is still in place and stands as a major impediment to Ukrainian economic development. Landownership is highly fragmented and the moratorium keeps the land market in this fragmented state. The absence of a transparent and easily accessible national system of land location and ownership precludes capital and foreign investment. There have been numerous propositions to lift the moratorium on January of 2013; however the land cadaster and land registry will have to be functional prior to that.

The Law On State Registration of Ownership Rights to Immovable Property and Their Encumbrances came into effect in 2004. This law stipulated the creation of a single cadaster of land parcels and immovable property. Disputes, however, arose between the Ministry of Justice and the State Committee for Land Resources as to which agency would oversee the registration of land ownership rights. Some argued for the creation of a single body in charge of the cadaster; others proposed dividing the two functions between the two agencies. Finally, it was decided to create two systems: one for registration of title to property and the other for registration of the land cadaster. The Ministry of Justice and the State Agency for Land Resources, respectively, maintain the two systems. The new wording of the Law On State Registration of Ownership Rights to Immovable Property and Their Encumbrances in 2010 specifies the registration of titles under established procedure. This change has been in effect since January of 2012. The Law On State Land Cadaster was passed by the Ukrainian parliament − Verkhovna Rada in July of 2011.

In Ukraine, the population holds state deeds to the right of private ownership of land parcels (approximately 80%) and "certificates of the right to a land share" (approximately 20%) that are appropriately registered. State deeds specify the parcel area, the names of the adjacent parcel owners and include a plan of the individual parcel of land.

Since the beginning of 2012 all Ukrainian regions have started administering programs for the creation of the land cadaster and land registry, however many of them are falling behind schedule. Government officials have expressed doubts about the timely completion of this work by December 31, 2012, which would mean further postponement of lifting of the moratorium.

Current policies on the land market of Ukraine are directed toward the creation of a transparent and organized system of land management in preparation for lifting the moratorium on sales of agricultural land. The analysis made in this paper may help to predict the impact that recent policy changes have had on agricultural technical efficiency.

THEORETICAL MODEL

Agricultural technical efficiency (TE) is used in this study as an economic indicator of how well the agricultural crop sector is performing in Ukraine based on the latest agricultural policy changes. In order to analyze the performance of Ukrainian crop production, TE is first estimated and then analyzed. Two approaches are used to estimate TE: data envelopment analysis (DEA) and stochastic frontier analysis (SFA). These approaches allow estimation of a static measure of TE. Two methods are used to compensate for the advantages and disadvantages each has over the other. DEA does not require specification of a functional form and assumes efficiency of firms. SFA requires functional specification, accounts for noise, and allows hypothesis testing.

DEA can be estimated with either input or output orientation. In this study it is estimated with an output orientation, which determines the amount by which output could be increased without requiring additional amounts of inputs. It is measured as a ratio of observed output to the maximum level of output to reach the frontier. It is calculated as [Coelli at al. 1998]:

$$\max_{\varphi,\lambda} \varphi \qquad (1)$$

$$\text{s. t. } -\varphi \mathbf{y}_i + Y\lambda \geq 0; \quad x_i - X\lambda \geq 0; \quad N1'\lambda = 1; \quad \lambda \geq 0$$

where:

$1 \leq \varphi \leq \infty$, and $\varphi - 1$ − the proportional increase in outputs that could be achieved by the *i*-th firm, with input quantities held constant,

$N1'\lambda = 1$ − the convexity constraint, where N1 is an N x 1 vector of ones,

λ is a N x 1 vector of constraints.

Technical efficiency score is estimated as $1/\varphi$.

