DOES OUTSOURCING SERVICES BENEFIT AGRICULTURAL PRODUCTIVITY IN UKRAINE?

by

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Kyiv School of Economics

Abstract

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In this thesis we investigate the impact of outsourcing services on the productivity of agricultural firms. In Ukraine such services became popular in the 1990s. Moreover, starting from 2007 all Ukrainian farms with non-missing information about costs of services provided by third parties have recoursed to outsourcing. Based on the unique firm-level dataset collected by the State Statistic Service of Ukraine on the basis of individual responses (form 50SG) of Ukrainian agricultural producers during 2001-2014, it is shown that there is a significant positive effect of outsourcing services by agricultural firms. It is an advantageous practice to maintain business processes and boost agricultural productivity.

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GLOSSARY

ACF. Ackerberg-Caves-Frazer correction.

COMTRADE. United Nations International Trade Statistics database

CPI. Consumer Price Index is a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services.

GDP. Gross domestic product.

LP. Levinson-Petrin approach.

NBU. National Bank of Ukraine.

OLS. Ordinary least squares method.

REAR. Real effective exchange rate.

TFP. Total factor productivity.

SSSU. State Statistics Service of Ukraine.

Chapter 1

INTRODUCTION

Agricultural sector has been historically one of the main drivers and contributors to Ukrainian GDP (Figure 1). In addition, importance of agriculture for Ukrainian economy becomes more apparent in terms of foreign trade. According to the National Investment Counsil report 2018[1]:

1) Over 2010-2017, agricultural share in total export has increased – from 21% in 2010 to 44% in 2017.

2) Agricultural exports have been the largest export category since 2013.

3) In 2017, its share was almost two times larger than that of the second largest export category (ferrous and nonferrous metals).

The analysis of agricultural productivity in the European Union (Giannakis and Bruggeman, 2015) classified the member countries into two clusters – the highly performing "Northern-Central European countries" (around the North Sea) on one hand and poorly-performing "continental peripheries" on the other. The second group included the Mediterranean, East-Central, Northern Scandinavian and Celtic (Ireland) countries. Unfortunately, Ukraine was a member of the second cluster of low performers.

The questions arise: What are the main characteristics that differ countries in these two groups and, why there are the ones that grow fast and ones who are "continental peripheries"?

[1]https://www.agroberichtenbuitenland.nl/binaries/agroberichtenbuitenland/documenten/rapporten/2018/07/04/ua-report-investment-council-ua-agriculture/agro-small.pdf

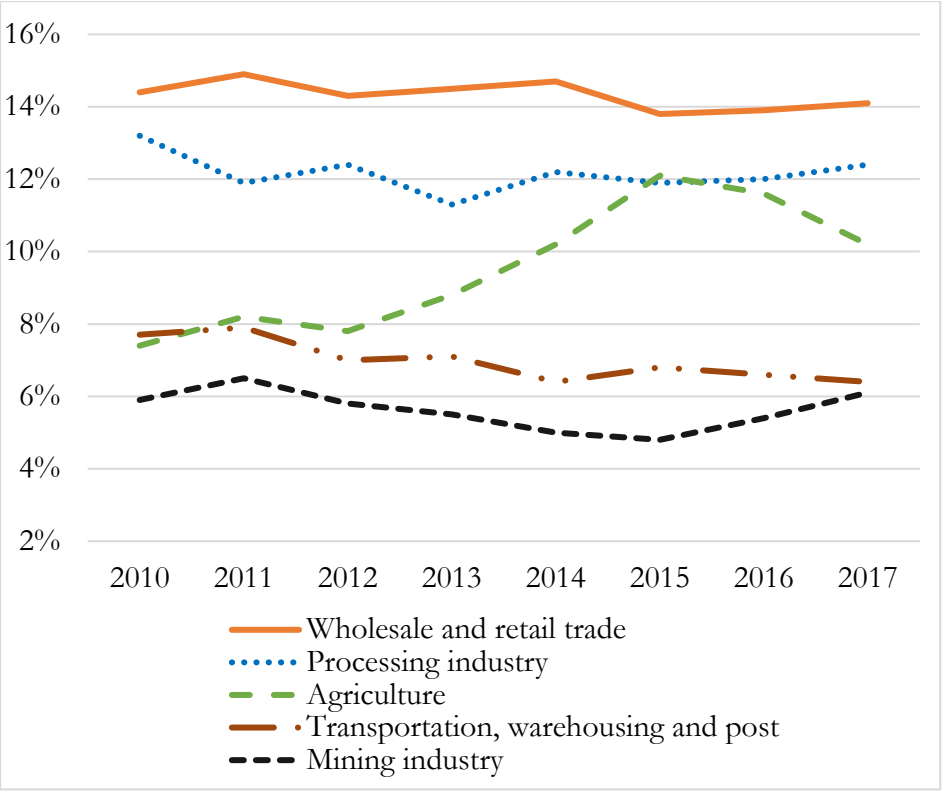

Figure 1. Top-5 industries contributing to GDP (nominal), % of GDP

Source: State Statistics Service of Ukraine

"Once you start thinking about growth, it is hard to think about anything else" Robert Lucas, a Nobel prize-winning economist, said. Therefore, there are a wide variety of research, that studied determinants of agricultural TFP at cross-country, regional and firm level. Key factors, proved empirically to be sources of agricultural TFP growth, are: land quality, commodity prices, land size, specialization, education, price policy, credit availability, terms of trade, stock of FDI, exporter status etc. (Assuncao and Braido, 2007; Azhar, 1991; Deininger, Nizalov, and Singh, 2018; Hussain and Ishfaq, 1997; Lissitsa and Odening, 2005; Parikh and Shah, 1994).

Outsourcing becomes more and more popular and important business tool all over the world. The global market size of outsourcing services in 2018 is about 85.6 billon U.S. dollars[2].

The view on the sources of company competitive advantages has changed over the last decades. Previously the main source of competitive advantages were the product or service characteristics that the company offers. Nowadays the essentials are the company business processes, which create business value. Thus, the functional approach has been changed to process one. This means any functions and business processes can be outsourced, and the company should carry out only those that create the maximum value of the product. A competitive advantage may be gained when products or services are produced in more efficient and effective way by outside firms (Yaofu, Xinhong and Chunbei, 2013).

