THE IMPACT OF LAND MORATORIUM ON AGRICULTURAL PRODUCTIVITY
IN UKRAINE

by

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Abstract

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Ukraine, being among the leaders on exceptionally fertile soil, is one of the top exporters of agricultural commodities in the world. However, Ukraine is still far from realizing fully its significant agricultural potential and land moratorium is among the reasons leading to this gap. This paper aims to assess the effect of land moratorium on agricultural productivity as well as other factors that may determine it using a rich 1995-2014 farm level data. Controlling for macroeconomic situation and tax support of agricultural producers in Ukraine along with developments on world agricultural commodities market and farms' characteristics, introduction of land moratorium appeared to have significant negative effect on TFP growth and technical efficiency in crop production.

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GLOSSARY

CAE – Collective agricultural enterprises

FAT – Fixed agricultural tax

GDP – Gross domestic product

MPS – Market price support

PSE – Producer support estimates

REER – Real effective exchange rate

SSSU – State Statistics Service of Ukraine

TFP – Total factor productivity

VAT – Value added tax

Chapter 1

INTRODUCTION

Currently land moratorium, a ban on sale of agricultural land is considered as one of the major obstacles for accelerating the agricultural production growth in Ukraine. Among the main negative consequences of its existence are low growth rates of the land cost as an asset, less efficient use of land because of barriers for redistributing of land resources to a more efficient owner and producer and lack of transparency in land use.

Moreover, land moratorium prevents from increasing of the investment inflow and expansion of financial capacity especially for small and medium producers, as there is no opportunity for them to use land as collateral (Deininger et al, 2018). Mentioned negative effects of land moratorium will be discussed in more detail in the subsequent chapter.

The land moratorium issue is particularly acute in view of the exceptional importance of agricultural production for the development of the Ukrainian economy. In particular, agriculture is the third sector of the national economy, after industry and trade, by the share of GVA in GDP: in 2018 it was about 10%, declining from 24% in 1990 (Figure 1). Almost one fifth of the employed population is engaged in agricultural production.

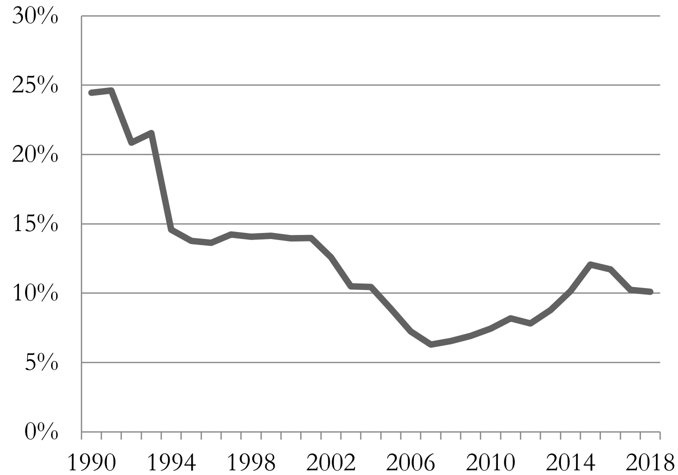

Figure 1. Agriculture, forestry, and fishing, value added (% of GDP in current prices)[1]
Source: Based on the SSSU data

Agri-food products[2] significantly contribute to the Ukrainian export: in 2018 they accounted for 69.1% of the total exported amount. Cereal crops are among the major export commodities, constituting 15.3% of export in 2018 (while in 2001 the corresponding share was 3%)[3]. Ukraine is one of the top world exporters of grains. In particular, as of 2017 Ukraine is fourth in the world by export value of corn and barley, sixth by export value of wheat, seventh by export value of soya beans[4].

Agricultural sector occupies the second place among the types of economic activity by the amount of allocated capital investments: it accounted for 14.1% of

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[1] Starting from 2000 data is according to SNA 2008, before this year – according to the former revisions of SNA Data for 2010-2014 are given excluding the temporarily occupied territories of the Autonomous Republic of Crimea, the city of Sevastopol, data for 2015-2016 – also excluding the part of the anti-terrorist operation zone.
[2] Section I-IV according to Ukrainian classification of foreign economics goods
[3] Calculations based on SSSU data
[4] Data from World's Top Exports

the total amount of capital investments in 2017, and this share has been steadily increasing over the past years[5].

However, Ukraine is far from realizing its significant agricultural potential and land moratorium is among the reasons leading to this gap. While about 70% of land in Ukraine is agricultural and our country is among the leaders on exceptionally fertile soil, having one-third of the world-wide stock of chernozem, GVA per hectare of agricultural land in Ukraine is considerably lower comparing with countries that have less productive land endowments (Table 1).

Table 1. Agriculture, forestry, and fishing, value added in 2016

Top crop exporters	GVA (constant 2010 US$) per hectare of agricultural land	arable land
France	1 431	2 239
United States	530	1 414
Brazil	361	1 266
Argentina	204	773
Canada	421	604
Russian Federation	298	527
Ukraine	329	416

Source: Calculations based on World Bank national data 2016

Moreover, the agricultural sector in Ukraine is characterized by the low total factor productivity: according to the estimation of the US Department of Agriculture[6] the annual average agricultural TFP growth in Ukraine during 1991-2015 was about 0.017% (70th out of 172 countries)[7]. However, it is worth mentioning that over the last 10 years agricultural TFP growth noticeably

[5] Calculations based on SSSU data
[6] Database available at https://www.ers.usda.gov/data-products/international-agricultural-productivity/
[7] However this level of average annual TFP growth was higher than the level of general indicator for former USSR countries (0.015%)

accelerated (index for the base year 2005 in 2015 was 135 (Figure 2) and Ukraine was placed 26th according to this indicator).

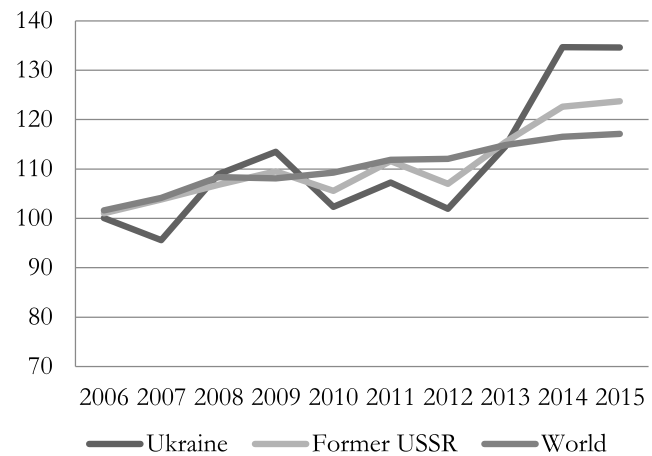

Figure 2. Agricultural Total Factor Productivity Growth Index (2005=100)
Source: USDA

Moratorium on agricultural land trade has been in place in Ukraine since 2001 (The World Bank, 2013). It was introduced as a temporary measure to protect landowners in a situation of underdeveloped land market infrastructure in the process of agricultural land privatization after the breakup of the Soviet Union. But effectively the moratorium was extended 9 times since then and currently it is characterized by an impressive scale as it affects 96% of agricultural land.

Empirical literature on the impact of land moratorium is rather scarce and this research study can contribute to it, as well as be relevant for the policy discussion on the land reform in Ukraine. This thesis is devoted to the assessment of the effect of land moratorium on technical efficiency and agricultural productivity growth as well as other factors that may determine them using a rich 1995-2014 farm level data.

In our analysis we use fixed effects panel regression procedure and our variable of main interest is dummy variable that reflects presence of land moratorium (takes value 1 for the period from 2001 till 2014 and 0 - for years 1995-2000) along with its interactions with farm-specific variables. Obtained results allow us to state, with some degree of caution, that presence of land moratorium has detrimental effect on technical efficiency and agricultural productivity growth in crop production and introduction of ban on sale of agricultural land was a structural break.

The paper is structured in the following way. The second chapter covers the history of land market developments in Ukraine. The third chapter is devoted to the analysis of the studies, which are relevant to the discussed topic. In the fourth chapter the general methodology used in our empirical analysis is presented along with particular methods implied for estimating the effect of land moratorium on agricultural productivity. Subsequent chapter deals with the data description. The last chapter contains the main empirical findings and results of the conducted analysis.

