DECIPHERING AGRICULTURAL COMPETITIVENESS IN UKRAINE

by

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Kyiv School of Economics

Abstract

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Ukrainian agriculture increasingly contributes to national economy and to global food security, giving grounds to the broad policy-making and private sector discussion on the levels of the competitiveness of agricultural producers and its key determinants. The main goal of this research is to assess the key drivers effecting competitiveness' development, using the cost measure of competitiveness – Social Cost Benefit ratio. The analysis was performed using a detailed 2010-2014 panel of the farm level accounting data and found that the major driver of agricultural competitiveness is land market that contributes 84.5% to competitiveness given at mean productivity, and implies a paramount implication of the land market liberalization for competitiveness growth. The second major driver of is productivity (efficiency) that accounts for 8.9% of cost competitiveness. Growing labor costs considered to have a negative effect on competitiveness, when inflation, which may capture devaluation effect, global commodity prices and the level of infrastructure development contribute positively to the cost competitiveness. Direct government support reveals to be an inefficient instrument of competitiveness stimulus, suggesting no effect on the cost competitiveness, whereas indirect market price support contributes negatively to the competitiveness of agricultural producers.

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To my parents

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I would like to express gratitude to my thesis advisor prof. Oleg Nivievskyi for constant supervision and support, even during the tight deadlines, while granting me the opportunity to apply my own ideas.

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GLOSSARY

FAO Food and Agriculture Organization of United Nations

MPS Market price support

NBU National Bank of Ukraine

NTM Non-tariff measures

OECD The Organization for Economic Co-operation and Development

PSE Producers Support Estimate

RCA Revealed Comparative advantage

SCB Social Cost Benefit

TFP Total factor productivity

WTO The World Trade Organization

Chapter 1

INTRODUCTION

Is Ukrainian agriculture competitive enough to take advantageous participation in global trade and survive rivalry on the market? This is the issue, giving solid basis for broad policy-making discussions, especially in context of productivity, as a key prerequisite for competitiveness growth, and government support. Empirical studies conducted for Ukraine are concentrated on the effect of state support. Utilizing cost measure of competitiveness, studies suggest negative effect of government support (Nivievskyi and von Cramon-Taubadel, 2008); whereas tax exemptions turn out to have positive, but rather cost inefficient effect on productivity growth in agriculture (Niviesvskyi, 2017). The issue of sustaining one of the core industries' capability of generating value added and contributing to the economy is of key priority. Albeit, a comprehensive research on competitiveness measures, with the impact of macro and micro environment, including current support system and productivity is still underway. This creates the basis for the research motivation. In our paper we are going to utilize a comprehensive measure of domestic agricultural industry's competitiveness and decipher which factors are contributing to its development in Ukraine.

1.1 Background setting of agricultural industry in Ukraine

Due to natural endowments and government policy spillovers, agriculture has historically been a core industry for Ukrainian economy. Its annual contribution to GDP is around 10[1] percent, growing consistently in absolute terms over the last two decades (see Figure 1).

[1] as of 2017, World bank https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=UA

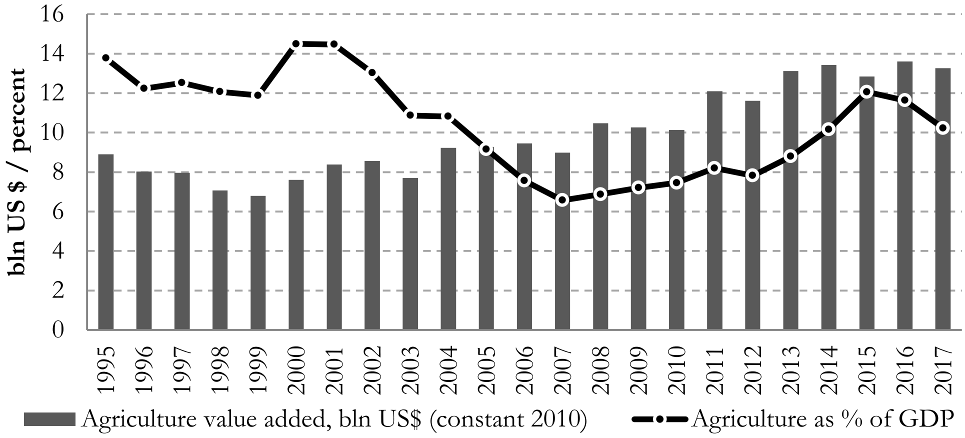

Figure 1. Agricultural value added in Ukraine

Source: own presentation, based on WB DI

Being considered a small open economy[2] the importance of agricultural industry for Ukraine, as a key exporting industry, could be hardly overestimated. As of 2017 sunflower seed & oil, maize and wheat occupied three leading positions in total export, front-running other commodities and services, and cumulatively summing up to 23% in total merchandise export (without considering left-overs of other agricultural export)[3]. Furthermore, Ukrainian agricultural commodities export takes leading position in the world in terms of sunflower oil (1st) and wheat (6th) as of 2016.[4]

Evaluating the global presence of Ukraine, as a key exporter of agricultural commodities, and structural importance of the industry, it is worth assessing the capacity of maintaining positions on global markets. The recent Ukraine-EU DCFTA agreement ratification in June, 2017 additionally opened new markets for Ukrainian agricultural producers, restraining tariff burden. Albeit, existence of strong domestic agricultural players on EU market, and high

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[2] Export-to-GDP ratio of Ukraine is 0.4795 as of 2017, World Bank https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?locations=UA; nominal GDP is 112.15 bln US $ as of 2017, World Bank https://data.worldbank.org/country/ukraine

[3] WTO http://stat.wto.org/CountryProfile/WSDBCountryPFView.aspx?Country=UA

[4] FAO statistics http://www.fao.org/faostat/en/#rankings/countries_by_commodity_exports

degree of global rivalry, poses the challenge for Ukrainian producers – competitiveness is crucial on the way of gaining and sustaining positions on global markets. Ability to compete and exhibit global presence is explained by the relationship between input and output prices (Liesner, 1958; Balassa, 1965) or by cost-leadership of a productive unit (Porter, 1990). Nonetheless, factor availability and price dynamics for inputs and outputs create a basis for competitiveness on domestic and global markets.

Ukraine is undoubtedly rich in natural endowments including exceptional soil quality and advantageous weather conditions. Albeit, operational activity is somewhat constrained by administrative measures in a form of land sale moratorium. It was introduced in 2001[5] with numerous extensions afterwards, and currently covers 96% (41 mln ha) of arable land, prohibiting any ownership change transactions with respect to agricultural land. As a consequence, agricultural producers operate mostly on leased land.[6] The constrained demand on interrelated market, biases land rental prices downwards, creating in short term supportive conditions on the cost side.