Large and small companies decide to use outsourcing services with a wide range of purposes:

1) to reduce and control operating costs (the main driver) (Bettis et al., 1992; Lacity and Hirschheim, 1993; Quinn, 2000; Verhoef, 2005; Bardhan et al., 2006; and Nayak, et al., 2007);

2) to improve company focus on core business activities (Kotabe and Murray, 1990; Saunders et al., 1997);

3) to make internal resources free for essential purposes (McFarlan and Nolan, 1995; Gilley and Rasheed, 2000);

4) to have an access to capabilities and facilities otherwise not accessible or affordable. Cooperating with a superior service provider can offer access to new technology, knowledge, intellectual and other material resources that the client may not own (Kotabe and Murray, 1990);

[2] https://www.statista.com/statistics/189788/global-outsourcing-market-size/

5) to mitigate risks and share them with a service provider company (Dess et al., 1995).

In addition, there is also the evidence of positive externality of outsourcing service that contributes to growth in other sectors of economy through input-output linkages.

Outsourcing is widespread in manufacturing industry and service sector, because it allows concentrating on the most profitable activities and, as was mentioned above, reducing costs. Obviously, this raises the question whether outsourcing is as useful to increase the efficiency of agricultural firms, as it is for other industries.

Outsourcing may be a common tool for increasing the efficiency of Ukrainian agriculture. In some countries (for instance, Netherlands) agricultural outsourcing is a regular practice. But over the world outsourcing of agricultural services remains a phenomenon that highly depends on farm size, machine ownership, diversification of agricultural production, cultural factors etc. (Igata, Hendriksen, and Heijman, 2008).

Outsourcing services in Ukraine became popular in the 1990s. Nevertheless, there are still a number of obstacles that creates an unfavorable environment for outsourcing development in Ukraine. They are the following according to the paper by Gazuda and Saldan (2015):

1) the habit of top-management to hire "own" accountant, "own" HR etc., even if it is not cost-effective;

2) the distrust of protecting intellectual property and confidential information via the non-disclosure agreements;

3) the uncertainty about the professionalism of third-party employees;

4) the complexity of controlling the outsourcer's activity;

5) the unpredictability of outsourcer` and outsourcee` financial position.

We are going to find out how outsourcing services from third parties benefit agricultural TFP. We expect that outsourcing services increase agricultural productivity.

This paper contributes to literature by investigating the direct effects of upstream outsourcing agricultural services on downstream agricultural firms' performance in Ukraine from 2001 till 2014 with the gap in 2006.

The structure of this paper is the following: Chapter 2 describes the literature on mentioned above factor of agricultural TFP; Chapter 3 provides the methodology of the analysis and models specifications; data sources and issues are reviewed in Chapter 4; the main empirical results are presented in Chapter 5; Chapter 6 summarizes all key findings of the paper and brings ideas for the further research.

Chapter 2

LITERATURE REVIEW

Increased agricultural productivity usually is a result of successfully implemented improved technologies. Wortman and Cummings (1978) defined four requirements, regardless of farm size, which should be met to achieve higher productivity. There are:

a) An improved farming system: a combination of materials and practices that is clearly more productive and profitable, with an acceptable low level of risk, than the one farm currently uses must be available to other farms;

b) Instruction for agronomists: the agronomists must be shown, how to put the practices into use, and they should understand why those are more efficient;

c) Supply of inputs: the inputs required, including fertilizers, and, if necessary, credit to finance their purchase, must be available to the firm when and where it needs them, and at reasonable costs;

d) Availability of markets: the farm must have access to a nearby market that can absorb increased suppliers without excessive price drops.

In this study, we concentrate on the first and third requirements, especially on the outsourcing services as inputs for farms.

2.1. The impact of the outsourcing services

Services are very heterogeneous, and span a wide range of economic activities. This diversity masks a fundamental function that many services perform in relation to overall economic growth and economic development: they are inputs into production. One dimension of this "input function" is that services facilitate transactions through space (transport, telecommunications) or time (financial services) (Melvin, 1989).

The most widely known definition of outsourcing is the following: "Under the circumstances of finite quantity of resources, for the purpose of attaining greater competitive advantages and then leaving only the most dominant core resources, a company choose to integrate the best specialized resource with the help of outside ones, and at last, achieve the goal of decreasing costs, improving performances, enhancing the company's core competitiveness and strengthening its strain capacity" (Yin, 2009).

According to the article by Arnold (2000), the agricultural outsourcing structure model is shown in Figure 2. The procedure of agriculture production has three main phrases: pre-production, in-production and post-production.

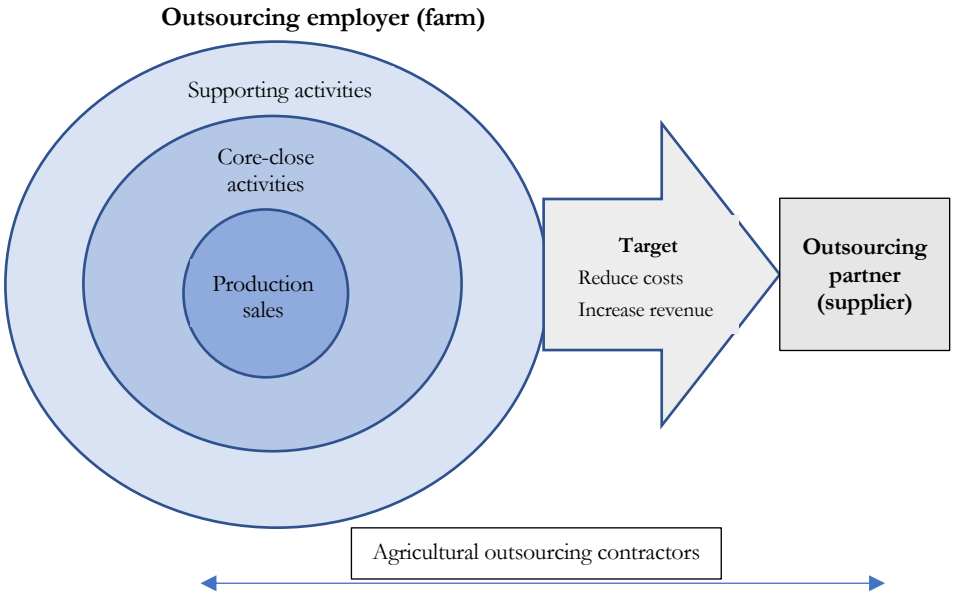

Figure 2. Agricultural outsourcing structure model
Source: Arnold (2000)

Pre-production (core-close activities) consists of the following functions: information collecting, farming project decision and purchase of means of production. In-production stage (supporting activities) implies plowing, seeding, fertilizing, irrigation, weeding and medication. Harvest, agricultural

product storage, processing, transportation, agricultural products processing and sales are part of the post-production stage. Production sales is being considered as the core business of the farms.