C h a p t e r 2

LAND MARKET DEVELOPMENTS

2.1 Agricultural land reform and moratorium in Ukraine

The formation of a land market is yet ongoing in Ukraine. Back in 2002 the World Bank conducted the research aimed at evaluating land market policies of several transition countries (Lehrman et al, 2002). According to the results of this research, Ukraine was placed 15th out of 22 countries, for which composite index was calculated. It was stated that Ukraine should significantly accelerate the creation of the competitive agricultural land market. However, 16 years passed but an efficient land market is not established so far.

While 'rental' arm of land market is functional in Ukraine and constitutes the main channel of farmland transactions for farmers and landowners, its 'sales and purchases' arm is, in fact, nonexistent (Nivievskyi, 2017). The underlying reason for this is moratorium on sales of agricultural land designed to make sales transactions in the farmland market legally impossible.

The scope of land moratorium is really impressive: 96% of agricultural land is under moratorium (Figure 3). At least 16% of Ukrainian citizens (owners of land shares) are affected by land moratorium as they can not dispose their land shares (pai) at their discretion[8].

[8] VoxUkraine article 'Moratorium on agricultural land', which is available at the link https://voxukraine.org/uk/moratoriy-na-zemli-ua/

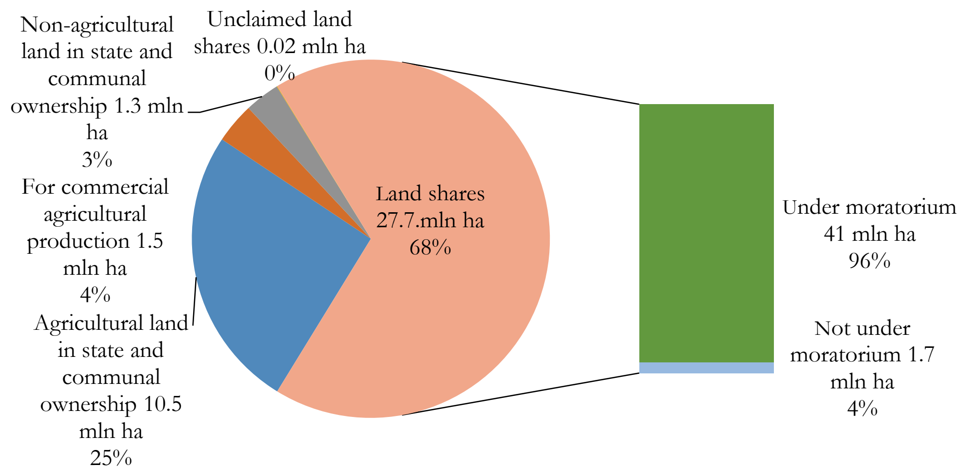

Figure 3. Scope of moratorium on agricultural land sales
Source: VoxUkraine article 'Moratorium on agricultural land'

Land reform is almost of the same age as Ukrainian independence. History of its implementation is commonly divided into four main periods. The first stage lasted from 1990 to 1992, when a number of laws[9] was adopted that created conditions for private farming and defined types of land ownership.

During the next period (1993-1996) the legal basis for land reform was established, workers of collective agricultural enterprises (CAE) received a right to land shares and could leave CAE with their shares[10]. In particular, each CEA member was given an allotment (share) of land identified with a certificate. Owners of these allotments received the right to manage their shares of land. The right of private ownership was also identified by state deeds (Meyers et al., 2005). Until 2001 there was no prohibition to freely manage land as asset, including the right to sell it. Thus, as we have farm level data available from 1995 we can model

[9] 20.12.1991 Law of Ukraine "On Private (Peasant) farm"; 30.01.1992 Law of Ukraine "On Forms of land Ownership"

[10] Presidential Decree "On urgent Measures to Accelerate Land Reform in Agriculture"

the effect of the land moratorium on the technical efficiency and agricultural productivity growth (in particular, in crop production).

In the subsequent years (1997-2000) the law on land leasing was adopted that provided for leasing of land plots, which are owned by legal units, citizens and the state. Also the fixed agricultural tax, based on land value, was introduced.[11] The last stage started from 2001 and lasts till present time. In 2001 the Land Code was adopted and land moratorium, the ban on sale of agricultural land, was first introduced. In general, the moratorium was extended 9 times (the last extension was made in February, 2019) and currently it will expire in January, 2020. As a result, Ukrainian land reform is the longest in the world and it lasts for more than 25 years.[12] Currently the policy discussion of the issue of establishing land market in Ukraine is particularly active. Thus, it is worth mentioning benefits and risks of lifting the farmland sales moratorium presented in Table 2.

Table 2. Arguments for and against lifting land moratorium

Arguments for the reform	Potential risks and obstacles to the reform
Opportunity for shareholders to exercise their constitutional right to property	Concentration of land in the hands of a small number of entities
Inflow of investments	Land in public ownership
Increase of the cost of land as asset	Uncertainty about land shares
More efficient land use	Estate of inheritance
Reduction of the share of public lands that are not used transparently	Insufficient quality of the land cadaster work

Source: Expert discussion 'Moratorium on land sales – risks and benefits'[13]

11 17.12.1998 Law of Ukraine "On Fixed Agricultural Tax"

12 Article '25 years of schemes and losses. What a moratorium on the sale of agricultural land brought us?' available at link https://www.epravda.com.ua/publications/2016/07/13/598945/

13 Available at link http://uacrisis.org/56351-moratorij-na-prodazh-zemli

Despite the exceptional fertility of agricultural land in Ukraine, its rental price is much lower in Ukraine compared with European countries. For instance, based on the Eurostat data in 2017 the highest average agricultural land rental price is recorded in the Netherlands at the level of 847 euro per hectare, in France the price is about 215 euro per hectare, Hungary and Czech Republic – 160 and 104 euro per hectare respectively, while in Ukraine renting price stands at 41 euro per hectare[14]. It was estimated that the cost of renting agricultural land in Ukraine is more than 10 times lower than it would be if the distortions in the land markets (among which land moratorium is one of the most serious ones) and other factors of production were eliminated (Nivievskyi and Nizalov, 2016).

A relatively cheap rental price is one of the factors demotivating the efficient use of agricultural land and its treatment as a highly valuable resource. Along with the well-known negative effects of the land market absence (lack of transparency in land use, obstacles for the investments attraction, narrowing of the financial capacity, especially for small farms because of the impossibility of a land collateral, etc.), significant risks are associated with lowering the quality of fertile soil.

In particular, currently, Ukraine has more than 1.1 million hectares of degraded, unproductive and technologically contaminated land[15]. One of the reasons that has led to such a situation is the lack of incentives for farmers to invest in land that they do not have any opportunity to buy. Thus, non-compliance with the crop rotation and adding insufficient amount of organic and mineral fertilizers are not rare phenomena for the crop production in Ukraine. As a result, due to the degradation of soils, the losses caused by smaller volumes of received agricultural products are estimated by FAO experts at $ 5 billion[16].

14Source of data about rental prices in Ukraine is Geocadaster

15 Source: http://www.fao.org/europe/news/detail-news/en/c/1128337/

16 Source: http://www.fao.org/3/a-i3905e.pdf

According to the World Bank estimates, successfully conducted land reform will lead to the boost of agricultural productivity, which in its turn could result in additional US$15 billion to the annual output and the increase in annual GDP by about 1.5 percentage points[17]. To produce such results it would be crucial to provide incentives for a long-term investment and establish the proper land management, access to credit, and transfer of land based on the productiveness of its use.

The main conclusion of the research on the impact of land moratorium conducted by the Ukrainian Institute For the Future[18] is that a successful land reform will contribute to the average annual nominal GDP growth of 6-7%. Two scenarios are considered in this study, which differ in the question of the possibility of buying land by foreigners, but methodology of the estimation procedure is not provided in the report.