Output price dynamics are highly exposed to global commodity prices, inducing spillover effect also on domestic market. Revenue component is highly dependent on the stage of economic cycle, which is enhanced by inability of Ukrainian producers influence prices and acting as price-takers on global markets. Considering monetary economics, after a period of drastic 3-time depreciation, Ukraine currently experiences slight domestic currency depreciation[7], which can be considered as supportive factor for foreign demand growth[8].

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5 Law of Ukraine №2242-III 18.01.2001

6 Mean value of rented land is 98.3% across Ukrainian agricultural firms according to sg-50 form statistics (State Statistical Committee of Ukraine)

7 NBU https://bank.gov.ua/control/uk/curmetal/currency/search/form/period

8 Marshall-Lerner condition states that devaluation stimulates exporting activity and makes domestic goods and services relatively cheaper, and thus more competitive on global market

The last but not the least context ingredient, impacting gradually both – input and output price dynamics – is government support. Support is mainly provided through market price distortions (distributed, however, unequally among the agricultural market sectors) and tax exemption (see Figure 2). An ongoing debate on the necessity of state support as a ley supporting factor of agricultural producers' competitiveness highlights the additional motivation for the research.

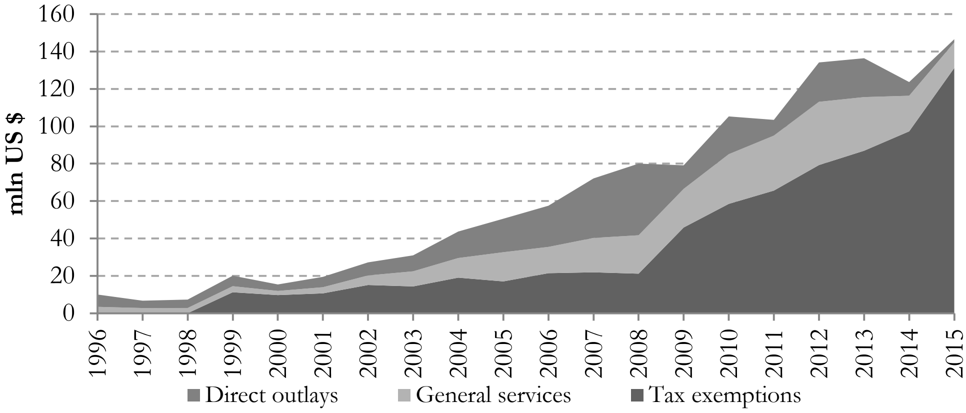

Figure 2. State agricultural support in Ukraine, except MPS

Source: own presentation, based on PSE OECD

1.2 Understanding competitiveness

Competitiveness is widely discussed in the literature, ranging from the ability to compete and gain market share to ensuring capacity for further growth through earnings accumulation. Several schools addressed the research towards understanding and measuring competitiveness, attributing it to comparative advantages (Neoclassic school), to cost-leadership and strategy (Management school) or referring to productivity as a key indicator of the long-run competitiveness. Albeit, the importance of strong competitiveness, especially of one of the key industries contributing to GDP, has never been questioned.

The key research question of the paper is "What are the key drivers effecting agricultural competitiveness' development?".

The research would be conducted on the unbalanced panel of firm-level accounting data of agricultural producers in Ukraine for 2010-2014 years, provided by State Statistics Service of Ukraine.

The key contribution of the paper is to perform the comprehensive assessment of the key drivers of competitiveness' development of Ukrainian agricultural producers, analyzing the cost measure of competitiveness.

The initial hypothesis is that competitiveness of Ukrainian agricultural producers is mainly driven by productivity, low land rental prices and low labor costs (all variables are expected to have significant positive effect on competitiveness), when government distortions (including subsidies and market price support) are expected to have significant negative effect on firms' competitiveness due to signaling disincentives for firms' efficient operating activity.

The results of the research may be effectively applied in the policy analysis in Ukraine, since we will conclude on whether producers benefit mostly from direct support, market support or the provision of general services or , alternatively, are mainly affected by other factors that could not be directly smoothed by the industrial or trade policy, or other type of government intervention.

Section two provides comprehensive summary of theoretical and empirical findings on competitiveness and its key determinants, including the review of available research methodologies. The third section introduces methodology, used in the research. Section four provides data description. Section five summarizes empirical estimation results and addresses the key research question, whereas section 6 concludes on key findings and provides policy suggestions, based on the outcomes of the conducted research.

Chapter 2

LITERATURE OVERVIEW

2.1 Theoretical findings

The analysis of competitiveness should be initiated via defining competitiveness as an economic concept, since there is no general convention among economists of what competitiveness is. The key complication descends from the fact, that the indicator is entitled to simultaneously address rather connected, but meanwhile divergent concepts: the cost strategy and market-related issues on the one hand, compared to productivity and efficiency issues on the other (Ketels, 2016). Economists define these approaches through understanding cost-measure of competitiveness as a short-run, whereas productivity-measure as a long-run assessment tool. Since there no evidence of superiority of one method on another, we will use the cost-measure and will be targeted on assessing market conditions for Ukrainian agricultural producers.

Competitiveness analysis, from economic perspective, falls within two alternative schools of thoughts – neoclassic and management schools - offering different approaches for further investigation. Since 18th century national competitiveness has been methodologically approached through trade analysis, supported by early works of Ricardo and developed by neoclassic school of thoughts (e.g. Hecksher – Ohlin theory). Neoclassic school is prioritizing the importance of trade success and based on the idea of comparative advantage. Albeit, utilization of neoclassic theory competitiveness indicators, such as RCA (Liesner, 1958; Balassa, 1965), are coherently applicable only for countries, where market distortions mostly appear on the import side (von Cramon-Taubadel et al, 2008), which is not the case of Ukraine (Nivievskyi and von Cramon-Taubadel, 2008)

Alternatively, in 1990 management school developed the competitiveness analysis framework, called Diamond theory (Porter, 1990), that concentrated analysis on the cost-leadership and strategy, rather than comparative advantage. Management school theory is suggested to be applied on firm-level analysis through comprehensive analysis of firm's performance indicators – cost superiority, productivity and profitability (Latruffe, 2010).

2.1.1 Cost measures of competitiveness

Cost measures of competitiveness in management school's framework are represented by Domestic Resource Cost (DRC) and Social Cost Benefit (SCB) ratios. DRC expresses the relative relationship between the full cost of non-tradable inputs to the value added they produce (Gorton et al, 2001). Ratio was initially introduced as gains and losses measurement indicator from continuing or disrupting projects. The key shortcoming of the ratio is that DRC tends to underestimate the firm's superiority because of comprehensive utilization of domestic non-tradable factors (Masters and Winter-Nelson, 1995). To overcome the key disadvantage of DRC ratio of employing domestic factors, SCB ratio was introduced (Masters and Winter-Nelson, 1995). SCB ratio is calculated as a relationship of domestic (non-tradable) inputs and tradable inputs to goods' final output value, accounting therefore for social prices and costs though adjusting procedures. Nevertheless, DRC could be still considered as a valid competitiveness measure as in contrast to SCB ratio it allows to detect unprofitable firms, which are unable to cover input costs with value added (DRC<0).