Igata et al. (2008) concludes that outsourcing is used significantly more by smaller farms, diversified in terms of production farms, and farms with a shortage of labor in Netherlands. On the contrast, in Japan the same authors do not find such connections between farm characteristics and decision to outsource in selfsame coutry.

Jensen, Rutherford and Tarr (2010) developed an small open economy Computable General Equilibrium model with 20 agricultural sectors of the Kenyan economy. Liberalization of barriers against potential service providers in transportation leads to substantial expansion of three agriculture sectors: cut flowers (151 percent), sugar cane (40 percent), and rice (10 percent). All these sectors benefit significantly from the lower costs of business services. Cut flowers are almost exclusively exported and depend heavily on transportation services. The cut flower sector benefits from full liberalization in two ways: it benefits directly from the reduced quality adjusted costs of transportation services and from the depreciation of the real exchange rate.

On the contrary, there are a number of negative consequences of outsourcing services. Companies that outsource should be very attentive to control the service suppliers' activities and maintain effective communication (Guterl, 1996). Another significant issue about outsourcing services is due to the workers` fear to lose jobs (Malhorta, 1997). According to the survey by Foster (1999), 55 percent of outsourcing relationships fail in the first five years. 12 percent of these, that decide to continue cooperation, are unhappy with their arrangement and regret to some extent signing an agreement. Other issues identified are the following: poor-quality communication, conflict of interest, inadequate or unclear expectations, the burden of inflexibility, too short agreements, a tactical rather than an strategic approach to outsourcing activities (Mullin, 1996; Grant, 1996; and Laabs, 1998).

In an overview of the empirical literature on the potential impacts of service trade, Whalley (2004) argues that a basic problem with this literature is that the heterogeneity of service activities is typically neglected, even though this may have important consequences. In this paper we will apply additional robustness checks to solve the problem of heterogeneity.

2.2. Other determinants of total factor productivity

With the aim to minimize the risk of omitted variables researchers also take into account the following farms` characteristics: land area, district, using fertilizers; and macroeconomic indicators such as real effective exchange rate, real GDP, trade openness, share of credit to agriculture in total credit, world agricultural price index etc. (Abate, 2014; Ahmad, 2012; Kokic, Davidson, and Boero Rodriguez, 2006; Matyja, 2016; Ciaian, Falkowski, and Kancs, 2012).

The relationship between productivity and farm size is ambiguous. For instance, in a variety of research for India it was found that this relationship is negative (Bardhan 1973; Sen 1975; Srinivasan 1972). However, Azhar (1991) discovered that there was a positive association between cropped area and TFP growth in agriculture sector in Pakistan. Lerman and Sedik (2007) shows that the large corporate farms are not more productive than the smaller family farms in Ukraine. According to the paper by Deininger, Nizalov, and Singh (2018) productivity of agricultural firms in Ukraine increased not because farms became larger but because less productive ones exited and more productive ones entered.

It should be admitted that unobserved district (rayon) and farm-specific attributes make a difference. As a proxy for infrastructure, access to inputs and quality of management, the set controls mentioned above are significant and should be taken into account.

Mineral fertilizers are one of the most accessible types of agricultural inputs, which lead to significant increase in the firm productivity over a relatively short

period. For instance, in Asia chemical fertilizers contribute of about 50 percent to growth of yield (Hopper, 1993).

Despite the positive trends in recent years (Figure 3 and Figure 4), the current level of use of mineral fertilizers in Ukrainian agriculture remains low comparing to the recommendations of scientists, industry professionals, and comparing to the common level of demand on mineral fertilizers in developed countries. According to the National Investment Counsil report 2018[3], Ukrainian agricultural producers use 2-3 times less fertilizers per hectare than their peers in Europe, USA, Canada, India and China.

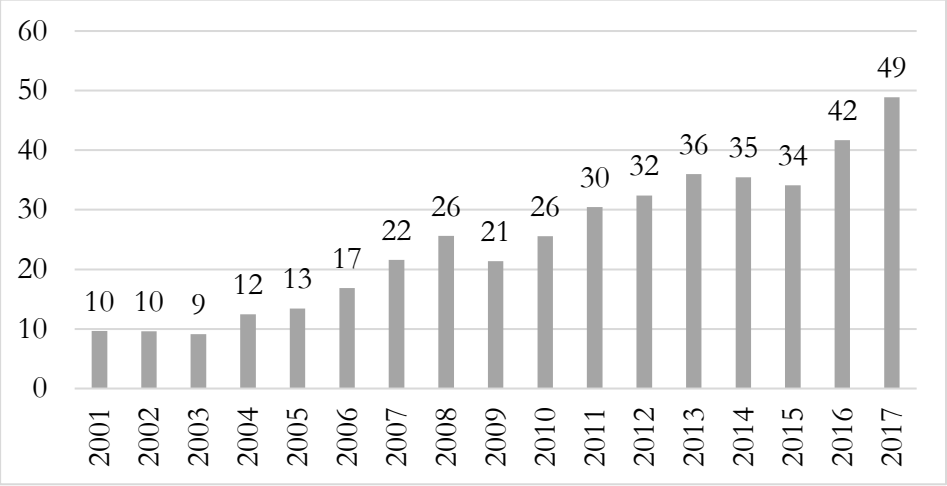

Figure 3. Chemical fertilizer consumption in Ukraine, kg per hectare
Source: State Statistics Service of Ukraine

In the research "Crop Production Levels and Fertilizer Use" (1981) mentioned that most of the major countries where yield-value index for crop production per hectare were outstanding had relatively high average rates of fertilizers use per hectare of arable land (for example, Netherlands, Japan, Switzerland). Over

[3]https://www.agroberichtenbuitenland.nl/binaries/agroberichtenbuitenland/documenten/rapporten/2018/07/04/ua-report-investment-council-ua-agriculture/agro-small.pdf

and above, from this book we can conclude that relationship between amount of fertilizers usage per hectare and crop yield is not linear.