The effect of lifting the moratorium on land sale in Ukraine presented in Easybusiness (2016) report on "Introduction of free land market in Ukraine: economic effect" is estimated to be additional 28 to 85 bn USD by 2025 depending on the three scenarios compared to the existing state of affairs. Under the scenario, according to which there is no regulations and foreigners are allowed to buy land, the expected average farmland sales price is US$ 5000/ha and the farmland rental price is forecasted to increase to US$150/ha. The estimated effect on GDP will be additional 9% of the current GDP by 2025.

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17 Source: http://www.worldbank.org/en/news/opinion/2017/10/02/ukraine-can-boost-annual-output-us15-billion-with-land-reform

18 "Moratorium on land: the extent of losses for the Ukrainian economy" conducted by Ukrainian Institute For The Future in 2017

2.2 Agricultural land market experiences of other countries

In this context it is also appropriate to outline briefly the experience of carrying out the land reform in a number of CIS countries and post socialist countries. One of the most effective reforms was conducted in Poland, Georgia and Latvia (Romanovska, 2013). In particular, Polish land market functions successfully and is attractive for investments. On average, 300-400 thousand hectares of farmland are bought and sold annually. This contributes to the development of farming in the country - currently about 2 million hectares are cultivated by private producers, who own from 100 to 400 hectares of land.

In Georgia the state created adequate mechanisms for property registration, the use of parcels and formal preconditions for operating the land market, abuse is minimized. However, due to favorable rental conditions, uneven demand for land, the market is currently under development.

Despite the fact that Latvia is not an agrarian country, the land market is functioning harmoniously and efficiently. From the 25 largest Latvian latifundists, the only one belongs to Latvians. The largest owner in the country is the Swedish company, which owns about 60 thousand hectares.

At the same time, land reforms in such countries as Moldova and Russia are less successful due to the number of reasons. For instance, Moldova faces such obstacles as noticeable urban migration processes and extensive land use, which leads to soil depletion.

Bureaucracy and large share of land in public ownership (85-90%) in Russia prevent occurrence of incentives and instruments for land transfer to active economic circulation.

Table 3. Main characteristics of the land reform of several countries

	Main priority of land reform		The predominant form of land ownership in the country					The predominant form of land use by owners		Complex and bureaucratic registration procedures	Significant shadow turnover of land
	Peasants	Efficient production	state/ municipal	Small private	Average private	Large private	Foreign	Own production	Renting out		
Russia		*	*						*	*	*
Moldova	*			*	*	*	*		*	*	*
Georgia	*				*				*		
Latvia		*			*	*	*	*			
Lithuania	*			*				*			
Estonia	*				*				*		
Poland	*			*	*			*	*		
Hungary	*		*	*				*	*	*	*
Brazil		*				*	*	*	*	*	*

Source: 'International experience of land reform: why there is no panacea'[19]

According to the Global Farmland Index 2016 emerging markets of Romania, Hungary, Poland, Uruguay and Argentina have the highest rates of farmland value growth: the annualized average growth across these countries stands at 20% since 2002.

[19] Available at the link http://cost.ua/files/land-reform/case-ukraine_land_reform.pdf

C h a p t e r 3

LITERATURE REVIEW

Land moratorium is the hardest and uncommonly used type of farmland tradability restrictions. This fact could explain the obvious lack of both theoretical framework and empirical evidence on the impact of land moratorium.

However, the effects of other farmland restrictions, are, in general, covered in the literature. Pre-emptive rights to purchase land parcels, restrictions on land sale to ensure continued agricultural use, transfer taxes, restrictions on purchase of land by foreigners are among typical types of such regulations (Nivievskyi et al, 2016).

In general administrative restrictions, the most common forms of which are limits on tradability of land and ownership ceilings, are considered both costly and frequently ineffective in addressing undesirable equity outcomes (Deininger and Feder, 2001).

Among theoretical studies, mainly partial equilibrium framework was used to show that an increase in the severity of the farmland ownership regulation leads to the reduction of the land services price and consequently the farmland price (Ferguson et.al, 2006). Based on the extension of the model with the effect of imperfect credit markets, it was revealed that stringency of credit constraints for farms, combined with restrictions on land market, affects the amount of non-land inputs farms can use. This results in the lower productivity, and consequently the lower farms' demand for land services and corresponding land services price (Nivievskyi et al, 2016).

Results of the conducted empirical research are consistent with the mentioned theoretical model that overall reveals a negative effect of farmland restrictions.

As for the impact on productivity, there are a number of studies aimed at estimating the effect of maximum landholding size restrictions on it. In particular, Ghatak and Roy (2007) found a significant adverse effect of land ceilings on agricultural productivity in India, while Adamopoulos and Restuccia (2014) for the Philippines' data showed that land ceilings led not only to a significant reduction of agricultural productivity, but also the average farm size.

Returning to the impact of land moratorium, main channels of its transmission to productivity in agriculture are investment channel and opportunity of using agricultural land as collateral.

As for the investment channel, it is the absence of opportunity to purchase land that leads to uncertainty regarding the ability of a long-term use of land. This, in its turn, has a noticeable adverse effect on the incentives of sustainable land management to maintain its high quality through crop rotation, investments in irrigation, planting perennials. Also it erodes a stimulus to undertake productivity enhancing investments (Deininger et al, 2017).

Another important channel is inability of using land as collateral. Small and medium producers experience lack of financing as they cannot use one of their most valuable assets as collateral to obtain it because of the ban on land transfers. As a result, financial restrictions undermine opportunities for farmers to grow further and produce more products with higher value added. This is empirically supported by the evidence from the CEE transition economies that suggests an increase of the total factor productivity as the farm access to credit increases, partially reflecting that an improvement in access to credit leads to an adjustment of the relative input intensities on farms (Ciaian et al, 2010).

The improvement of the access to credit for farmland owners is also among the means through which lifting of land moratorium will have a sizable positive effect on the welfare of landowners. Other channels are related to the improvement of land lease market and launch of land sale market. In particular, lifting of land moratorium will naturally cause the decrease of the amount of land available for lease. In its turn, this will contribute to the increase of price elasticity of lease land supply. As a result, rental price will increase and consequently farmland owners' revenues will grow up. Launch of sales-purchase market will lead to the establishment of new redistribution tool that will generate an additional stream of revenues both for landowners (from sale) and producers (from capitalization of incomes) (Nizalov, 2017).

The overall empirical evidence suggests positive effects of land sales on the agricultural productivity and welfare. Based on the rich longitudinal data for India, supplemented by the indicator of rainfall shocks, it was shown that land sales and purchase transactions contributed to the productivity improvement and had a positive impact on equity (Deininger et al, 2009).

Besides the existence of land market, a wide range of factors determine agricultural productivity. A decent number of studies aimed at determining drivers of agricultural TFP growth apply a conceptual framework of growth accounting that was first introduced by Solow (1957). According to this approach the growth in TFP is attributed to that part of growth in output, which cannot be explained by growth in factor inputs like land, labor and capital.

Among the factors that have a significant effect on productivity in agriculture, a leading role is assigned to investments, mainly in the agricultural research. In case of the Indian crops sector the results of growth accounting procedure revealed that the noticeable TFP growth was driven by investments primarily in research, but also in irrigation, extension and markets (Rosegrant and Evenson, 1995). Investments in agricultural research turned out to be an important factor that positively affects TFP in both the crop and livestock sectors of Thai agriculture (Suphannachart and Warr, 2010).

Capital is also among the major drivers of the agricultural TFP growth. In particular, for South Asia countries the levels of natural, human and technology capital endowments are positively associated with the TFP change, while the financial capital and crop diversification turned out to have opposite effects (Anik et al, 2017). As for the European field crop farming, materials appeared to be the most important input along with labor, as hiring workers by performing the highly specialized tasks in the number of countries led to the increase in agricultural productivity (Petrick and Kloss, 2017). However, in case of severely restricted land markets, which result in the considerable factor misallocation, it was found out that the land size and capital were actually unrelated to the farm TFP (Restuccia and Santaeulalia-Llopis, 2017).