2.2 Empirical findings

2.2.1 Measures of competitiveness

Empirical evidence utilizing cost measures is quite rich in CEE counties. Gorton et al (2000) used DRC measure to estimate agricultural sectors of

Bulgaria and Czech Republic, concluding on strong competitiveness of both countries in crops in EU15 area, and non-competitiveness in livestock on the global scale. The scrutiny of Gorton et al (2001) for Polish farms concluded on the similar sectorial competitiveness. Some studies used adjustment for EU prices, when calculating DRC ratio and accounting for international environment (Gorton et al, 2001; Bojnec, 2003). Study on a number of CEE countries, including Bulgaria, Chezh Republic, Hungary, Poland, Romania, Slovakia and Slovenia (Gorton and Davidova, 2001) on specific commodities, concluded that crop sector was more competitive than livestock, whereas wheat and sunflower were the most competitive commodities within crop sector. Liefert (2002) assessed Russian agricultural competitiveness using SCB ratio, whereas Nivievskyi and von Cramon-Taubadel (2008) utilized both DRC and SCB measures to analyses dairy sector in Ukraine, concluding that in 2005 only 15% of farms were competitive.

2.2.2 Determinants of competitiveness

The prominent factor, claimed in empirical literature to have significant effect on competitiveness, is firm size. The debate was risen by Cornia (1978), who claimed that smaller farms perform better than large ones due to higher workers' motivation and easier management. Whereas counter-argument of easier market access for large firms was utilized to support positive size effect on firms' performance (Hall and LeVeen, 1978). Further research is rather inconsistent in the sign of effect and highly depends on size indicator chosen. Another factor, driven by empirical research is farm specialization that proved to have positive significant effect in majority of studies. Brummer (2001) claims that specialization, due to multitasking, improves managerial practices. On the other hand specialization is expected to improve efficiency through risks' diversification (Hallam and Machado, 1996; Carroll et al, 2009). Including factor intensity as determinant of farm's competitiveness yields controversial results on technical efficiency, which is considered an alternative measure of competitiveness (Ketels, 2016). When investigating factor intensity, defined as labour to animal ratio, Nivievskyi and von Cramon-Taubadel (2008) found negative effect on SCB competitiveness measure. Share of external factors (share of hired labour in total labour, share of hired land in total land) is often included, while analyzing technical efficiency. This factor, however, is not claimed to have unified result (Weersink et al, 1990; Hadley, 2006; Latruffe et al, 2009) – higher share of hired labor may cause supervision issues, but be more skilled and educated; higher share of rented land may prevent farmer from long-term investments, but meanwhile stimulate her to be more productive to pay rents. Additionally, social capital is considered to be one of the key determinants of agri-producers' competitiveness. It is usually included in the research through such proxies for farmer's managerial skills as age, level of education management tenure. Age is a factor, yielding the most contradictive results across the studies – suggesting negative effect of age due to older farmer's unwillingness to adjust and acquire operational improvements (Hadley, 2006) and positive effect due to knowledge and experience (Munroe, 2001; Chen et al, 2009).

Apart from controlling on internal factors, external environment, including location (Brummer, 2001; Hadley, 2006) also makes a difference. In particular, such factor endowments as soil (land) quality (Soule et al, 2000) and capital availability (Akinlo, 2005) are assessed. Furthermore, demand conditions should be evaluated (Porter, 1990), which could be approximated through macroeconomic environment (as effect on aggregate demand). A comprehensive study, performed by Akinlo (2005) for Sub-Saharan countries introduces such factors as inflation rate, openness of the economy (through Export-to-GDP ratio) and FDI as percent of GDP. A core factor, assessed in empirical studies, is government support - in the form of price support or direct subsidies. Empirical studies suggest that state support distorts farms' competitiveness (OECD, 2001) and has negative effect on firm's international competitiveness (e.g. Nivievskyi and von Cramon-Taubadel, 2008). Only

Hadley (2006), using farm-level data, reported positive significant effect on competitiveness measures for livestock farms in England. Separately from macro environment, infrastructure is considered as micro level external determinant of competitiveness, which is empirically proved to have a positive effect on productivity (Yee et al, Rao et al, 2004; Bernstein and Mamuneas, 2008). The situation on global markets also has a significant effect. Particularly, booming commodity markets are associated with higher output prices. Fulginiti et al (1999) concluded that higher output prices positively impact firms' productivity. Such results are consistent with Schmookler-type hypothesis, that good times stimulate innovation. Whereas Fuglie (2008) argued that high commodity prices cause the slowdown in total factor productivity, supporting Hicksian-type hypothesis on non-innovating behavior in good times.

Chapter 3

METHODOLOGY

3.1 Evaluating competitiveness

The available scientific research does not reveal consensus on the measure of competitiveness assessment. Ascending from the Ricardian theory, current measures of competitiveness are mostly based on the concept of a comparative advantage. Research on competitiveness concentrates around the Revealed comparative advantage (RCA) indicators developed by Balassa (1965), followed by the introduction Domestic resource cost (DRC) ratio, accompanied in the PAM framework (Monke and Pearson, 1989). The key difference of both 'families' of indicators lies in the usage of actually observed export prices (RCA) and socially optimal prices for inputs and outputs (DRC). The second group is known as ex-ante competitiveness measures that allow potential competitiveness to be assessed, when economic environment is believed to be distorted by the industrial and trade policy within the country, especially effecting the export side. Hence, for the analysis of agricultural producers we will be using the family of indicators, based on the social, rather than market prices.

In order to analyze the competitiveness of Ukrainian agricultural producers we will make use of the tool of Policy Analysis Matrix (PAM) initially offered by Monke and Pearson (1989). The PAM framework accompanies the investigation of individual efficiency (proxied by profitability in private and social prices) and the effect from price distortions, created by the policy impact, or market failures (see Table 1).