The second approach that is used to estimate static technical efficiency is the SFA approach. The goal of SFA is to explain TE performance using economic and policy variables. To estimate this model the following Cobb-Douglas production function is used:

$$\ln y_i = \Sigma \beta_i \ln x_i + v_i + u_i \qquad (2)$$

where:

$i = 1, 2, \ldots, n$, $\ln y_i$ − the logarithm of the total value of output for the crop sector for farms in region *i*,

$\ln x_i$ – the logarithm of input quantities in region *i*,
υ_i – a random error, $\upsilon_i \sim N(0, \sigma^2_v)$,
u_i – the measure of technical inefficiency, $u_i \sim N(\mu, \sigma^2)$, truncated from the left at zero.

This model was independently proposed by Aigner at al. [1977] and Meeusen and Van den Broeck [1977]. This stochastic frontier model allows simultaneous estimation of causal factors that explain technical inefficiencies, u_i:

$$u_i = z_{it}\delta + w_{it} \tag{3}$$

where:
z_{it} – the exogenous variables that explain inefficiencies, which can be farm or policy characteristics,
δ – the vector of parameters to be estimated,
w_{it} – a random variable.

Substituting u_i back in equation (2) yields:

$$\ln y_i = \Sigma\, \beta_i \ln x_i + z_{it}\, \delta + w_{it} + v_i, \;\; i = 1, 2, ..., 25 \tag{4}$$

DATA

The author estimates and examines the technical efficiency of the crop sector in Ukraine in 2010. The data for this analysis were collected from State Statistics Service of Ukraine website. Cross-sectional data for 25 Ukrainian regions were collected for the year 2010. The map of all Ukrainian regions is provided in Figure 2.

The crop sector is selected for several reasons. First, the crop sector in Ukraine represents a larger share of total agricultural production than livestock. Total agricultural output in both sectors has been shrinking since the late 1980s, and during the first year of Ukrainian independence the crop and livestock sectors produced about equal amounts of outputs. However, in 1993 the crop sector started to pick up the speed of production due to the initial impact of agricultural reforms, such as price and trade liberalization, enterprise privatization, and others. The inability of large agricultural enterprises to maintain livestock operations resulted in a shift of livestock operations to private producers and household farms. Cattle inventories on private farms today are very small and increasing very slowly; rapid recovery of the livestock sector is unlikely.

By the year 2001, the crop sector produced 70 percent and the livestock sector produced 30 percent of total agricultural output. In 2010, this proportion changed to 58.6 percent in crops and 41.4 percent in livestock [Prokopenko 2011]. The second reason for analyzing the crop sector is that the current legislative land policy is more pertinent to the crop sector. The third and final reason for analyzing the crop sector is that this analysis allows a comparison of today's performance of the Ukrainian crop sector with its performance 16 years ago, using the results of an earlier analysis.

Variables used to estimate TE are presented in Table 1. These data are collected for all types of agricultural enterprises, including household holdings. In this study

FIGURE 2. Regional map of Ukraine.
RYSUNEK 2. Mapa administracyjna Ukrainy.
Source: Ukraine Atlas: Maps
Źródło: Atlas Ukrainy; mapy

TABLE 1. Summary statistics of Ukrainian data
TABELA 1. Analiza statystyczna danych ukraińskich

Specification	Mean	Standard Deviation	Minimum	Maximum
Scalar Output	58,677.6	856.2	1012.2	4224.2
Land	24,343.9	507.4	179.3	1945.6
Fertilizer	10,606.4	240.3	14.3	314.0
Machinery/equipment	41,582.0	853.0	142.0	3303.0

the term "all agricultural enterprises" includes: government enterprises, all types of cooperatives, private enterprises, farms, other non-government enterprises, and household holdings. Variables collected for all agricultural enterprises used in this analysis include: total crop output, labor, fertilizer, and land (Table 2). Total crop output is measured by the value of total crop production for the year 2010 in 2005 prices.

Land is measured as the total agricultural land used by all agricultural enterprises in crop production in thousand hectares. Fertilizer is measured as the amount of mineral fertilizers used in thousand tons. The machinery/equipment variable represents the total capacity of tractors', trucks', and combines' engines and all other engines used in all agricultural enterprises in the crop sector measured in thousand kilowatt-hours.