The farm size is another important factor that influences TFP in agriculture. In general, the empirical literature suggests some positive farm size-productivity relationship with certain exceptions. For instance, based on the farm level data for the Australia's grains industry, it was found that the farm size along with the moisture availability and formal education of farmers positively contributed to farm productivity (Sheng and Chancellor, 2018). To the other factors that had a significant impact on farm productivity in Australia's grains industry belong the land use intensity, access to finance, land area, crop specialization, investment income and corporate ownership (Kokic et al, 2006).

Chapter 4

METHODOLOGY

4.1 Modeling the effect of land moratorium on productivity

To the best of our knowledge there are virtually no theoretical and empirical models on the effect of land moratorium on agricultural productivity. Thus there is an obvious lack of specific methodological approaches for estimating the impact of land moratorium.

The econometric techniques applied to assess the impacts of different policy interventions tend to be microeconomic by their nature and mainly focus on groups of beneficiaries (together with control groups / non-treatment groups) and changes in their performance caused by these interventions[20]. Our data, in general, do not allow us to use such technique.

However, in the theoretical and empirical literature on determinants of productivity we can find the approach of including time dummies reflecting qualitatively different periods, for instance, the presence of crisis. In particular, Oulton and Sebastiá-Barriel developed the following theoretical framework for productivity growth:

$$q_{it} - q_{it-1} = \lambda(q_{it}^{*} - q_{it-1}) + \beta(q_{it-1} - q_{it-2}) + (1 - \lambda - \beta) \times \\ \times (q_{it-2} - q_{it-3}) + \gamma crisis_{it} + \varepsilon_{it} \quad (1)$$

[20] Source: Approaches to Impact Assessment by OECD available at https://www.oecd.org/sti/inno/Approaches-OECDImpact.pdf

In this equation q_{it} is the log of the productivity level, q_{it}^{*} is the log of the long-run productivity level, $crisis_{it}$ is a dummy indicating the presence (value 1) or absence (value 0) of a financial crisis, and ε_{it} is a mean-zero error term.

The empirical literature suggests that the crisis dummy (in particular, banking or currency crisis) has a marginally significant effect on productivity (Aghion et al., 2006). There is also an approach in empirical studies of introducing independent variables in the regression in an interaction term with a crisis dummy (Pardo, 2016).

We adopt the abovementioned method of using dummy variable in our model and introduce the binary variable that reflects the presence of ban on sale of agricultural land. Our goal is to test whether introduction of land moratorium can be considered as a significant structural break. For this purpose, we apply the approach for our panel model, which is, in principle, similar to Chow test procedure. In particular, along with the dummy reflecting land moratorium presence, its interactions with farm-specific variables are introduced. Then joint significance of the obtained regression coefficients for mentioned dummy and interaction terms is tested.

In the analysis of factors affecting the agricultural productivity panel data are frequently available. Thus, in a decent number of empirical studies panel regressions are estimated, including fixed effect models (Rosegrant and Evenson, 1995, Sheng and Chancellor, 2018). Our model is also estimated using the fixed effects panel regression procedure to control for unobserved farm-specific variables that may affect productivity growth and in such a way we partially address the endogeneity problem.

The main hypothesis to be tested is that the absence of moratorium on agriculture land sales has a highly significant positive effect on technical efficiency and agricultural productivity growth. The specification of the econometric model being used to test the main hypothesis is the following:

$$y_{it} = \beta_{yfs} FS_{it} + \beta_{ymc} MC_t + \beta_{ywc} WC_t + \beta_{yd} D_t + \beta_{ydfs} (D_t * FS_{it}) + \alpha_i + u_{it} \quad (2)$$

where y_{it} is technical efficiency and agricultural productivity growth in crop production

FS_{it} is the matrix of farm specific variables that affect productivity

MC_t is the matrix of macroeconomic controls

WC_t is variable reflecting agro-climatic conditions

D_t is time-varying dummy variable reflecting presence of land moratorium

Following the literature on the determinants of agricultural productivity, a set of independent variables contains such indicators as the farm size (proxied by the amount of agricultural land used by farm), capital intensity (calculated as a ratio of real capital costs to real labor costs), proxy for managerial ability and dummies for types of crops produced by a farm. Managerial ability is proxied by net crop revenue per hectare partially following approach used by Byma and Tauer (2010). The abovementioned set of dummies contains three binary variables, each reflecting whether farm produces grain and oilseeds, vegetables and perennial crops.

In order to find a pure effect of land moratorium on agricultural productivity growth, a set of producer support estimates and macroeconomics variables is added to the model. Among them are values of tax benefits (from fixed agricultural tax and special value added tax regime) and market price support received by farmers. The empirical study for Ukraine suggests that tax exemptions positively affect agricultural TFP growth, despite being a cost-inefficient way to enhance productivity growth in agriculture (Nivievskyi, 2018).

Tax incentives for agricultural producers were introduced in Ukraine in 1999 and benefits from them were calculated following the approach applied by Nivievskyi (2018). In particular, the amount of VAT benefits was obtained as 20% from the crop revenues for each farm. The benefits from FAT system were assumed to be equal to profit tax liabilities[21] (profit corporate tax rate in Ukraine was 23% during the considered period). Market Price Support (MPS) arises from policy measures that create a gap between domestic market prices and border prices of specific agricultural commodities[22]. In our model we include this variable as percent of gross crop revenues.

Also growth rate of real GDP (as a macroeconomic variable vulnerable by major crises that occurred during observed period: currency and financial crises) and a real effective exchange rate belong to the group of control variables as the traditional view is that there is a positive link between productivity growth and REER appreciation (Lee and Tang, 2007).

To control for the effect of Ukraine's accession to World Trade Organization we use dynamics of average Most-Favoured-Nation tariffs for agricultural products. Such proxy captures this effect considerably better than simple dummy as tariff reduction is considered to be one of the main channels (along with market access and the adjustments of the domestic tax system) through which accession to WTO affects economy (Ferdinand et al., 2004). In fact, Ukraine's WTO accession

[21] In case of losses, FAT benefits were set to equal to zero.
[22] Source: The PSE manual

began long before official accession in 2008 and was reflected in tariffs' dynamics. The data on MFN tariffs are calculations of Movchan Veronika, Academic Director and Head of the Center for Economic Studies at IER.

Given that agricultural production in Ukraine is to a large extent export oriented and sensitive to the developments on agricultural commodities markets, a set of control variables also contains world agricultural price index. We use forward operator for this variable as agricultural productivity is likely to be affected by expectations regarding future prices of agricultural products.

To control for agro-climatic conditions in different years (moisture availability, extreme temperature regimes) we use data on yearly grain yields in Ukraine as their dynamics reflects meteorological conditions pretty well because of sensitivity to them. In the empirical literature yield shocks, which are due to random weather shocks, are used for the demand and supply schedules estimations (Roberts and Schlenker, 2013).

4.2. Productivity identification

Major approaches to measure total factor productivity are commonly divided into parametric, efficiency frontier and index number approaches (Ali, 2011).As each method has its own advantages we make use of two approaches to estimate TFP in levels: index and semi-parametric. Spearman's rank correlation coefficient was calculated to measure statistical dependence between rankings of TFP estimated by different methods.

There are a few advantages of the index number approach over the parametric. In particular, it does not require explicit specification of functional form, the construction of separate indices for different components of the total output is possible. Moreover, there is no problem of degrees of freedom, and the number of observations over time is not crucial.

Total factor productivity is typically calculated as the ratio of the output quantity index to the input quantity index (Bjurek, 1996). Fisher TFP index used in this study is the geometric mean of Laspeyres and Paasche indexes (Key, 2018). Weights for the Laspeyres TFP index are the initial year prices (1995 in this study), while the Paasche index uses the final year prices (2014 in this study) as weights.

$$TFP_{Lt} = \frac{\sum_{m=1}^{M} p_{m_1} y_{m_t}}{\sum_{k=1}^{K} w_{k_1} x_{k_t}} \quad TFP_{Pt} = \frac{\sum_{m=1}^{M} p_{m_T} y_{m_t}}{\sum_{k=1}^{K} w_{k_T} x_{k_t}} \quad TFP_{Ft} = \sqrt{TFP_{Lt} \cdot TFP_{Pt}} \tag{3}$$

The semi-parametric approach, in particular Olley & Pakes (1996) and Levinsohn & Petrin (2003) methods, addresses two major methodological issues that arise when TFP is estimated by using ordinary least squares to a panel of farms (Beveren, 2012). Among these problems are endogeneity of input choices and selection bias. Simultaneity emerges as productivity, contained in residuals, is likely to be correlated with input choices (independent variables in the production function). The problem of endogeneity of attrition arises as decisions on the input allocation are made taking into account farm's survival in a particular period.