Table 1. Policy Analysis Matrix (PAM) framework

	Revenues	Costs		Profits
		Tradable inputs	Domestic factors	
Private (financial) prices	A	B	C	D=A-(B+C)
Social (economic) prices	E	F	G	H=E-(F+G)
Divergences	I=A-E	J=B-F	K=C-G	L=D-H
Profitability coefficient (PC)	PC = D / H			
Domestic resource cost ratio (DRC)	DRC = G/(E-F)			
Private cost ratio (PCR)	PCR = C/(A-B)			
Nominal protection coefficient (NPC)	NPC = A / E			
Effective protection coefficient (EPC)	EPC = (A-B) / (E-F)			
Social cost benefit ratio (SCB)	SCB = (F+G) / E			

Source: adopted from Monke and Pearson (1989), Masters and Winter-Nelson (1995)

Note: I refers to output subsidies, J to input subsidies, K to factor transfers and L to net transfers

The PAM approach is based on the idea of revealing 'true' opportunity costs and prices, while using them in the analysis in order to assess the comparative advantage of the specific sector, industry or individual producer. PAM allows for the competitiveness analysis through the employment of 6 alternative ratios the most ubiquitous in agricultural economics of which is Domestic Resource Cost ratio (DRC). It measures the effectiveness of domestic factors utilization in the production process, calculated as a ratio of domestic factors' social costs to the generated value added. Despite the wide usage in the empirical research, the ratio is critiqued for being positively biased, especially for the domestic factors-intensive production (Masters and Winter-Nelson, 1995). Hence, in our research we will use alternatively introduced Social cost benefit ratio (SCB). It is inherently derived from the PAM and employs the same, though rearranged, arguments as DRC ratio. Social cost benefit ratio for firm i:

$$SCB_i = \frac{\sum P^{social}_{i,trade(j)} \times Q_{i,trade(j)} + \sum P^{social}_{i,non-trade\,(k)} \times Q_{i,non-trade\,(k)}}{\sum P^{social}_{i,output(j+k)} * Q_{i,output\,(j+k)}} \quad (1)$$

Social cost benefit ratio is empirically easier to apply in the research, as it does not necessitate the inputs' division into tradable and non-tradable since they both enter the numerator (1). Albeit, in spite of DRC ratio SCB does not reveal highly uncompetitive firms, as it is always more than zero SCB > 0. Social cost benefit ratio may fall into the interval from zero to plus infinity SCB ϵ (0; +∞). In particular, SCB ϵ (0; 1) reveals competitive firms being able to cover their costs and thus being economically profitable, SCB=1 if a firm breaks even and SCB > 1 shows that the firm is uncompetitive.

Table 2. Conversion coefficients, applied to output prices

	Conversion coefficients						
	2010	2011	2012	2013	2014	2015	2016
Crops:							
Wheat	1.095	1.296	1.327	1.355	1.437	1.392	1.221
Barley	1.045	1.428	1.361	1.264	1.414	1.431	1.263
Maize	1.072	1.328	1.170	1.303	1.148	1.038	1.015
Rye	0.881	1.363	1.314	1.340	1.297	1.165	1.216
Oat	1.155	1.819	1.642	1.171	1.258	1.224	1.119
Sunflower	1.101	1.127	1.257	1.319	1.231	1.139	1.177
Livestock:							
Beef	1.000	1.000	1.000	0.930	1.000	1.000	1.000
Pork	0.904	0.978	0.885	0.844	1.000	1.000	1.000
Poultry	0.650	0.570	0.593	0.822	0.866	1.000	0.920
Milk	1.092	1.134	1.138	1.326	1.534	1.323	1.301
Eggs	0.948	0.848	1.000	1.000	1.000	1.000	0.951

Source: calculations on the basis of PSE OECD tables[9]
Note: Coefficient is calculated as reference border price, divided by private price

[9] PSE OECD: http://www.oecd.org/agriculture/topics/agricultural-policy-monitoring-and-evaluation/

The analysis in part of social prices, and consequently divergences, will be based on the list of assumptions about social prices and costs conversions.

Output prices: since we evaluate the multilateral competitiveness of the Ukrainian agriculture, as social prices are considered as the world equilibrium prices (Monke, 1981), which are proxied by the reference border prices and implemented in the analysis in the form of conversion coefficients. The estimated conversion coefficients are applied to individual output prices of an agricultural firm (see Table 2).

Table 3. Conversion coefficients, applied to tradable input prices

	Tariff	Non-tariff measure equivalent	Total protection	Conversion coefficient
Seed	6.30%	2%	8.30%	1.083
Fertilizer	4.70%	2%	6.70%	1.067
Fodder	14.40%	2%	16.40%	1.164

Source: Ryzhenkov et al, 2013

Note: Coefficients are presented as of 2013

Tradable inputs: the prices for seeds and fertilizers are believed to be distorted and corrected for tariffs and non-tariff measures (NTM) to eliminate the effect of trade policy. Tariffs are taken from DCFTA research (Ryzhenkov et al, 2013), while NTM are considered as 2% of ad valorem tariff equivalent, following the methodology of Nivievskyi and Von-Cramon Taubadel (2008). Other tradable inputs' social prices assumed to have no distortions from the trade policy side. The distortions, ascending from industrial policy, are corrected through the direct subsidies' effect elimination via adding them to the cost side, thus arriving at final social prices of tradable inputs (see Table 3).

Domestic factors (non-tradable inputs): we assume labor and capital prices to be not distorted as we assume the minimum wage to be non-binding and money market to be efficient, hence – private and social prices for these domestic factors are supposed to coincide. Since there is no land market in Ukraine and lease market is, as a consequence, rather distorted, we will follow the methodology offered by Monke and Pearson (1989). It implies that social cost of land is an opportunity cost of not growing the most effective crop, measured by net profitability. Although, this method enables us to assess the 'shadow' price of land, it has some important limitations such as crop rotation restriction. As a result, such an approach may overestimate a negative effect on competitiveness, unreasonably increasing the opportunity cost of land. Albeit, this method persists as the first best alternative and enables us to assess at least the lower bound of competitiveness interval, which is plausible for the purposes of the research.

3.2 Analyzing the key determinants of the competitiveness

As SCB ratio is calculated separately for each commodity, before proceeding with analysis we have to aggregate it on the firm-level. The estimated SCB for an individual firm are calculated as the weighted average of SCB of key commodities produced by the firm. The shares of key commodities are normalized to sum up to one, as only some of the products are under scrutiny.

The theory of international trade does not provide a theoretical model that would accompany competitiveness and the explanatory variables, which could be assessed empirically. Hence, in our research we use theoretical model of SCB decomposition, suggested by Nivievskyi (2009). Decomposition is derived for competitiveness change using cost measure, however, it is also valid for levels assessment, since it is consistent with economic theory and empirical evidence on the key determinants of competitiveness.

$$\frac{dSCB}{SCB} = \sum_k^K s_k \frac{dw_k}{w_k} - \sum_m^M r_m \frac{dp_m}{p_m} - \sum_m^M (r_m - \mu_m) \frac{dy_m}{y_m} - \sum_k^K (\lambda_k - s_k) \frac{dx_k}{x_k} - (RTS - 1) \sum_k^K \lambda_k \frac{dx_k}{x_k} + + \frac{\partial lnD_0(\cdot)}{\partial t} + \frac{\partial u}{\partial t} \quad (2)$$