TABLE 2. Data for main variables by region (oblast) for 2010
TABELA 2. Wartości głównych zmiennych dla regionów w 2010 roku

Region	Total value of output in 2005 prices [million hryvna]	Land [1,000 ha]	Fertilizer [th tons]	Machinery and equipment [th kw·h^{-1}]
Autonomous republic of Krym	2064.8	757.6	2529.0	1553.0
Vinnyts'ka	4224.2	1410.6	9140.0	2823.0
Volyns'ka	1481	348.4	1336.0	880.0
Dnipropetrovs'ka	3491.3	1945.6	6161.0	3033.0
Donets'ka	2633.3	1330.9	3505.0	2106.0
Zhytomirs'ka	1859.6	554.2	2560.0	1169.0
Zakarpats'ka	1012.2	179.3	143.0	142.0
Zaporiz'ka	2319.8	1505.7	4201.0	2505.0
Ivano-Frankivs'ka	1012.2	234.8	740.0	357.0
Kyyivs'ka	3405.4	1023.4	5745.0	2584.0
Kirovohrads'ka	2688.5	1504.1	5067.0	2339.0
Luhans'ka	1365.9	879.3	3000.0	1380.0
L'vivs'ka	2102.4	412.6	2479.0	757.0
Mykolayivs'ka	2414.2	1369.8	3954.0	1620.0
Odes'ka	3329.4	1550	5252.0	2714.0
Poltavs'ka	3548.6	1705.5	8620.0	2664.0
Rivnens'ka	1738.5	375	2162.0	704.0
Sums'ka	1809.1	912.8	5019.0	1485.0
Ternopil's'ka	1867.1	673.9	4988.0	907.0
Kharkivs'ka	2495.2	1411.9	6187.0	2485.0
Khersons'ka	3107.8	1076.6	3093.0	1667.0
Khmel'nyts'ka	2728.9	832.5	6114.0	1618.0
Cherkas'ka	2805.1	1131.6	7724.0	2040.0
Chernivets'ka	1156.6	259.5	861.0	327.0
Chernihivs'ka	2016.5	958.3	5484.0	1723.0
Average	58,677.6	24,343.9	10,606.4	41,582.0

Unfortunately, some of the data needed for this study are not available for all Ukrainian regions. Additional variables used in this study to represent land policy variables include: the total number of all agricultural enterprises (z_1), the total number of farming enterprises (z_2), the amount of land leased by all agricultural enterprises (z_3), and the amount of land leased by farming enterprises (z_4). These variables were collected for all 25 Ukrainian regions.

RESULTS

The stochastic frontier model was estimated using FRONTIER software. A likelihood ratio (LR) test was used to determine a functional form of the production function that would appropriately represent the Ukrainian data. Two functional forms considered in this study are: the trans-log and the Cobb-Douglas. The values of two log likelihood functions are used to calculate the LR value:

LR = –2 [15.6 – 14.9] = 1.4

The LR value is compared with the upper 5 percent for the χ^2 of 14.07. The null hypothesis that the Cobb-Douglas frontier is an appropriate representation of data is not rejected in favor of trans-log specification. Model 1 in Table 3 shows the final test statistics and the magnitudes of Cobb-Douglas coefficients. The elasticity of crop output with respect to machinery/equipment in Ukraine is found to be significant and equal to 0.271. There are many problems with investment in capital equipment and machinery in Ukraine and these problems are resolving at a very slow pace. For many farmers it is still difficult to obtain large, long-term loans at a reasonable rate. Most credit is extended as seasonal loans with high collateral demands and at interest rates of 25−30 percent.