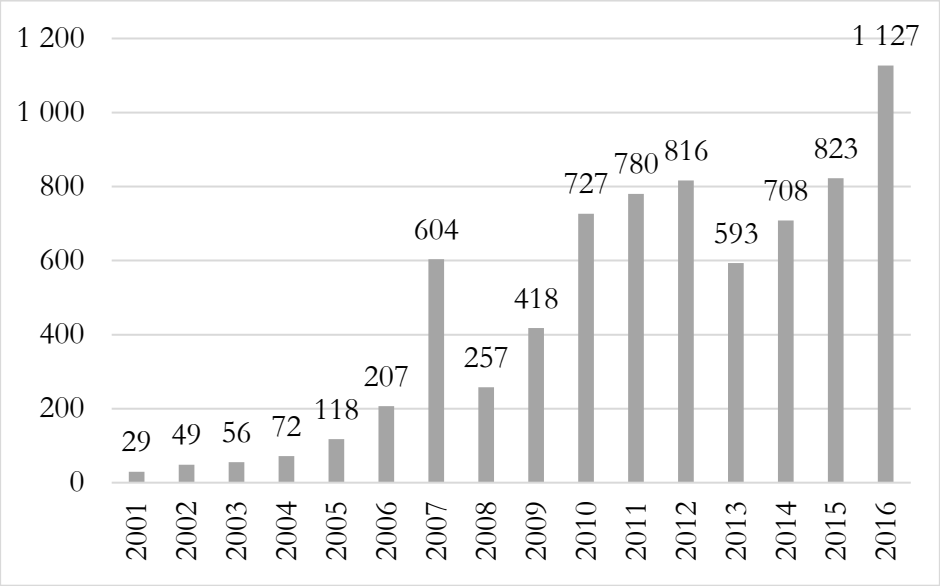

Figure 4. Ukrainian import of fertilizers, bln USD
Source: COMTRADE database

Abate (2014) employed a Sequential Dynamic CGE model, and found out that trade openness both in goods and services has a positive impact on agricultural TFP. For instance, cereal production has expanded by 16.88% as a result of this simulation.

Ahmad (2012) shows that credit (proxy for liberalization in financial sector) plays a role in enhancing agricultural TFP growth in Pakistan with long-run and short-run elasticities of 0.1 and 0.06, respectively.

According to the research by Ciaian, Falkowski, and Kancs (2012), access to credit increases TFP up to 1.9% per 1 th. EUR of additional credit for farms in Central and Eastern European countries. Furthermore, authors also conclude that farms are credit constrained with respect to variable inputs and capital

investments, as variable inputs and capital investments grow up to 2.3% and 29% accordingly, per 1 th. EUR of additional credit. In our model we are going to use share of credit to agriculture in total credit as a proxy for farms` access to financial sources.

Chapter 3

METHODOLOGY

In this section we proceed in two steps of the analysis. We start with estimating the total factor productivity of agricultural producers. The next step is evaluating the impact of the outsourcing services on agricultural TFP.

3.1. The measurement of total factor productivity

Firm-level productivity, which is a key variable in this paper, is estimated using several methods in order to guarantee robustness of results.

Two-factor Cobb-Douglas production function was estimated applying Ordinary Least Squares (OLS) regression, fixed effect model, Levinson-Petrin approach (Levinsohn and Petrin, 2003) and Levinson-Petrin approach (LP) with Ackerberg-Caves-Frazer (ACF) correction for the following specification:

$$\log(va) = \beta_0 + \beta_1 * \log(labor) + \beta_2 * \log(capital) + \varepsilon \quad (1)$$

where "va" is value added (revenue minus variable costs of the farm), "labor" is the labor costs including social charges, "capital" is the depreciation costs (as a measure of capital, because the information about amount of capital is not available in the dataset). All these variables are deflated.

Applying OLS method for panel data usually leads to issues such as endogeneity of input choices and selection bias (Beveren, 2012). We cannot use the Olley-Pakes approach (Olley and Pakes, 1996), because of the absence information about farms` investments. Instead, we decide to use Levinson-Petrin approach for value-added case with and without Ackerberg-Caves-Frazer correction.

ACF correction for LP method is useful because of the multicollinearity and identification problems related to the labour variable (Beveren, 2012).

Next step is to predict TFP from the residuals of the model. With the aim to check the adequacy of TFP calculated we will observe Spearman's rank correlation between estimated TFP measures.

3.2. The estimation of the outsourcing services impact on agricultural TFP

The OLS final model has the following form:

$$\log(TFP_{it}) = \beta_0 + \beta_1 \times \log(outsourcing\ services_{it}) + X_t + Z_{it} + \epsilon \quad (2)$$

where $\log(TFP_{it})$ is natural logarithm of TFP for firm *i* in period *t;*

$\log(outsourcing\ services_{it})$ is the natural logarithm of costs spent on the outsourcing services by firm *i* in period *t*;

X_t is the set of controls for macroeconomic indicators and agricultural industry specifications in period *t;*

Z_{it} is the set of controls for individual characteristics of firm *i* in period *t*.

Chapter 4

DATA DESCRIPTION

In this thesis we deal with the unique firm-level dataset collected by the State Statistic Service of Ukraine on the basis of individual responses (form 50SG) of Ukrainian agricultural producers during 2001-2014 with the gap in 2006. The gap for year 2006 caused by the problem of transitivity. What the "transitivity" means? It means that we can use the ID for the firm in 2005 and find this firm (if it still operates on the market) in 2009 or 2010. But, unfortunately, there are no matches by ID for 2005 and 2006; 2006 and 2007.