According to the SCB decomposition[10] (2), cost measure of competitiveness has a theoretic association with the following components. The first two components represent 'factor cost effect', which is expected to effect the competitiveness in a negative manner, and 'terms of trade effect', which is expected to contribute to competitiveness growth in a positive manner. The next two components are interpreted as 'output allocative efficiency effect' with positive effect on the cost competitiveness, followed by 'input allocative efficiency' also with expected positive effect. As highlighted in the model of Nivievskyi (2009), if the firm chooses output and input bundles optimally, grounding exclusively on the market price signals, these two components are equal to zero. However, if the market signals are distorted with government intervention on the output side (e.g market price support and/or trade policy interventions) and/or on the input side (e.g. subsidies for input use and/or trade policy interventions), these two components may well capture the effect of the policy interventions that lead to inefficiencies. Additionally, since these two factors capture the effect of prices, we may additionally anticipate the pricing effect, introduced in the model by inflation and the effect of global commodity market prices change. RTS is interpreted as 'returns to scale' or 'size effect', anticipated to effect the competitiveness positively. The last two

[10] Nivievskyi (2009) also provides the alternative decomposition of SCB level instead of the change. We believe that SCB change decomposition could be effectively employed for the modeling purposes in this research work, however level decomposition is also available. SCB=TE*AE-π/py, where TE denotes technical efficiency, AE – allocative efficiency, π – profit in monetary value, py – firms' output in monetary value. Such decomposition could be further decomposed into the factor present in empirical model, in particular – technical efficiency, explicitly present in the model, government distortions implicitly present in allocative efficiency term, scale and price factors, arising from the last term.

factors represent technical efficiency and technical change. The last two components contribute to the TFP change, along with the allocative efficiency, hence are referred in the empirical research as total factor productivity.

Hence, the theoretical framework of competitiveness decomposition accompanies the following factors: TFP, trade and industrial policy distortions, terms of trade, size of the firm, vector of inputs' values (including logistics costs, which could be proxied of inverse of infrastructure), price vector (commodity prices and inflation). The factors of decomposition are consistent with existing empirical literature on the determinants of competitiveness.

Although, most empirical studies consider only one of competitiveness measures in the analysis, SCB ratio decomposition has shown that productivity and cost measure of competitiveness are interdependent. Hence, we as the first independent variable we consider efficiency measure of competitiveness in the form of productivity estimate.

Policy effect –three variables of trade and industrial policy distortions will be considered: the first variable is individual direct subsidies on the micro-level in period t and (t-1) as the firm is expected to make production decisions in the previous period; the second one is VAT exemptions, which are of non-discretionary nature in period t and (t-1); and MPS on the aggregated level, weighted by the commodity sold in period t and (t-1). Compared to subsidies, apart from having an impact on production decisions, we will also consider MPS to have more economically significant effect on cost competitiveness directly in the current period.

The size of the firm – since we analyze the cost measure of competitiveness, firms are expected to express economies of scale, but due to the management issues (Cornia, 1978) on large firms, we hypothesize about the concave effect of size variable on competitiveness, the variable enters in period t.

As a vector of input values we consider labor, energy (fuel and electricity), fertilizer, logistics costs and land. As land costs we consider rental costs for an individual firm in period t. Instead of logistics costs, we will consider infrastructure. Infrastructure – proved to be an important determinant of competitiveness, as it has a large impact on transportation costs (Yee et al, 2004; Bernstein and Mamuneas, 2008). We will assess the level of infrastructure development with Logistics Performance Index, calculated by World Bank Group in period t. Since this index is calculated once in two years, we will use linear approximation to fill the gap in unavailable observations, as it shows a clear upward sloping trend.

As price factors we will consider domestic inflation and global commodity prices, which affect input and output prices for individual firm. Inflation – as a proxy for pricing and macroeconomic stability in period t, following Akinlo (2005). Commodity prices – in order to analyze the effect of output prices dynamics, the index of world commodity prices will be introduced, calculated individually for each firm as weighted average of commodity indices, weighted for the share of commodity in goods sold in period t. We do not explicitly introduce terms of trade in the model, as they are implicitly included through vector of input values and firm size, which is proxied by total revenue per firm.

Final model will be estimated in terms of standardized variables (discussed in chapter 3.5) and will be of the following form:

$$zSCB_{it} = \beta_0 + \beta_1 zTFP_{it} + \beta_2 zI_{it} + \beta_3 zInf_t + \beta_4 zS_{it} + \beta_5 MPS_{it} + \beta_6 zR_{it} + \beta_7 zP_t + \beta_8 zC_t + \varepsilon_{it} \tag{3}$$

where SCB denotes cost measure of competitiveness, TFP - total factor productivity, I - vector of inputs, Inf – infrastructure variable, S – direct government support, MPS – indirect market price support, R – size, P – inflation, C – global commodity prices.

3.3 Estimating Total Factor Productivity

The economic sense of productivity and the methods of its scrutinizing have been widely discussed in the economic literature, accumulating a considerable legacy of theoretical and empirical evidence to study.

The first methodological approach for total factor productivity estimation is the index method. Among the most popular ones is considered Fisher index, which is computed as a square root of product of Laspeyres and Paashe indices. Despite straight-forward computations, which support the wide application of this method, it has drawbacks, such as deterministic nature of the model and potentially biased estimates (Van Biesebroeck, 2007). Additionally, since this method is outlier-sensitive, its utilization necessitates prior procedures of data preparation. However, after outlier-detecting procedures this method is plausible and widely-used in the empirical research.

An alternative to non-parametric, or index method, could be considered a parametric method. Despite lower outlier-sensitivity and stochastic nature, this approach does not allow for firms heterogeneity. The available methods are summarized in the Table 4 below.

In order to address the existing drawbacks of parametric and non-parametric methods, semi-parametric approach has been introduced – known as order-m (Cazals et al, 2002) and order-α (Aragon et al, 2005) efficiency frontiers. Semi-parametric approach is mostly used for the analysis of input or output efficiency, rather than total factor productivity. However, efficiency scores are valid proxies for TFP, thus efficiency will be used in our analysis as a productivity measure.