TABLE 3. Stochastic frontier Cobb-Douglas production function estimates
TABELA 3. Oszacowanie stochastycznej granicznej funkcji produkcji Cobba-Douglasa

Variables	Model 1	Model 2
X variables		
Intercept	4.656[a] (0.421)	4.654[a] (0.940)
Land	0.155 (0.179)	0.125 (0.282)
Fertilizer	0.061 (0.104)	0.120 (0.122)
Machinery	0.271[c] (0.203)	0.224[c] (0.172)
Z variables		
z_0 – Constant	–	4.293 (3.639)
z_1 – Total number of ag. enterprises	–	0.823 (1.686)
z_2 – Total number of farming enterprises	–	–1.485 (1.296)
z_3 – Leased land in ag. enterprises	–	0.746[a] (0.33)
z_4 – Leased land in farming enterprises	–	1.051[a] (0.327)
Other variables		
γ	0.770[a]	0.826[c]
σ^2	0.066[c]	0.02[b]

Notes: The standard errors are shown in parenthesis

[a, b] and [c] denote sifnificance at 1%, 5% and 10% significance levl respectively.

Land and fertilizer variables do not show statistical significance. The insignificance of land in this model is a surprising result. Land used in agricultural production has been declining in Ukraine since its independence. Of Ukraine's total land area of 60 million hectares only 30.4 million were used in crop production in 2000 [Lindeman 2004]. By the year 2010, land used in crop production had decreased by another 20 percent.

The insignificance of fertilizer application can be explained by the fact that in Ukraine during last 20 years the application rate of fertilizer has dropped significantly. For example, the fertilizer application rate for wheat plunged from 149 kilograms per hectare in 1990 to 24 kilograms per hectare in 2000 [Lindeman 2004]. Because of high fertilizer prices, farmers in Ukraine still rely to a considerable degree on mechanical weed control.

One of the objectives of this study was to analyze TE by region in relationship to available land policy variables. A second stochastic frontier model was estimated with four additional variables. These exogenous variables show how current land policies impact TE in the regions. Table 3 shows results for Model 2 with additional policy variables. The explanatory power of this model increases after the four variables are added. In this model, as in the first stochastic frontier model, machinery shows statistical significance. Two exogenous variables, rented land in all agricultural enterprises and rented land in farming enterprises were found to be significant.

The total number of all operating agricultural enterprises in Ukraine grew through the 2000 suntil 2008, when it started to decrease. In 2010, around 42,230 agricultural enterprises were operating in crop production in Ukraine. SFA indicates that this number should decrease in order to increase TE in crop production; however this variable does not show significance in the model. The results show that an increase in the amount of land leased out by all agricultural enterprises decreases inefficiency or increases efficiency. The category of all agricultural enterprises includes a variety of private, collective, and state enterprises. Many do not have sufficient expertise and means, in terms of equipment and labor, to organize efficient crop production, so they lease their land to other enterprises, mainly to farming enterprises. Land leased out by farming enterprises decreases efficiency in Ukraine. Farming enterprises in Ukraine are more efficient than all agricultural enterprises in crop production. Farming enterprises overall lease from 70 to 80 percent of land. Leasing farmland reduces the efficiency of production.

All agricultural enterprises together use more private and state land than do all farming enterprises together. State land term includes land owned by local municipalities. Currently there is no official documentation, like land-surveys, for differentiating between state and municipally owned land. The lack of ownership and responsibility of state and municipal land contributes to inefficient use and management of the land. Separation and delimitation of land between state-owned land and municipally owned land is an issue that has been on the front burner in Ukraine since 2009.

DEA was used to estimate TE scores for 25 Ukrainian regions under constant returns to scale, since the Cobb-Douglas production function selected for SFA analysis operates under this assumption. The DEA model was estimated with the same set of variables as SFA Model 2. For the reasons mentioned above, the TE scores are comparable across these models. Table 4 shows TE scores for the 2010 production year by region. Average TE score for the Ukrainian crop sector estimated by the SFA and DEA approaches are very similar. SFA yielded a TEscore of 0.902 while DEA estimated a TE score of 0.937. DEA scores were a bit higher than SFA scores. This outcome is consistent with the results of previous research [e.g., Hjalmrsson at al. 1996, Hamrouni and Ratsimbanier 2012].