This data set allows using for the further analysis such information:

- For every specific type of crop: production (in metric centers), the cost of production, number of workers, the cost of sold products, sales revenue;
- Costs of: labor (wage bill and social charges), mineral fertilizers, fuel, electricity, repairs, depreciation, payments for rented land, payments for rented property etc.;
- Farms' financial results: from selling agricultural products: profit, loss, other revenue, other losses, net profits, net loss, farm profitability, average annual value of fixed and variable (floating) assets, average annual number of workers employed in production, administrative costs, marketing costs.
- Land use: total, leased, agricultural land, total including arable land, hayfield, pastures.

The second dataset consists of macro level indicators, such as real GDP, REER, share of credit to agriculture in total credit, world agricultural price index, trade openness, which were collected from numerous open sources (IMF International Financial Statistics, World Bank Database, FAOSTAT

database, National Bank of Ukraine). The dynamics of these main macroeconomic controls and agricultural industry controls are presented in Table 4 at the end of this chapter.

4.1. Data preparation

Before the productivity estimation, it is important to check for duplicates and adjust financial data for inflation in financial indicators (convert to real values). The annual Produced Price Indices are obtained from the State Statistics Service of Ukraine.

All farms with either missing and zero labour, material costs or agricultural land inputs were dropped from the sample. In addition, firms, which produced only crops, with outstanding land productivity exceeding 1500 th. UAH/ha were removed.

4.2. Sample Composition

Initial sample consists of 133,440 observations. For the rest of our empirical analysis we will use the set of firms` observations with all key financial information needed for TFP estimation (Table 1). This means that there should not be any missing or negative values of the variables "capital", "labor costs" and "material costs".

The descriptive statistics of key farms' key variables in the dataset, which would be used for further analysis in this research, are presented in Table 2.

Table 1. Sample composition

Year	Initial sample size	Farms with key financials*	Crop producers with key financials	Livestock producers with key financials
2001	12,820	11,727	2,448	2,415
2002	11,820	10,980	2,696	2,693
2003	10,258	9,562	2,387	2,384
2004	9,386	8,748	3,104	3,101
2005	8,520	7,860	3,079	3,078
2006	7,611	7,124	2,690	2,685
2007	8,883	7,752	2,116	2,113
2008	9,284	8,481	2,497	2,487
2009	9,249	8,433	2,636	2,628
2010	9,180	8,351	1,853	1,848
2011	9,538	8,476	1,578	1,574
2012	9,160	8,225	1,400	1,391
2013	9,112	8,153	1,268	1,260
2014	8,619	7,577	1,113	1,107
Total	133,440	121,449	30,865	30,764

Source: Based on data from the SSSU Form 50SG
Notes: *Key financials include total labor costs, material costs and total area of agricultural land – inputs to production function for TFP estimation.

Table 2. Descriptive statistics of variables in the dataset

Variable	Number of observations	Mean value	Standard deviation	Minimum value	Maximum value
Total revenue, th. UAH	128,546	6,162.51	26,037.45	0	3,478,419
Crop revenue, th. UAH	125,785	4,608.19	20,376.04	0	2,559,140
Livestock revenue, th. UAH	94,724	1,707.982	12,683.81	0	1,603,920
Depreciation, th. UAH	118,233	353.04	2,757.12	0	642,900
Agricultural land, hectares	127,175	2,026.721	3,691.02	0.2	319,716
Labor costs, th. UAH	126,474	774.19	10,747.02	0.1	3,615,318
Labor costs related to crop production, th. UAH	126,474	514.79	10,545.49	0	3,613,412
Labor costs related to livestock production, th. UAH	126,474	259.41	1,557.27	0	161,899.2
Material costs, th. UAH	128,224	4,338.08	24,729.47	0.1	2,935,956
Material costs related to crop production, th. UAH	128,224	2,967.45	15,282.87	0	2,928,517
Material costs related to livestock production, th. UAH	128,224	1,370.63	18,320.5	0	2,310,054
Fuel and lubricants, th. UAH	125,045	706.92	3,362.93	0	765,097
Cost of outsourcing services, th. UAH	120,859	880.28	5,453.01	0	755,257

Source: Based on data from the SSSU Form 50SG

From Figure 5, we can make the conclusion that for farms with non-missing information about costs of outsourcing services becomes more popular to use this instrument of maintaining business processes. All farms starting from 2007 have recoursed to outsourcing.

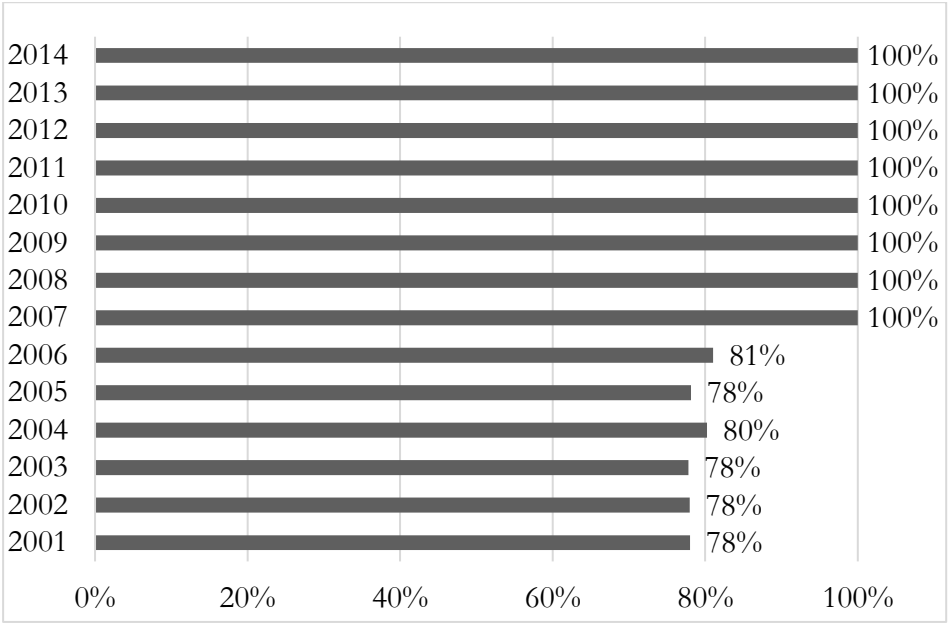

Figure 5. Share of farms that outsource services from third parts
Source: Based on data from the SSSU Form 50SG

Figure 6 describes the dynamics of deflated costs of outsourcing services over 2001-2014 years. Box plot is built for the values of TFP below the value of 95th percentile level. Based on this figure it can be concluded that on average farms spent on outsourcing services more and more from year to year.