Table 4. Methods of TFP estimation

	Advantages	Disadvantages
	Non-parametric approaches	
Index method	1) no estimation utilized	1) Deterministic nature of model
Malmquist, 1953 Caves et al, 1982 Bjurek, 1996	2) allows for heterogeneous production technology	2) Productivity estimate may be factor-biased 3) Dealing with outliers and measurement errors is not available, except prior procedures
Data envelopement method	1) allows for heterogeneous production technology	1) does not account for firms size (and economies of scale)
Farrel, 1957		2) results are sensitive to outliers and measurement errors
Free Disposable Hull		3) most applications are not stochastic
Charnes et al, 1978		4) curse of dimentionality
	Parametric approaches	
Ordinary Least Squares	1) easy in interpretation	1) endogeneity problem
	2) quick, may serve as benchmark	2) does not allow for firms heterogeneity
Stochastic production frontier	1) does not have endogeneity problem	1) does not allow for firms heterogeneity
Aigner et al, Meeusen et al 1977	2) stochastic model	
Battese et al, 1992 Van Biesebroeck, 2004	3) enables to divide productivity and random component	
Instrumental variables	1) efficient in addressing measurement error	1) instruments could be weak
Blundell et al, 1998		2) long panel is necessary

Source: Van Biesebroeck, 2007

In our research we will use order- α approach, as it is less computationally intense than order-m approach, when believed to yield unbiased, efficient and consistent estimates, which are the closest to the true frontier (Tauchmann, 2011).

$$\theta_i^{OA_{input}} = P_{100-\alpha}\left\{\max_{m=1,\dots M}\left\{\frac{X_{mj}}{X_{mi}}\right\}\right\} \tag{4}$$

Among the peer DMUs, the one that exhibits minimum input consumption, denoted j serves as reference to i, and θ is calculated as relative input use. (Aragon et al, 2005). As we apply alpha-efficiency, we choose specific alpha ($\alpha = 98$), which serves as a reference point in the estimation procedure. Analysis is performed using statistical package in Stata 13.0 (Tauchmann, 2011). As inputs for production function estimation we include labor, capital, inventories (seeds/fodder and fertilizers), energy and land in physical area.

As a robustness check, we will also introduce index method. This a conventional method of total factor productivity calculation in comparison to alpha-frontier, which measures efficiency or managerial effort, but still could be a valid proxy for total factor productivity. Among existing alternatives, we consider Fisher index for TFP calculation (see Table 5). It includes the measures of Laspeyres and Paashe quantity indices, however it is balanced since its methodology accompanies both measures (McLellan, 2004). Output prices are deflated considering price indices for crop and livestock production with respective shares in the revenues for individual firm using the data from State Statistical Service of Ukraine. Input prices are deflated using GDP deflator.

Table 5. Index method of TFP estimation

	Input quantity indices		**Ouput quantity indices**		**Productivity**
Laspeyres index	IL=	(Pinp_0*Qinp_t)/ (Pinp_0*Qinp_0)	OL=	(Pout_0*Qout_t)/(Pout_0*Qout_0)	
Paashe index	IP=	(Pinp_t*Qinp_t)/ (Pinp_t*Qinp_0)	OP=	(Pout_t*Qout_t)/ (Pout_t*Qout_0)	
Fisher index	IF=	(IL*IP)^(1/2)	OF=	(OL*OP)^(1/2)	TFP=OF/IF

Source: McLellan (2004)

3.4 Estimation issues

Analyzing the data available, we should account for the following estimation issues:

1) Endogeneity: in order to get rid of unobserved heterogeneity, we apply the fixed effect model – to get rid of unobserved firm-specific factors; random effects model is not likely to be applicable as unobserved factors (e.g. management) are expected to be correlated with variables in the model. In order to ensure the method chosen, we apply the Haussman test.

2) Serial correlation: so as to address serial correlation we use Newey-West standard errors, which correct for both heteroscedasticity and autocorrelation. Thus, they are considered to be heteroscedasticity and autocorrelation consistent (HAC) estimators of the covariance matrix.

3.5 Estimating the relative importance of determinants

Empirical assessment of the key determinants of explanatory variable could be potentially be complicated by unclear interpretation and small economic significance of the factors. Therefore, we are interested in analyzing the relative importance of the explanatory variables. In order to proceed with analyzing the relative importance of key factors we will apply conventional stardartisation technique:

$$x_i^* = \frac{x_i - \bar{x}}{s_i} \tag{5}$$

Despite wide criticism - Hanuskek and Jackson (1978), King (1986) and Bring (1994) – is still widely used in empirical literature, while analyzing the determinants or key contributors of left hand-side variables and even claimed to improve computational accuracy apart from improved ease of interpretation (Neter, Wasserman, and Kutner, 1989). Bring (1994) considers mean-scaling as the technique that creates the inconsistency of mean-scaled variable, as original and stardardised variables belong to different populations. Hence, data transformation with partial standard errors is introduced. Albeit, considering heteroscedasticity of distribution, it appears to be a serious issue for partial standard errors estimation. Thus, we proceed with our analysis applying conventional standartisation through mean and standard errors variables' transformation.

Chapter 4

DATA DESCRIPTION

4.1 Data preparation

The first dataset is the firm-level data collected from the State Statistic Service of Ukraine on the basis of individual responses of Ukrainian agricultural producers. We expect the data to be possibly exposed to the measurement error, when there is an evidence of severe outliers. We utilize blocked adaptive computationally efficient outlier nominators (BACON) algorithm proposed by Billor, Hadi, and Velleman (2000). This method allows for multivariate outliers' detection and decreases the chance of considering 'true' extreme value as an outlier. In order to check the data for outliers we apply the method to the following sets of variables for social cost benefit ratio and total factor productivity analysis correspondingly: The first set of the variables include:

1) harvested area / increment in live weight - for crops and livestock correspondingly;

2) total cost of goods sold;

3) price per unit (mt) of commodity.

The second set of the variables include aggregated on the firm level input and output variables, in particular the value of labor, seeds, fodder, fertilizers and energy along with the value of capital (proxied by depreciation), area of cultivated land and the monetary value of total revenues.

4.2 Sample composition

The data used for the research consist of two separate datasets, merged for the sake of research. The first dataset used in the research is an unbalanced panel of micro-level data from Ukrainian agricultural producers over the period of 2010-2016. The second dataset consists of macro level indicators, such as total market price support for agricultural commodities, inflation, world commodity prices and infrastructure index for the same period, collected from numerous open sources (OECD PSE, CIA Outlook, NBU and WB) (see Table 6).

Data sample accompanies three measures of government support, which are of different nature, and thus – should be included in the model separately to properly evaluate the effect of government support:

1)Market price support in a form of individually constructed index per firm (weighted for the firm's output) – indicates current market environment for a producers of a particular commodity and overall policy in the industry. This component captures the effect of trade policy, considering final good import and export policy measures.

2)Individual support in a form of budgetary outlays accounts for the input and output subsidies, directly effecting firm's cost side. This support is of discretionary nature and assigned to the firms individually.

3)Value added tax (VAT) exemptions is the third analyzed component of the government support. Compared to direct outlays, VAT exemptions are assigned automatically for agricultural producers, which moreover were under special VAT regime treatment. Albeit it was abandoned on 1st January, 2017, with further re-introduction for oil producers in May, 2018.