TABLE 4. Technical efficiency scores by region with SFA and DEA methods, 2010
TABELA 4. Wartości efektywności technicznej dla regionów według metod SFA i DEA, 2010 rok

Region	SFA	DEA
Autonomous republic of Krym	0.956	0.920
Vinnits'ka	0.957	0.948
Volyns'ka	0.943	0.979
Dnipropetrovs'ka	0.963	0.874
Donets'ka	0.968	0.920
Zhytomyrs'ka	0.819	0.973
Zakarpats'ka	0.992	1.000
Zaporiz'ka	0.885	0.864
Ivano-Frankivs'ka	0.875	1.000
Kyyivs'ka	0.983	0.942
Kirovograds'ka	0.883	0.872
Luhans'ka	0.564	0.869
L'vivs'ka	0.962	0.993
Mykolayivs'ka	0.980	0.863
Odes'ka	0.991	0.862
Poltavs'ka	0.985	0.926
Rivnens'ka	0.867	1.000
Sums'ka	0.747	0.946
Ternopil's'ka	0.907	0.964
Kharkivs'ka	0.744	0.919
Khersons'ka	0.983	0.917
Khmel'nyts'ka	0.919	0.949
Cherkas'ka	0.965	0.934
Chernivets'ka	0.977	0.986
Chernihivs'ka	0.729	1.000
Average	0.902	0.937

It is expected that the two methods do not identify extreme performers consistently, and that SFA, which is a parametric method, is regarded as somewhat more reliable for policy analysis [Fiorentino at al. 2006].

The stochastic frontier model shows that the Zakarpats'ka, Odes'ka, Poltavs'ka, Kyyivs'ka, and Khersons'ka regions had the highest TE scores during the year 2010. Close evaluation of these regions revealed that in terms of total production of crops the Kyyivs'ka, Odes'ka, and Khersons'ka regions increased in production relative to the previous year while other leading regions show a slight decrease in total crop production. The increase in crop production in the Kyyivs'ka, Odes'ka, and Khersons'ka regions reflects an increase in production by household holdings in these regions of 106.5 percent, 128 percent and 108.9 percent, respectively [Prokopenko 2011]. These are regions that grow winter grains [Lindeman 2004]. In Ukraine,

95 percent of wheat is grown as winter wheat; rye, barley and rapeseed represent other winter crops.

Data envelopment analysis shows that Zakarpats'ka region, Ivano-Frankivs'ka region, Rivnens'ka region, and Chernihivs'ka region determine an efficient frontier. The efficiency of the other regions was measured as a distance to this efficient frontier. In order to understand the results of both approaches, an examination of production practices in all leading regions is in order. A comparison of the proportion of land used in crop production held by the populace and land in all other agricultural enterprises reveals that in all of the most efficient regions determined by the DEA approach, the amount of land held by the populace is greater than the amount of land in all other agricultural enterprises. For example, in Zakarpats'ka populace holdings constitute 6.7 times more land in crop production than all other agricultural enterprises taken together in the region, in the Ivano-Frankivs'ka region 3.5 times more, and in the Rivnens'ka region 2.1 times more. This is not the case with the leading regions ranked by SFA analysis; the majority of land in the Kyyivs'ka, Odes'ka, Poltavs'ka, and Khersons'ka regions is concentrated in all other agricultural enterprises and not in the hands of the general population.

All four regions selected by DEA show a large share of crop production by household holdings. These archaic forms of farming are still prevalent in almost all Ukrainian regions. Household plots are less susceptible to changes in prices of inputs, because they employ more manual labor and mainly organic fertilizer. They also allow a high degree of adaptation to landscape conditions and in the type of crop. Private plots moreover allow the application of environmentally friendly agricultural production. Many individual owners of household plots describe their production practices as "organic" production.