In this study Levinsohn-Petrin method with Ackerberg-Caves-Frazer correction is used to estimate TFP in crop production. This particular approach is applied as, unlike investments data, the data on material costs and their structure is available for each farm across all years. ACF correction is used, as LP estimation algorithm suffers from the multi-collinearity and identification issues with the labor variable.

The following model is used to estimate the production function:

$$y_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_{al} al_{it} + \varpi_{it} + \varepsilon_{it} \tag{4}$$

where the y_{it} is the logarithm of output for each farm *i* at period *t*, l_{it} is the logarithm of labor, k_{it} is the logarithm of capital, m_{it} is the logarithm of material costs (that consist of costs for fuel and energy, seeds and fertilizers), al_{it} is the logarithm of agricultural land and ϖ_{it} is logarithm of farm-level TFP.

In this study we estimate the value added production function as applying ACF correction to the production function with output, as the dependent variable, does not ensure correct parameter identification. Value added is calculated as the difference between deflated crop production revenues and material costs.

The vector of state variables in the estimation procedure consists of deflated depreciation costs and used area of agricultural land while the vector of free variables includes the number of employees. Finally, the proxy variable is deflated material costs, which consist of costs on fuel, energy, fertilizers and seed. TFP estimates are obtained as exponentiation of production function residuals. TFP growth in crop production is calculated as annual growth rates of obtained TFP levels.

Technical efficiency was estimated using frontier production function approach (Battese, 1992). The model of a stochastic frontier production function for panel data introduced by Pitt and Lee (1981) is the following:

$$Y_{it} = f(x_{it};\beta)\exp(V_{it} - U_{it}) \qquad (5)$$
$$i = 1,2,\ldots,N$$
$$t = 1,2,\ldots,T$$

where Y_{it} represents the possible production level for for the *i*th farm at the *t*th year; $f(x_{it};\beta)$ is a suitable production function (Cobb-Douglas in our case) of the vector, x_{it}, of inputs for the *i*th farm at the *t*th year and a vector, β, of unknown parameters; U_{it} is a non-negative random variable associated with farm-specific factors which contribute to the *i*th farm not attaining maximum efficiency of production at the *t*th year; V_{it} is a random error having zero mean, which is associated with random factors (e.g., measurement errors in production, weather, industrial action, etc.) not under the control of the farm.

Technical efficiency of an individual farm is defined in terms of the ratio of the observed output to the corresponding frontier output, conditional on the levels of inputs used by that farm (Battese, 1992).

Chapter 5

DATA DESCRIPTION

5.1 Data source and preparation

The major source of data for this research is Ukraine-wide farm-level accounting data for an unbalanced panel of agricultural enterprises collected by the State Statistics Service of Ukraine. This database contains farm-year 186 777 observations, for which the data on the main economic indicators of agricultural enterprises' performance are available over the period of 1995-2014.

The set of main variables used in the analysis contains such indicators as revenues from crop production and expenses on different inputs by types of agricultural products.

A number of other data sources were used in the analysis. In particular, the data on macroeconomic indicators were obtained from IMF International Financial Statistics and World Bank Database (including Commodity Price Data). The OECD Producer Support Estimates database was the main source of the data on market price support for crop producers.

The following steps were taken to prepare dataset:

- The data on revenues and expenses were deflated (converted to quantities) using annual price indices: industrial producer price indices and consumer price index (from the State Statistics Service of Ukraine);
- All farms with zero labor costs or agricultural land input were removed from the sample (the price of non-complication of data preparation process by imputation procedures was lost observations, but their number was not really essential especially in a view of large initial dataset). Also farms with

land productivity exceeding 1500 th. UAH/ha were removed from the sample (as a few farms with this value of land productivity were considered as clear outliers).

- We kept only variables (revenues and costs) related to crop production as this branch of agricultural production is considered as the most affected by land moratorium;
- The dummy was created for the period of land moratorium presence (takes value 1 for the period from 2001 till 2014 and 0 - for years 1995-2000).

The final dataset consists of 184 608 observations across 1995-2014 years with the total number of farms, performance of which is studied in this research– 29 994. The main statistical properties of key variables in the dataset, being used for the analysis in this research, are presented in Table 4.

Table 4. Descriptive statistics of variables in the dataset

Variable	Number of observations	Mean value	Standard deviation	Minimum value	Maximum value
Total crop revenue, th. UAH	184 608	303.6	1 099.9	0	154 842.0
Plant labor, employees	184 608	69.0	95.4	0	6 124.0
Agricultural land, hectares	184 608	2 118.2	3 291.9	1	319 716.0
Depreciation, th. UAH	184 608	48.5	323.7	0	97 883.1
Labor cost, th. UAH	184 608	26.9	180.2	0	70 135.6
Material cost, th. UAH	184 608	265.9	1 107.8	0	265 605.8
Seed cost, th. UAH	184 608	61.7	247.2	0	74 551.9
Fertilizers cost, th. UAH	184 608	69.8	294.4	0	42 619.4
Fuel and energy, th.UAH	184 608	10.5	74.5	0	7 849.4
Other cost, th. UAH	184 608	77.4	422.6	0	96 394.5

5.2 Data description

In our analysis we used three major groups of variables. The first one contains key dependent variables among which are technical efficiency and TFP growth rate (results of its calculation and analysis are described in the subsequent chapter). The second group of variables consists of main farms' characteristics that have an effect on technical efficiency and productivity growth. This group is formed by such variables as the farm size, capital intensity, proxy for managerial ability and dummies for types of crops produced by a farm. Based on Figure 4 it can be concluded that on average farms decreased in size over the considered period. Among possible reasons, which underlie this change, were official disband of collective agricultural enterprises in 1999 and the financial crisis taking place during the period under the study.

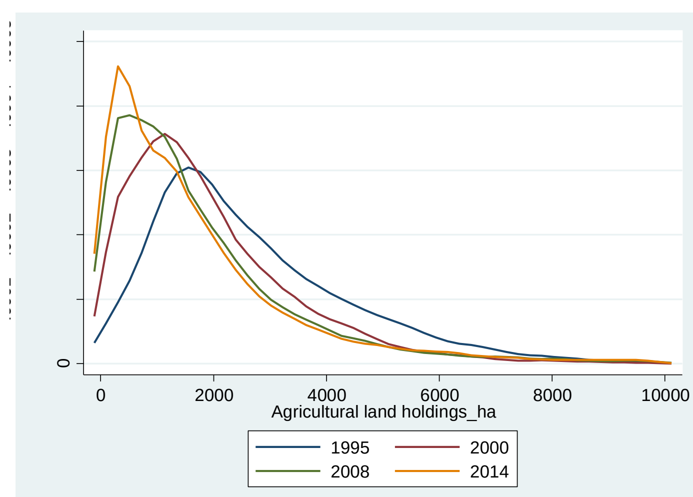

Figure 4. Change in farm size between 1995-2014[23]
Source: Calculations based on the SSSU database of farm-level accounting data

[23] Graph is built for 99% of all observations.

During the observed period the level of farms' capital intensity almost steadily increased, while according to the dynamics of our proxy for managerial ability after 2007 its level declined rather substantially.

Figure 5. Dynamic of average level of capital intensity and managerial ability
Source: Calculations based on the SSSU database of farm-level accounting data

When it comes to the types of crops produced by agricultural enterprises, Figure 6 shows steadily decreasing number of farms that produce crops with higher value added (vegetables) and perennials. Significantly lower number of such farms compared with the number of farms that produce cereals and oilseeds suggests that there is basically lack of incentives to make long-term investments.