Table 6. Statistical properties of variables in the dataset

Variable		# of obs	Mean	St. deviation	Min	Max
SCB	ratio	19396	0.93	0.36	0.01	7.90
TFP (alpha frontier)	ratio	19396	1.33	1.49	0.04	21.09
TFP (index)	ratio	13484	1.11	0.66	0.02	11.38
Market price support, weighted for firm output structure	bln UAH	19396	-6.20	4.60	-29.00	9.52
Individual support, direct outlays	thsd UAH	9561	153	2578	0	224812
Individual support, VAT	thsd UAH	19396	682	15828	0	1951973
Size, total revenue	thsd UAH	19396	18847	25178	12	370920
Depreciation	thsd UAH	19396	883	1404	0.5	17852
Total labour employed	thsd UAH	19396	2080	2545	6	28754
Total land	ha	19396	2563	2406	9	30366
Fertilizer, annual cost	thsd UAH	19396	2205	3380	0.1	44190
Energy, annual cost	thsd UAH	19396	2278	2586	6	31037
World commodity prices	index	17987	1.05	0.21	0.72	1.57
Infrastructure, LPI	index	19396	2.79	0.13	2.57	2.98
Inflation, GDP deflator	index	19396	15.19	9.72	4.34	38.88

4.3 Social cost benefit ratio estimation

Social cost-benefit ratio is a key measure used in the analysis to determine on the level of competitiveness of Ukrainian agricultural producers. After correcting input and output prices for trade and industrial policy distortions, we are able to estimate the competitiveness under fully liberalized market conditions. SCB ratio is calculated for each of the key crop and livestock commodities, using respective conversion coefficients for inputs and output (see Table 7).

Analyzing density distribution functions, we may observe that most crops may be considered competitive on the global scale. Sunflower seed may be considered to be the most competitive crop, which currently bears an export tax, levied in order to support sunflower oil producers due to 'infant industry' argument, while oats, rye and barley are somewhat falling behind (see Figure 3, Table 7).

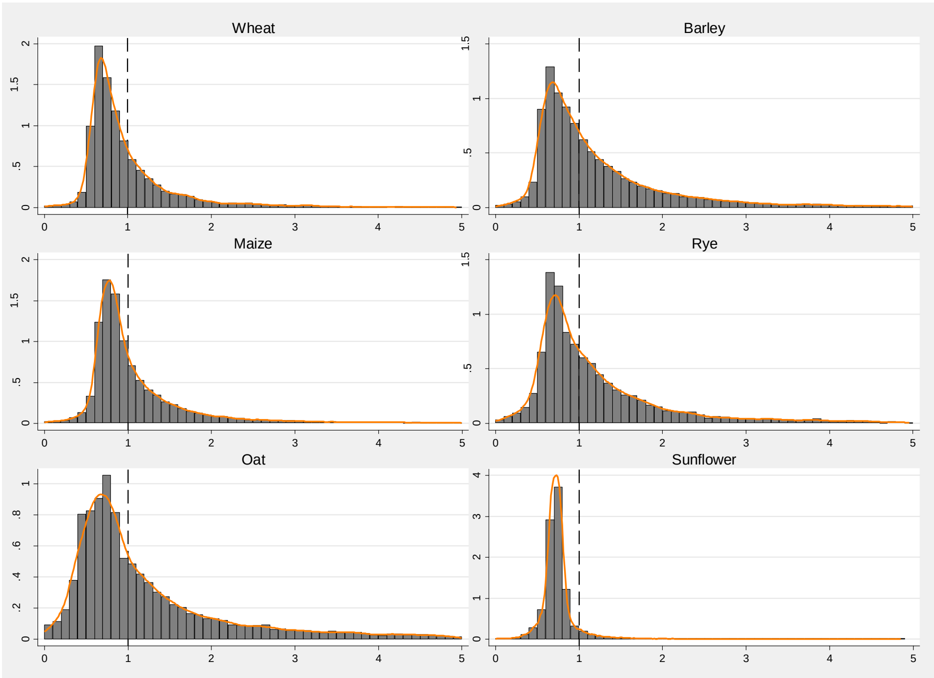

Figure 3. SCB ratios distributions for key crops 2010-2016

Source: own calculations

Note: commodity is considered competitive if SCB<1

Alternative inference may be drawn from livestock commodities' competitiveness produced in Ukraine (see Figure 4). All of them but milk are supported by government industrial policy, experiencing positive market price differential and target individual support through direct outlays (PSE OECD)[11]. The argument is especially bright concerning poultry producers, who apart from enjoying industrial policy privileges, also experience support from trade policy in a form of import tariff.

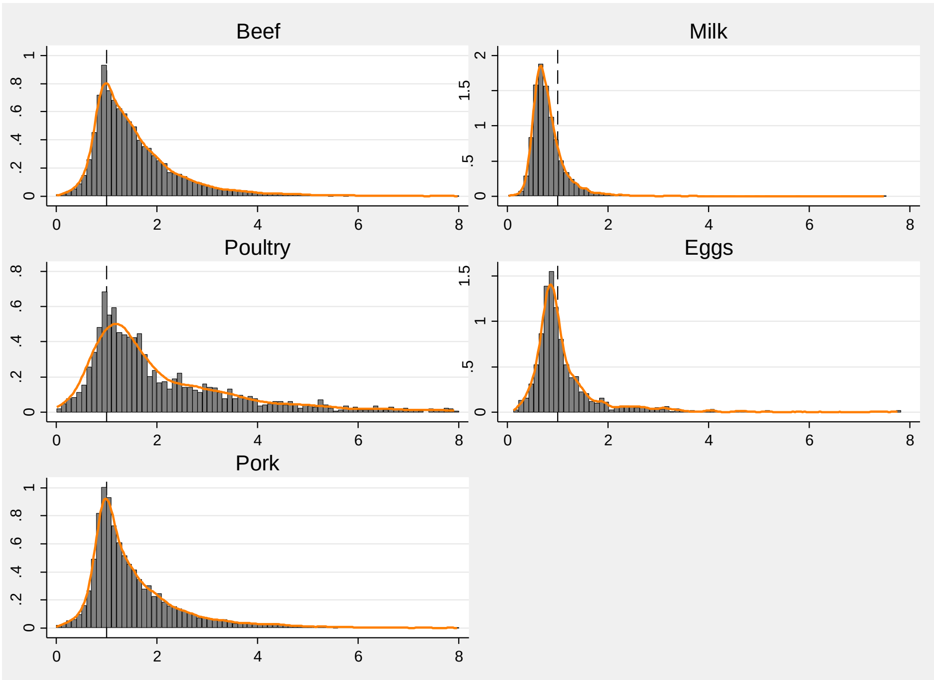

Figure 4. SCB ratios distributions for key livestock commodities 2010-2016

Source: own calculations

Note: commodity is considered competitive if SCB<1

The market conditions are rapidly changing over time and so does the industrial and trade policy due to its discretionary nature and changing

[11] PSE OECD: http://www.oecd.org/agriculture/topics/agricultural-policy-monitoring-and-evaluation/

economic and environment. Hence, we would expect that estimated SCB ratios are also changing over time being affected by the highlighted factors.