In the Zakarpats'ka region, households produced 95.9 percent of all crop output, in the Ivano-Frankivs'ka region households produced 86.7 percent of all crop output, for the Rivnens'ka region this percentage was 77.3 percent and for the Chernihivs'ka region, 55.2 percent [Prokopenko 2011]. Agricultural enterprises own a smaller amount of land in these regions relative to other regions, but farming enterprises use the majority of this land. However, a large amount of the land in farming enterprises is leased.

SFA's best performers, the Kyyivs'ka, Odes'ka, Poltavs'ka, and Khersons'ka regions, produce around half of the total crop output in agricultural enterprises. In the Kyyivs'ka region, 49 percent of crop output is produced by agricultural enterprises, in the Odes'ka region − 52.5 percent, in the Poltavs'ka region – around 53 percent, and in Khersons'ka – around 47 percent. Thus, for these regions changes in current land policy are equally important for private owners and for agricultural enterprises. In the Kyyivs'ka region, 89 percent of land is owned by agricultural enterprises, in the Odes'ka region 81 percent, in the Poltavs'ka region 88 percent, and in the Khersons'ka region 80 percent. In these Ukrainian regions enterprises lease out over 90 percent of their land; farming enterprises lease out between 70 and 80 percent of their land.

Current analysis allows a comparison of TE of the Ukrainian crop sector after the passage of 16 years. In 1994, Ukrainian TE scores were 0.731 (SFA) and

0.836 (DEA) [Murova et al. 2004]. In 2010 TE in Ukraine had increased to 0.902 (SFA) and to 0.937 (DEA). This increase in TE shows that there has been progress in more efficiently utilizing the resources used in crop production. Thus, it can be concluded that production practices are improving and the recent and current economic policies in Ukraine have overall had a positive impact on TE.

SUMMARY

Two approaches for measuring technical efficiency (TE) are used in this study: stochastic frontier analysis (SFA) and data envelopment analysis (DEA). Both approaches show that technical efficiency varies considerably across Ukrainian regions, however the majority of Ukrainian regions exhibit high efficiency in crop production. An average Ukrainian TE score of 0.902 was estimated with DEA analysis and an average TE score of 0.937 was estimated with SFA analysis. Both approaches show an increase in technical efficiency following 16 years of reforms and the establishment of an operational market in land that is a free market, to a certain degree.

SFA reveals the leading Ukrainian regions that increased crop production in 2010. It shows that agricultural enterprises in these regions produce slightly more than 50 percent of the entire crop output. Individual citizens on their household plots produce the rest of the crop output. All agricultural enterprises in the leading regions of Ukraine use more than 80 percent of all agricultural land used in crop production. These agricultural enterprises lease out more than 90 percent of their land. Farming enterprises in these regions represent on average from 77 to 96 percent of total agricultural enterprises. They lease out around 70−80 percent of the land used for crop production. Current land policy in Ukraine encourages leasing the majority of agricultural land, which leads to the inefficient use of land as a resource and in turn leads to a decrease in production efficiency.

DEA analysis reveals that in the most efficient regions, land is accumulated in private hands. The amount of land in private hands in these regions is from 2 to 6 times greater than the amount of land in all other agricultural enterprises. The majority of crops, from 55 to 95 percent, are grown on private plots 1−4 hectares in size. Even though the majority of crops are produced on the household plots, farming enterprises use a large proportion of land in these regions, the majority of which they lease.

SFA analysis shows that the majority of Ukrainian regions are efficient in the production of crops. Nine regions in the country operate at levels below the average efficient level of crop production. The underperforming regions include northern regions with low soil fertility and where crops require a longer growing period. Large amounts of land are rented between agricultural enterprises, farming enterprises and other private farms and rural citizens. Unavailability of a market in land and an undeveloped credit system have encouraged the current practice of leasing agricultural land. Leasing agricultural land is cheap, and 65 percent of all lease payments are made in kind. Lease of agricultural land by all agricultural enterprises leads to inefficiency in crop sector. Farming enterprises are more selective in their leasing practices. They lease in land either from private landowners or from other farmers.