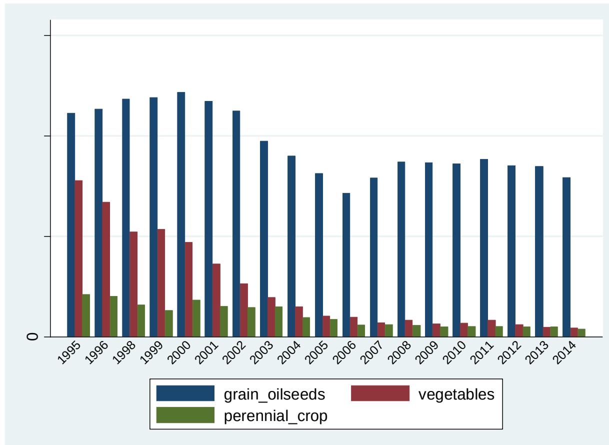

Figure 6. Number of farms that produce particular type of crops
Source: Calculations based on the SSSU database of farm-level accounting data

Crop production is naturally affected by agro-climatic conditions, to control for which we use annual grain yields. Figure 7 clearly reflects two years with extreme weather conditions during the observed period: winterkill in 2003 and rather severe drought in 2007.

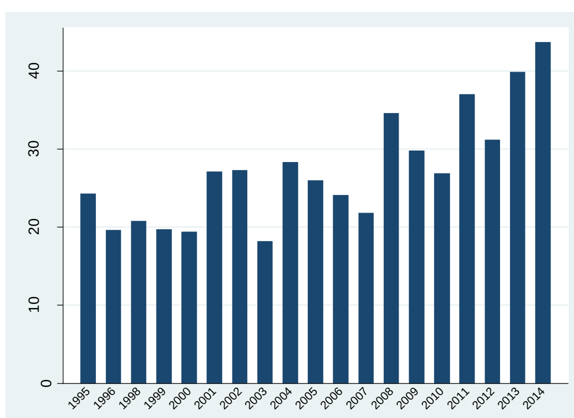

Figure 7. Annual level of grain yield
Source: Own presentation based on the SSSU data

Finally, the third group of variables used in this study consists of PSE and macroeconomic controls that affect technical efficiency and productivity growth. Among them are the following indicators (all in real terms): effective exchange rate index, growth rate of world agricultural prices, GDP growth, average MFN tariffs for agricultural products, value of benefits from fixed agricultural tax and special value added tax regime for agricultural producers and value of market price support as percent of gross crop revenues. Dynamics of abovementioned controls is presented in Table 5.

Table 5. Dynamics of the main PSE and macroeconomic controls

Year	REER (2010=100)	World agricultural price index (2010=100)	Real GDP growth (index)	Real MPS of crop producers, % of revenues	Average MFN tariff	Real FAT benefits, thous. UAH	Real VAT benefits, thous. UAH
						for crop producers	
1995	95.7	72.7	87.8	-15.1	NA	0.0	0.0
1996	113.1	75.7	90.0	-12.8	19.4	0.0	0.0
1997	133.8	76.6	97.0	13.8	31.8	0.0	0.0
1998	122.3	69.8	98.1	2.7	36.9	0.0	0.0
1999	96.4	62.8	99.8	-9.3	44.5	2.0	38.9
2000	95.7	61.4	105.9	1.1	45.8	3.0	31.5
2001	105.8	61.5	109.2	2.0	53.1	4.0	42.4
2002	101.7	66.9	105.2	-8.6	56.0	4.9	50.1
2003	93.5	69.0	109.5	3.3	52.4	4.4	41.0
2004	91.6	71.2	112.1	-6.9	49.0	8.0	64.6
2005	101.0	70.7	103.0	-3.2	27.2	9.1	78.6
2006	105.7	76.0	107.4	-1.3	27.7	14.0	97.8
2007	106.4	85.1	107.6	-6.3	27.4	2.9	41.2
2008	116.3	99.9	102.3	-23.4	32.2	3.6	67.5
2009	97.4	92.8	85.2	-5.9	9.3	6.0	79.1
2010	100.0	100.0	103.8	-2.8	9.3	3.5	59.1
2011	100.3	109.4	102.3	-16.1	8.7	4.2	73.2
2012	102.8	103.7	100.2	-16.2	9.2	10.0	95.2
2013	99.7	96.3	100.0	-17.9	8.7	4.5	98.2
2014	78.3	94.1	93.4	-17.2	8.7	12.5	121.2

Chapter 6

ESTIMATION RESULTS

6.1 Technical efficiency and TFP estimation

Firstly, we applied Levinsohn-Petrin method with Ackerberg-Caves-Phrazer correction to our cleaned data to estimate the total factor productivity. Then we used the index approach, in particular Fisher TFP index, to calculate the total factor productivity of crop production. The obtained results are presented in Figure 8 and Figure 9.

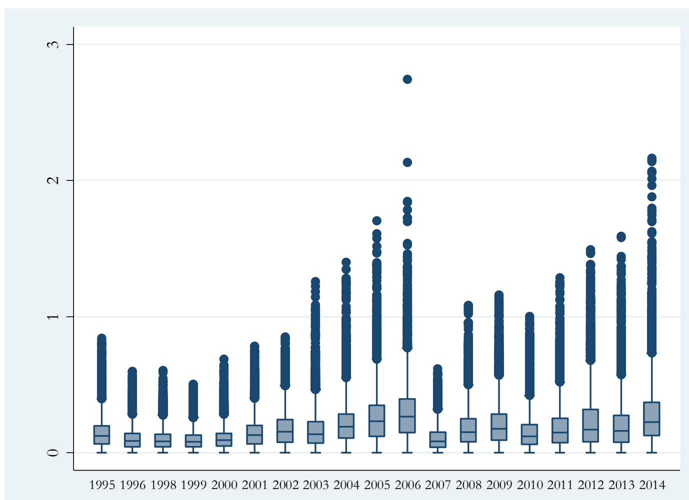

Figure 8. TFP of crop production estimated using semiparametric approach
Note: Box plots are built for the values of TFP below the value of 99th percentile

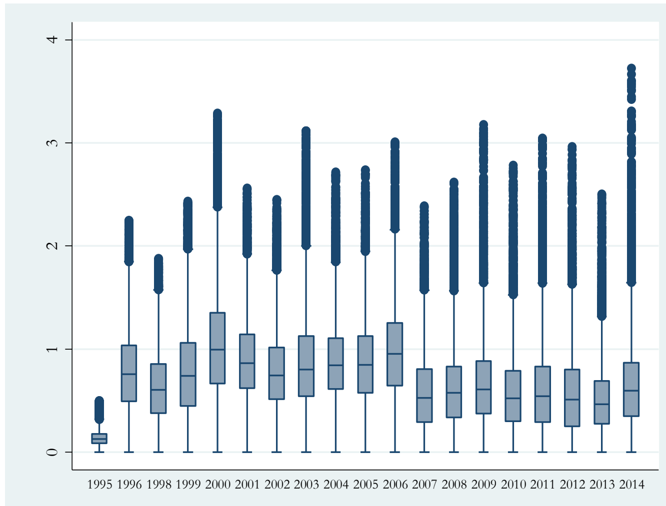

Figure 9. TFP of crop production calculated using index approach
Note: Box plots are built for the values of TFP below the value of 99th percentile

When it comes to components of the TFP in crop production, naturally crop output significantly contributes to it, while among the inputs seeds and fertilizers are strong extractors (Table 6).

As for the semi-parametric method, TFP was estimated as exponentiation of residuals of the production function with value added as a dependent variable (LP approach with ACF correction). Also coefficients of the production function with output (proxied by deflated crop revenues) as dependent variable were estimated (Appendix A).

Table 6. Components of TFP in crop production

	Log(TFP_Fisher_index)
Log(real crop revenue)	0.935*** (0.001)
Log(real capital costs)	-0.064*** (0.001)
Log(real labor costs)	-0.059*** (0.001)
Log(real fuel and energy costs)	-0.023*** (0.001)
Log(real rent)	-0.077*** (0.001)
Log(real fertilizers costs)	-0.103*** (0.001)
Log(real seed costs)	-0.192*** (0.001)
Log(real other costs)	-0.333*** (0.002)
Constant	-2.173*** (0.006)
Observations	65 223
R2	0.9458
F Statistic	132 358.15*** (df = 8; 51 672)

Significance level:*** p<0.01

The rank correlation between the total factor productivity estimated using semi-parametric approach and index method is significant and generally high, considering completely different nature of applied methods (Table 8).