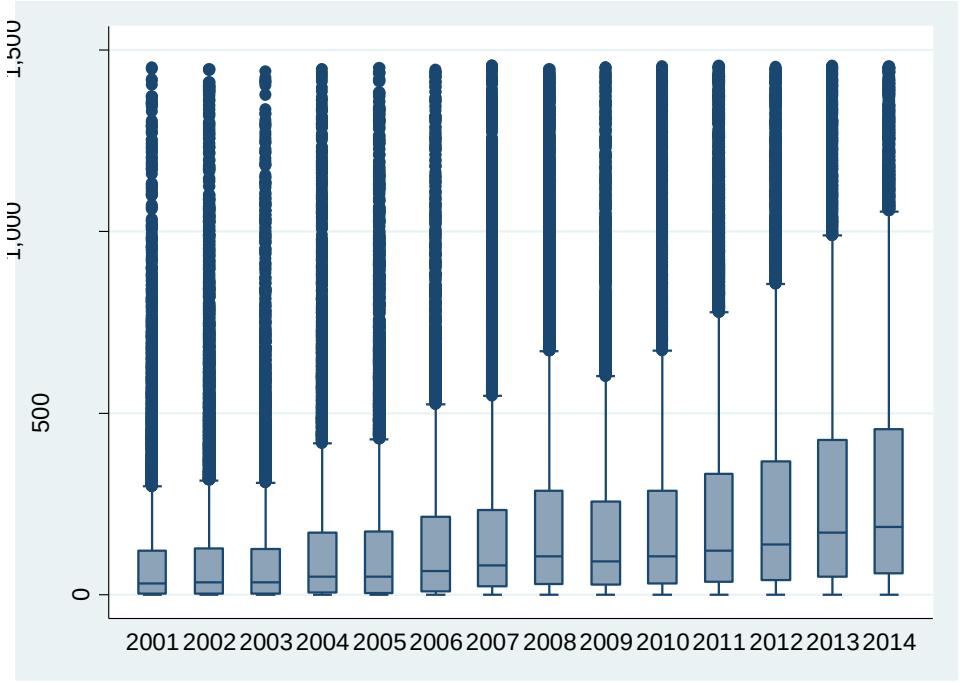

Figure 6. Dynamics of deflated costs of outsourcing services over 2001-2014
Source: Based on data from the SSSU Form 50SG

In addition, for the years 2006-2014 detailed information about the costs of outsourcing services by products are available in the dataset (Table 3).

Table 3. Descriptive statistics of the outsourcing services costs by products for 2006-2014

Variable	Number of observations	Mean value	Standard deviation	Minimum value	Maximum value
Wheat, th. UAH	66,347	147.62	637.05	0	54,488
Rye, th. UAH	20,513	13.64	74.18	0	3,371
Maize, th. UAH	41,509	343.82	2,810.62	0	175,870
Barley, th. UAH	58,331	239.28	54.36	0	39,728
Oat, th. UAH	25,022	6.49	53.96	0	7,067
Sunflower, th. UAH	52,967	147.93	888.34	0	77,553
Soybeans, th. UAH	26,523	158.51	863.41	0	43,254
Rapeseed, th. UAH	29,559	91.21	428.52	0	22,417
Flaxseed, th, UAH	7,492	0.35	9.04	0	551
Sugarbeets, th. UAH	13,915	366.12	2,520.45	0	160,201
Hops, th. UAH	7,481	1.11	16.24	0	635
Cattle, th. UAH	29,281	22.43	207.59	0	24,911
Pork, th. UAH	31,265	37.26	578.67	0	56,695
Sheep breeding, th. UAH	12,338	0.97	8.93	0	345
Goat breeding, th. UAH	7,364	0.00	0.13	0	8
Poultry, th. UAH	9,903	148.92	1,513	0	40,709
Milk, th. UAH	27,017	48.83	344.61	0	34952
Wool, th. UAH	9,764	0.36	3.78	0	194
Chicken eggs, th. UAH	8,861	110.97	1,243.03	0	59,285

Source: Based on data from the SSSU Form 50SG

Table 4. Dynamics of the main macroeconomic and agricultural indicators

Year	REER (2010=100)	GDP, constant 2010 bn US$	Trade openness, in % of GDP	World agricultural price index (2010=100)	Share of credit to agriculture in total credit, in %
2001	105.73	97.63	104.00	61.48	6.32
2002	101.72	102.75	100.66	66.90	6.41
2003	93.52	112.53	107.46	69.00	6.83
2004	91.56	126.16	113.77	71.17	6.02
2005	100.92	129.94	97.18	70.69	5.82
2006	105.67	139.61	91.46	76.04	4.92
2007	106.41	150.21	90.81	85.14	3.94
2008	116.23	153.67	96.95	99.92	6.59
2009	97.33	130.99	89.87	92.79	5.80
2010	100.00	136.01	98.14	100.00	5.95
2011	100.34	143.45	106.24	109.44	6.00
2012	102.87	143.79	104.09	103.68	6.09
2013	99.73	143.75	95.15	96.30	6.29
2014	78.28	134.33	100.69	94.12	7.10

Source: World Bank, FAO statistics

Chapter 5

ESTIMATION RESULTS

In this chapter we proceed in two steps of the analysis as was describes in the Methodology section. We start with estimating the total factor productivity of agricultural producers. The next step is evaluating the impact of the outsourcing services on agricultural TFP, taking into account the set of controls for macroeconomic indicators and agricultural industry specifics, and the set of controls for individual farm characteristics.