Farming enterprises participate in leasing based on the availability of needed resources and farming expertise. They are using their resources to the fullest and increase the efficiency of production in the crop sector.

There is plenty of farmland for lease in Ukraine. However, unavailability of liquid currency and credit from Ukrainian banks makes it impossible for common citizens to start a new enterprise. Foreign investors cannot buy land in Ukraine either. The only way for foreigners to gain a foothold in agricultural land is to lease it directly from farmers. It is a common practice now to sign a medium (up to 25 years) or long-term (up to 99 years) lease. Foreign investors register their companies as Ukrainian owned companies and sign lease agreements with private farmers. In some cases, large investors have to sign hundreds or even thousands of such lease agreements. Lifting the moratorium on the sale of land will not eliminate the barrier to the ownership of land by foreign citizens. They would still need to re-sign their current contracts on the lease of land.

Is there a future in consolidating household plots into economically viable sized farms? This is most probably unlikely on a large scale due to the many other production and marketing aspects involved. It may, however, be possible to consolidate a small proportion of household plots.

All structures of the farming sector − agricultural enterprises, household plots, and individual private farms − still remain problematic in terms of efficiency in Ukraine, and are constrained by the lack of appropriate policies and inadequate markets.

Ukraine is facing a number of challenges in terms of the size of an agricultural enterprise. Even the large-scale farms, which are considered to be the most efficient forms of operation, do not have enough funds and other resources to organize efficient production. Current literature provides a number of cases in inefficiency of large-scale enterprises [Gumeniuk et al. 2009]. At the present time, there are relatively very few medium-sized commercial farms in Ukraine, and subsistence farms are too small to be commercially viable in the long run.

The absence of a land market reduces the growth potential of Ukrainian agriculture and leads to an overall loss to the national welfare. The government sets land rents at a fixed percentage on the nominal value of the land. However, the nominal value of agricultural land does not reflect its real market value. This leads to inefficient use of land. In recent years a massive black market in land has emerged in Ukraine. The price of land in Ukraine is around $500−700 per hectare, while in reality it should be higher.

The owners and investors are full of hope that the moratorium on land sales will be removed soon. However, there are many concerns that oligarchic groups and a corrupted government are driving the move toward total agricultural privatization. The near future will show if the free market is given a chance to work and to determine the true market price of land in Ukraine.

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POLITYKA AGRARNA NA UKRAINIE I JEJ WPŁYW NA EFEKTYWNOŚĆ TECHNICZNĄ

Abstrakt. Badany jest wpływ polityki agrarnej na efektywność techniczną (ET) ukraińskiego sektora roślin w 2010 roku. Zastosowano dwie metody dla oceny wynikow ET: analizę stochastycznej granicznej funkcji produkcji Cobba-Douglasa (SFA) oraz metodę obwiedni danych (DEA). Regiony o wysokiej efektywności technicznej są badane pod kątem polityki

agrarnej. Publikowana analiza pokazuje, że przeciętnie dzierżawa gruntów przez różnego typu przedsiębiorstwa związane z sektorem rolnym wpływa na wzrost ET, natomiast dzierżawa przez gospodarstwa rolne obniża tę efektywność. Porównanie obecnych wyników TE z wynikami sprzed 16 lat pokazuje zróżnicowanie regionalnych zmian, ale również ogólną poprawę ET na Ukrainie.

Słowa kluczowe: efektywność techniczna, ukraiński sektor produkcji roślinnej, stochastyczna graniczna funkcja produkcji Cobba-Douglasa, metoda obwiedni danych, dzierżawa gruntów, polityka agrarna