Table 8. Spearman's rank correlation between estimated TFP measures

Spearman's rho	TFP_LP_with_ACF	TFP_LP	TFP_Fisher_index
TFP_LP_with_ACF	1.0000		
TFP_LP	0.9515 (0.0000)	1.0000	
TFP_Fisher_index	0.5981 (0.0000)	0.6949 (0.0000)	1.0000

Note: Significance level in parentheses

In general the total factor productivity of crop production was steadily growing throughout the period under the study except for the year 2007, when strong drought hit Ukraine. When it comes to technical efficiency, its mean level throughout the period under consideration is 0.47 with the highest value in 2006 (Figure 10).

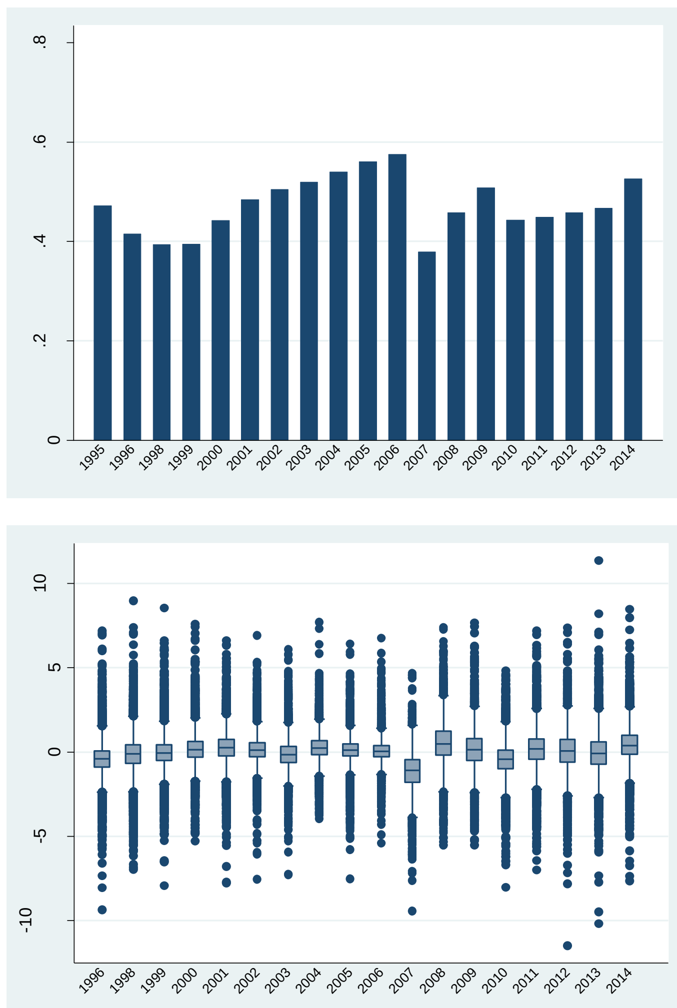

Figure 10. Technical efficiency and logarithm of TFP growth of crop production over 1995-2014

6.2 Effect of land moratorium on the efficiency and productivity growth

Using the specification from Chapter 4, we estimated the model for technical efficiency and TFP growth in crop production applying fixed effect approach with robust clustered standard errors. The results are presented in Table 9.

After controlling for macroeconomic situation, tax and market price support of crop producers in Ukraine along with developments on world agricultural commodities market, farms' characteristics and agro-climatic conditions, land moratorium presence appears to have significant negative effect on technical efficiency and TFP growth. Thus, we can state, with some reservations, that we fail to reject our main hypothesis that land moratorium has a statistically significant adverse effect on technical efficiency and agricultural TFP change in Ukraine. Applying test for joined significance of the obtained regression coefficients for land moratorium dummy and its interaction terms with farm-specific variables we obtain values of F-statistics that allow to state, with some degree of caution, that land moratorium introduction was, indeed, a structural break. According to the empirical results due to ban on sales of agricultural land technical efficiency of crop producers decreased by 0.11%, while the annual TFP growth decreased by 0.06 p.p. annually in the period of land moratorium presence. If we apply assumption that on average TFP growth could be 0.06 p.p. higher each year, current TFP in crop production could be about 2 times higher.

Based on the obtained results it can be concluded that small farms in crop production are characterized by higher technical efficiency, while negative effect of farm size on TFP growth rates appears to be not statistically significant. Obtained inverse relationship in Ukraine is quite rare as in general empirical literature suggests positive effect of farm size on technical efficiency and productivity. However, there are some exceptions as, for instance, in case of Paraguay (Masterson, 2007), Brazil (Helfand and Taylor, 2017). Estimated coefficients, quit expectedly, suggest that more capital intensive farms and farms with higher level of managerial ability are more technically efficient.

However, values of obtained elasticities are low suggesting that mentioned positive effects are not really sizeable in magnitude. In particular, 1% increase in capital intensity is associated with 0.03% increase in technical efficiency in crop production while the magnitude of positive effect of managerial ability is higher for TFP growth than for technical efficiency.

When it comes to specialization, farms that produce crops with higher value added (vegetables, perennials) are slightly more technically efficient and have higher TFP growth rates. In particular, annual TFP growth is 0.1% higher in production of vegetables and perennial crops compared to production of other crops (grains and oilseeds).

In line with the literature we followed, a positive and statistically significant contemporaneous effect of tax exemptions on TFP growth and technical efficiency is obtained. It is worth mentioning that at the same time TFP growth and technical efficiency are negatively associated with tax benefits received in the previous period. Also tax benefits instrument of the support of crop producers lacks cost efficiency as levels of estimated elasticity are rather low. As MPS for crop producers for the majority of considered years was negative (negative market price differential), its adverse effect on technical efficiency and TFP growth is quite expected.

Estimated effect of agricultural price index is of unexpected sign unlike effects of other macroeconomic controls on farms' technical efficiency. Thus, holding effects of other variables fixed we do not obtain expected stimulating effect of world agricultural prices increase on TFP growth and efficiency. At the same time negative and statistically significant link between REER depreciation and technical efficiency and positive association of the latest with real GDP growth is in line with quite logical traditional assumption about positive relationship between macroeconomic situation and efficiency.

While link between real GDP growth and TFP growth appears to be statistically insignificant, positive and statistically different from zero effect of REER depreciation on TFP growth might be explained by the fact that crop producers in Ukraine are rather export-oriented and weaker domestic currency stimulates exports as the Ukrainian exporter's competitiveness is improved in international markets.

Negative and statistically different from zero coefficient for MFN tariffs suggests that there is a positive effect of lowering trade barriers on technical efficiency. Thus, more favorable trade conditions encourage farmers to increase their efficiency while 1% increase in MFN tariffs results in 0.03% decline in technical efficiency. In case of TFP growth negative effect of MFN tariffs appears to be statistically insignificant.

When it comes to the effect of agro-climatic conditions there might be two explanations of obtained negative effect. Firstly, as we use annual grain yield as a proxy for extreme agro-climatic conditions, negative sign of its regression coefficient seems to be rather logical. Secondly, it might be that favorable weather conditions, reflected in high grain yields, do not motivate farmers to be more efficient and productive as they do not have to increase productivity to have high yields.

Results of the Hausman's specification test suggest that the hypothesis that the individual-level effects are adequately modeled by a random-effects model is resoundingly rejected.