5.1. TFP estimation

The estimation results of TFP using three algorithms (ordinary least squares method, fixed effect and Levinson-Petrin approach) are presented in Table 5.

For LP model deflated depreciation costs are used as a state variable. A proxy variable is deflated material costs because of its quite fast response to macroeconomic fluctuations.

In addition, we apply Ackerberg-Caves-Frazer correction for LP method because of the multicollinearity and identification issues related to the labour costs (Beveren, 2012).

We observe that all the coefficients from Table 5 are significant and have expected values. Then TFP estimates can be calculated as exponentiation of residuals obtained from these production functions. Descriptive statistics of TFP measures are presented in Table 6.

Table 5. TFP estimation results for OLS, fixed effect and LP models

Variable	Model specification			
	OLS	Fixed effect	LP for value added case	LP for value added case with ACF correction
ln(labor), th. UAH	0.34*** (0.0036)	0.19*** (0.0053)	0.24*** (0.0025)	0.35*** (0.0011)
ln(capital), th. UAH	0.39*** (0.0030)	0.15*** (0.0038)	0.24*** (0.0060)	0.36*** (0.0069)
constant	3.15*** (0 .0146)	4.77*** (0.0243)	-	-
R^2	0.3889	0.3859	-	-
Chi^2	-	-	5,270.38	2,567.69
No. obs.	86,020	86,020	84,822	84,822

Note: *** significant at 99% level, standard errors in parentheses
Source: author's calculations

Table 6. Descriptive statistics of TFP measures

Variable	Number of observations	Mean value	Standard deviation	Minimum value	Maximum value
ln(TFP_OLS)	86,020	-1.15e-10	1.23	-9.39	7.71
ln(TFP_FE)	86,020	-8.07e-11	1.35	-10.16	6.03
ln(TFP_LP_VA)	86,020	4.19	1.28	-5.51	10.67
ln(TFP_LP_VA_ACF)	86,020	3.24	1.23	-6.13	10.83

Source: author's calculations

Spearman's correlation measures the strength and direction of association between variables. Spearman's rank correlation between estimated TFP measures is presented in Table 7. As a result, high Spearman's correlation means that our estimates are accurate and close to the true value.

Table 7. Spearman's rank correlation between estimated TFP measures

Spearman's rho	**ln(TFP_OLS)**	**ln(TFP_FE)**	**ln(TFP_LP_VA)**	**ln(TFP_LP_VA) with ACF**
ln(TFP_OLS)	1.0000			
ln(TFP_FE)	0.8933	1.0000		
ln(TFP_LP_VA)	0.9514	0.9876	1.0000	
ln(TFP_LP_VA) with ACF	0.9990	0.9099	0.9625	1.0000

Source: author's calculations

We decide to use for further calculations TFP that is the residual of the Levinson-Petrin model with ACF correction. The development of total factor productivity over 2001-2014 is shown in Figure 7.

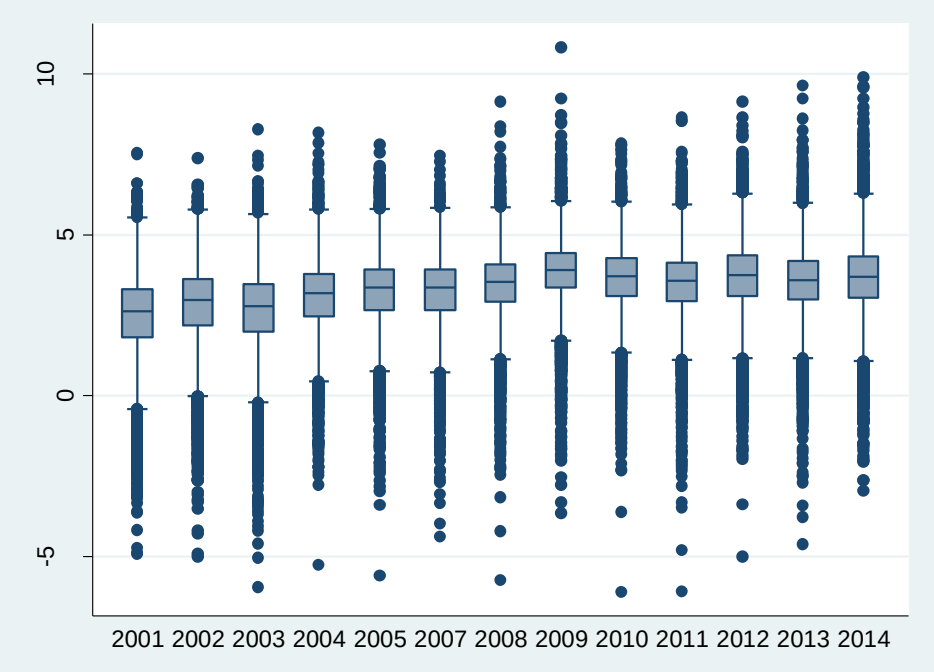

Figure 7. Total factor productivity over 2001-2014

Source: author's calculations

In general, the total factor productivity of agricultural firms has shown steady growth throughout the first nine years of the period under the study. Suchwise, the maximum was reached in 2009, after which this determinant of yield fluctuated right until the most recent observations fell into the dataset, below its record. Nonetheless, it has not dropped beneath the 2007 rates. Actually, this was the point of time when strong a drought hit Ukraine. Other examples of declines we could observe on the depiction happened in 2003 and 2010. While the former case is connected with 2002 Ukrainian unexpected deflation coincided with the large harvest, the latter refers to the widescale financial crisis, which swamped the markets in 2008-2009. Particularly noteworthy fact is that the aforementioned slumps materialized with up to one-year lag.

5.2. Impact of outsourcing services on agricultural TFP

We have mentioned a set of determinants of total factor productivity in previous chapters. Correct calculation of outsourcing would not be comprehensive and complete without complex revealing of negative or positive effects altogether with doing so for that collection. Literature helped us to hypothesize about the extent and sign of each of the variables on the TFP of the sector under consideration.

Some of them could be connected with competitive advantage potential creation to carry out profitable activities reducing costs (like the implementation of brand-new technologies). Yet, unfavourable obstacles affections are also unavoidable. Combined with both macroeconomic benchmarks and original features of the firms as independent variables, the analysis should give us reasonable results. This is achieved due to the fact that the risk of essential variables absence has minimized.