Table 9. Estimation results for second stage model

	Ln(Technical efficiency)	Ln(TFP growth)
Farms' characteristics		
Ln(agricultural land)	-0.118*** (0.008)	-0.007 (0.033)
Ln(capital intensity)	0.026*** (0.002)	-0.031** (0.012)
Ln(managerial ability)	0.093*** (0.006)	0.170*** (0.019)
Grain_oilseeds dummy	-0.048 (0.034)	-0.273* (0.154)
Vegetables dummy	0.004** (0.002)	0.063*** (0.010)
Perennial dummy	0.004* (0.002)	0.116*** (0.013)
Agro-climatic conditions		
Ln(grain yield)t	-0.072*** (0.004)	-0.123*** (0.030)
Macroeconomic controls		
Ln(REER)t	-0.056*** (0.008)	0.796*** (0.058)
Ln(World agricultural price index) t+1	-0.130*** (0.010)	-0.336*** (0.069)
Ln(MFN tariffs)t	-0.027*** (0.002)	-0.002 (0.018)
Ln(Real GDP growth)t	0.218*** (0.013)	-0.095 (0.108)
Ln(tax benefits) t	0.096*** (0.008)	0.610*** (0.033)
Ln(tax benefits) t-1	-0.010*** (0.001)	-1.146*** (0.011)
(Real MPS as % of revenues)t-1	-0.002** (0.000)	-0.013*** (0.001)
Land moratorium		
Land moratorium dummy	-0.092*** (0.029)	-0.257* (0.144)
Land moratorium dummy*Ln(agricultural land)	0.020** (0.008)	-0.058** (0.029)
Land moratorium dummy*Ln(capital intensity)	-0.014*** (0.002)	0.064*** (0.012)
Land moratorium dummy*Ln(tax benefits)	-0.014* (0.008)	0.210*** (0.032)
Land moratorium dummy*Ln(managerial ability)	-0.022*** (0.006)	-0.021 (0.020)
Constant	0.445*** (0.095)	1.506* (0.773)

Table 9 continued

	Ln(Technical efficiency)	Ln(TFP growth)
Number of observations	46 925	41 606
R2	0.677	0.506
F-statistics	1 563.22 df (19, 12 416)	1 515.27 df (19, 11 258)
F-statistics for test for joint significance of interest[24]	189.40 df (5, 12 416)	33.47 df (5, 11 258)
Postestimation test		
Hausman's test Chi2(19)	865.85	1 152.65

Standard error in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To consider the full picture models were also estimated for TFP in levels (Appendix B). Firstly, we estimate model without interaction terms and introduce dummy variable on land moratorium with 1-year lag as our assumption is that introduction of land moratorium had an adverse effect on agricultural productivity not right away (at the same time period).

Holding fixed macroeconomic situation and support of agricultural producers in Ukraine, world agricultural prices, agro-climatic conditions and farms' characteristics dummy on land moratorium with 1-year lag appeared to have significant negative effect on TFP levels in crop production: having land moratorium present is associated with 0.3% decrease in TFP levels compared to period without ban on sales of agricultural land. However, after adding in our model interaction terms with farm-specific variables, we end up with insignificant effect of land moratorium presence on TFP levels.

[24] Test for joint significance of the obtained regression coefficients for land moratorium dummy and its interactions with farm-specific variables

Chapter 7

CONCLUSIONS

Ukrainian case of a moratorium or a ban on purchases and sales of agricultural land is probably the biggest and the longest one in the world history. Being introduced as a temporary measure in 2001, it has been constantly extended till today. So far a competitive agricultural land sales and purchase market is not established in Ukraine, which is considered to be one of the major obstacles for accelerating agricultural productivity growth. Agricultural production significantly contributes to the growth of the Ukrainian economy and has rather noticeable impact on the global supply of agri-food products and of global food security. This makes the issue of land moratorium particularly important not just from Ukraine's but also from global perspective. The ban on sale and purchase of farmland creates uncertainty regarding ability of agricultural producers to use the land over the long term. This, expectedly, has sizeable adverse effect on the incentives for sustainable land management and treating it as a highly valuable resource that has to be invested in and protected from degradation. Also inability of using land as collateral under land moratorium creates financial restrictions that undermine opportunities for farmers to grow further and make productivity enhancing investments.

In this paper, using a rich 1995-2014 panel of farm level data from Ukraine we explore the effect of agricultural land sales moratorium on agricultural productivity. To argue, of course with some degree of caution, that we find a pure effect of land moratorium on technical efficiency and productivity growth in crop production, we control for macroeconomic situation, tax and market price support of crop producers in Ukraine along with developments on world agricultural commodities market and trade conditions, farms' characteristics and agro-climatic conditions. After accounting for the impact of the abovementioned controls, land moratorium appears to have significant negative effect on technical efficiency and TFP growth. Empirical results demonstrate that the land moratorium was, indeed, a structural break for agricultural growth. It decreased technical efficiency of crop producers by 0.11%, while the annual TFP growth decreased by 0.06 p.p. due to the moratorium.

The main policy implication of this research is that lifting of land moratorium is expected to have significant positive effect on agricultural productivity. However, a few important issues should be mentioned. First of all, conditions should be created for land market launch to be effective: assured secure property rights, transparency and clarity in land ownership, reliable Geocadastre data, adopted laws that make illegal manipulations with land ownership impossible. Secondly, lifting of land moratorium should not be expected to have right-away positive effect on farms' performance as there will be a natural transition period. Finally, the absence of land moratorium in 90-s is probably noticeably different from absence of land moratorium today, when farms have much better access to financial markets.

There is wide room for further in-depth research, in particular, in terms of applying more robust methodological approaches. Strictly speaking, for such type of analysis it is more appropriate to use control and treatment groups to evaluate changes in their performance caused by such kind of intervention as introduction of ban on sales of agricultural land. However, to use such technique particular data are needed and could be obtained, for instance, in case of lifting of land moratorium in pilot regions. Also farms' investment seems to be more natural choice for a dependent variable as investment channel of the transmission mechanism of land moratorium is rather strong. However, again this is a question of data availability.

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APPENDIX A

PRODUCTION FUNCTION COEFFICIENTS

Table 7. Estimated production function coefficients using Levinsohn-Petrin method

Input	ln(value added)	ln(output)
ln(labor)	0.203*** (0.003)	0.128*** (0.003)
ln(land)	0.697*** (0.001)	0.354*** (0.022)
ln(capital)	0.146*** (0.005)	0.063*** (0.018)
ln(material costs)		0.511*** (0.005)

Note: *** -significant at 99% level, standard errors in parentheses

APPENDIX B

SECOND STAGE MODEL FOR TFP IN LEVELS

Table 10. Estimation results for second stage model for TFP in levels

	Ln(TFP levels)	Ln(TFP levels)
Farms' characteristics		
Ln(agricultural land)	-0.182*** (0.01)	-0.154*** (0.015)
Ln(capital intensity)	-0.03*** (0.002)	-0.047*** (0.005)
Ln(managerial ability)	0.144*** (0.002)	0.124*** (0.009)
Grain_oilseeds dummy	-0.342*** (0.092)	-0.344*** (0.092)
Vegetables dummy	0.008* (0.004)	0.045*** (0.004)
Perennial dummy	0.019** (0.006)	0.074*** (0.006)
Agro-climatic conditions		
Ln(grain yield)t	-0.546*** (0.014)	0.009 (0.014)
Macroeconomic controls		
Ln(REER)t	-0.494*** (0.017)	-0.127*** (0.015)
Ln(World agricultural price index) t	0.12*** (0.026)	0.136*** (0.029)
Ln(MFN tariffs)t	0.003 (0.006)	0.079*** (0.007)
Ln(Real GDP growth)t	0.454*** (0.025)	0.618*** (0.026)
Ln(tax benefits) t	0.246*** (0.007)	-0.044*** (0.003)
Ln(tax benefits) t-1	-0.036*** (0.003)	0.274*** (0.014)
(Real MPS as % of revenues)t	-0.006*** (0.0005)	0.011*** (0.005)
Land moratorium		
Land moratorium dummy t-1	-0.309*** (0.006)	
Land moratorium dummy		0.106 (0.065)

Table 10 continued

	Ln(TFP levels)	Ln(TFP levels)
Land moratorium dummy* Ln(agricultural land)		-0.035** (0.014)
Land moratorium dummy*Ln(capital intensity)		0.019*** (0.005)
Land moratorium dummy*Ln(tax benefits)		-0.018 (0.014)
Land moratorium dummy* Ln(managerial ability)		0.014 (0.009)
Constant	2.903	-2.006
Number of observations	55 146	55 146
R2	0.473	0.464
F-statistics	1 919.39 df (15, 14 469)	1 469.29 df (19, 14 469)