The last dilemmas are connected with hooded endogeneity of fixed components and, not less important, omitted variables of volatile nature. The methodology allows us to run one after another ordinary least squares with and

without lagged TFP. The regressand for the whole set of independent variables would be the natural logarithm of TFP. The estimation results of the mentioned above approaches are presented in Table 8.

Table 8. Estimation results

Variables	OLS		OLS (z-scores)	
ln(costs of outsourcing services)	0.080*** (0.0031)	0.036*** (0.0046)	0.117*** (0.0046)	0.052*** (0.0067)
ln(fertilizers)	0.143*** (0.0037)	0.127*** (0.0043)	0.193*** (0.0050)	0.171*** (0.0059)
ln(land)	0.039*** (0.0054)	0.029*** (0.0063)	0.039*** (0.0055)	0.029*** (0.0065)
real GDP	0.001** (0.0005)	0.004*** (0.0007)	0.001** (0.0004)	0.003*** (0.0005)
REER	-0.010*** (0.0005)	-0.011*** (0.0006)	-0.069*** (0.0036)	-0.077*** (0.0044)
world agricultural price index	0.013*** (0.0005)	0.007*** (0.0006)	0.161*** (0.0068)	0.092*** (0.0077)
trade openness	-0.016*** (0.0007)	-0.019*** (0.0008)	-0.084*** (0.0039)	-0.098*** (0.0042)
share of credit to agriculture	-0.0312*** (0.0077)	-0.295*** (0.0128)	-0.018*** (0.0045)	-0.171*** (0.0075)
lag of ln(costs of outsourcing services)	-	0.065*** (0.0045)	-	0.092*** (0.0063)
Constant	3.518*** (0.1245)	5.849*** (0.1573)	-0.089*** (0.0556)	-0.249*** (0.0722)
R^2	0.1810	0.1681	0.1810	0.1681
No. obs.	67,001	45,297	67,001	45,297

Note: ln(TFP) is dependent variable
*** significant at 99% level, ** significant at 95% level,
standard errors in parentheses
Source: author's calculations

An increase in our main variable of interest – the costs of outsourcing services – is associated with a statistically significant positive increase in TFP. Nevertheless, this effect is smaller for the models where lagged TFP is included.

Fertilizers have a very important role as inputs for agriculture in terms of development of its productivity. It has great deal of responsibility in meeting the world's increasing demand for agricultural products. Among our independent variables, the costs of fertilizers have the biggest impact on agricultural TFP.

There is a positive relationship between land and agricultural TFP. This statistically significant coefficient on land is consistent with the findings from papers by Azhar (1991), Lerman and Sedik (2007), Deininger, Nizalov, and Singh (2018), that were already discussed in Literature review chapter.

The positive sign of the coefficient on real GDP obtained means, that there is a statistically significant relationship between the country well-being and the productivity of its agricultural firms.

REER is commonly used as a measure of the competitiveness of the traded goods sector. The negative sign of the coefficient on REER implies that the higher the purchasing power of Ukrainian hryvnia, the less attractive Ukrainian agricultural export is on the world market. In its turn, it leads to a decrease in the demand on Ukrainian agricultural products.

World agricultural price index is a common measure of the change in international prices of food commodities. The positive and statistically significant coefficient on this variable is expected according to the previous research (Hopper W., 1993; Hussain, 1997; Picazo-Tadeo, 2007).

The effect of trade openness highly depends on the specificity of the economic actors' characteristics and their degree of international competitiveness (Frieden and Rogowski, 1996). It is possible that other important individual variables should be included in regression (for instance, exporter/importer

status of agricultural firm). Unfortunately, there is no such information in our dataset.

The negative coefficient on the share of credit to agriculture in total credit for the case of Ukraine can be explained in the following way. Its maximum values appearance over the observed period coincident with deflation in 2003, the economic crisis in 2008 and start of ATO ("anti-terrorist operation") in 2014.

It should be admitted that the availability of data not only on a yearly basis but with higher frequency reporting can allow measuring the effect of independent variables in a more precise way.

Additionally, we test the presence of multicollinearity for all four models using the variance-inflating factor (VIF). VIF shows how the variance of an estimator is inflated by the presence of multicollinearity. As a rule of thumb, if the VIF of a variable exceeds 10, then variable is said to be highly collinear (Hair, 1995). According to this test there is no issue of multicollinearity for models presented in Table 8.

Chapter 6

CONCLUSIONS

This paper contributes to the literature by investigating the direct effects of upstream outsourcing agricultural services on downstream agricultural firms' performance in Ukraine.

We consider yearly agricultural firm-level data and the set of controls for macroeconomic indicators and agricultural industry specifications as key independent variables and TFP measures as a dependent variable. The sample covers around 14 years of observations – from 2001 till 2014 with the gap in 2006 caused by the problem of firms' ID transitivity. We checked the presence of the effects by running an OLS regression.

Outsourcing services are becoming very popular among agricultural firms in Ukraine. All farms in our dataset starting from 2007 have recoursed to outsourcing. Costs of outsourcing services increase in terms of both nominal and real values over the observed period.

Outsourcing services are advantageous for firms which don't have the ability to buy its own machinery and so that they appeal to subcontracting allowing them access to high-quality and expensive equipment even without the unabridged value of such capital expenditures and consequently to increase own total factor productivity

Our main regression detects statistically significant positive relation between agricultural total factor productivity and costs of outsourcing services.

Our results on the outsourcing effects have actual relevance for policies designing. We hope that it is possible to implement some by the State Statistic Service of Ukraine. We found that the consequent research could be deeper and more comprehensive with the introduction of the obligatory declaration of credit amounts and leasing payments by agricultural firms, as it was for

years 2004-2006. To add more, outsourcing expenditures disclosures could be done not only in products perspective as it was started in 2006, but also to be broken down by business processes. The corresponding list includes but is not limited to plowing, cultivation, crop harvesting, fertilizing, freight, repair of agricultural machinery, zootechnical and veterinary services etc.

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