Table 7. SCB dynamics by commodity

	Social cost-benefit ratio (average by year)						
	2010	2011	2012	2013	2014	2015	2016
Crops:							
Wheat	1.331	1.032	0.925	0.910	0.749	0.866	0.848
Barley	1.810	1.169	1.159	1.058	0.918	1.047	1.075
Maize	1.311	0.946	1.182	1.024	1.087	1.140	1.076
Rye	1.718	1.036	1.057	1.074	1.094	1.132	1.003
Oat	1.465	0.937	1.104	1.215	1.202	1.376	1.278
Sunflower	0.831	0.848	0.732	0.706	0.752	0.717	0.713
Livestock:							
Beef	1.731	1.494	1.558	2.008	1.649	1.259	1.388
Pork	1.692	1.619	1.628	1.756	1.464	1.242	1.393
Poultry	2.491	2.653	2.373	1.886	1.904	1.170	1.545
Milk	1.012	0.829	0.994	0.755	0.664	0.703	0.688
Eggs	1.314	1.457	1.003	1.073	1.036	0.958	1.176
Total	**1.147**	**0.969**	**0.970**	**0.965**	**0.894**	**0.836**	**0.840**

Source: own calculations

Note: commodity is considered competitive, if SCB<1; cumulative (total) SCB ratio is calculated as weighted average of the crops and livestock commodities produced by individual firm

The estimation results suggest on significant positive dynamics of agricultural competitiveness, with SCB ratio being substantially under unity in the years of 2014-2016. During 2011-2013 firms functioned around the break-even point, given social prices for inputs and outputs, and thus may be considered as neutral, analyzing global competitiveness. When in recent years of 2014-2016 we may consider farms to be competitive on the global scale. However, this effect is achieved to a great extent due to two most competitive commodities – sunflower seed and wheat, which occupy significant share in average farms' output.

Hence, we may indeed observe that Ukrainian agricultural producers become more competitive as time passes, supporting the argument with the density functions becoming more skewed to the right in 2014-2016 in comparison to prior periods. Albeit, after observing the underlying dynamics we may not yield any inference about the factors, attributive to changes without further analysis (see Figure 5).

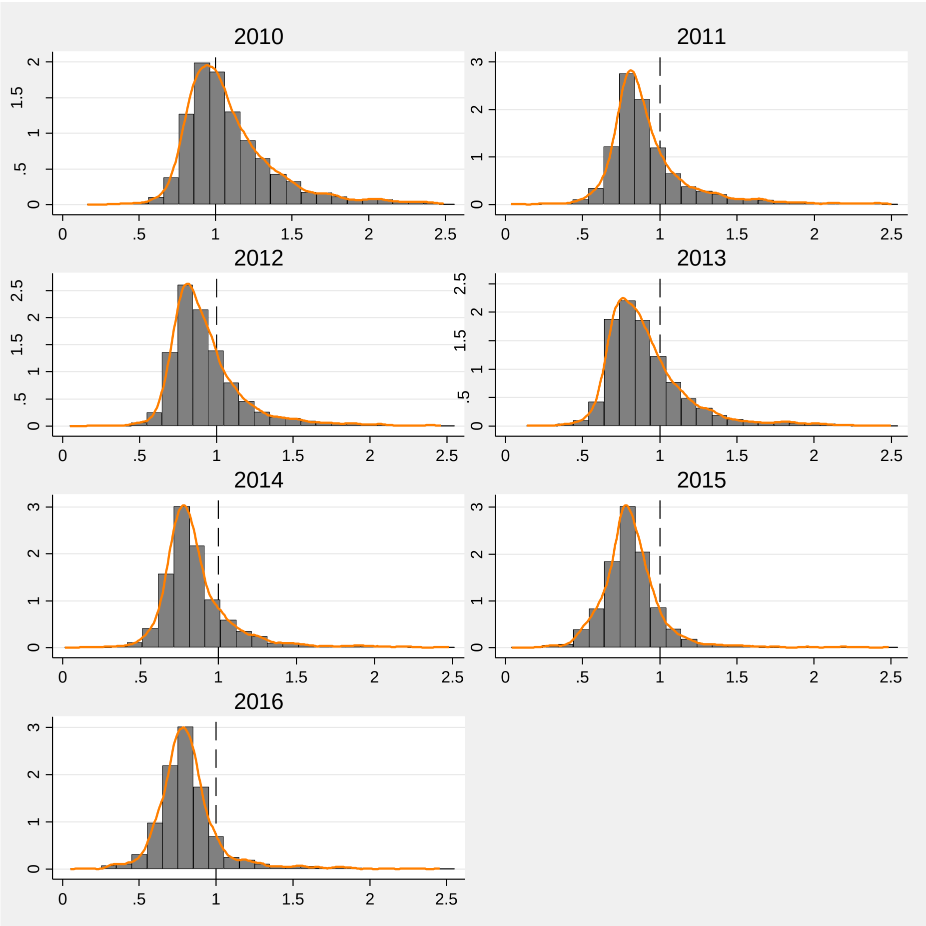

Figure 5. SCB ratio by year, cumulative for firm

Source: own calculations

Note: firm is considered competitive, if SCB<1; cumulative SCB ratio is calculated as weighted average of the crops and livestock commodities produced by individual firm

4.4 Total Factor Productivity estimation

Productivity is a complementary indicator of firms' competitiveness to SCB ratio and it should be evaluated for the proper assessment of the competitiveness of agricultural producers in Ukraine. To estimate productivity we used the semi-parametric approach suggested by Aragon et al. (2005) called alpha-frontier, using the implementation methodology by Tauchmann (2011), along with the index method by using Fisher index. The first method yields efficiency estimates, which mostly represent managerial efforts, but they are valid for using as a TFP proxy in the regression model, whereas the second approach yields TFP estimates. In order to estimate the production function we have used a list of inputs, namely labor, fertilizers, fuel, electricity, land, seeds and feed along with a cumulative output per firm. Production function is estimated for each year separately from 2010-2016, using the intra-year benchmark. For the index approach, productivity, similarly to cost competitiveness measure, is estimated using the same set of inputs for each year during the analyzed period of 2010-2016.

Table 8. TFP (efficiency) by year, estimated via semi-parametric method by firm

	2010	2011	2012	2013	2014	2015	2016
Mean productivity	2.062	2.148	2.221	2.156	2.144	2.072	2.252
Median productivity	1.239	1.144	1.133	1.156	1.056	1.020	1.139
Share of productive firms	0.652	0.592	0.580	0.597	0.531	0.510	0.584

Source: own calculations

Note: higher values represent higher productivity, cumulative for firm

Table 9. TFP dynamics by year, estimated via index method by firm

	2010	2011	2012	2013	2014	2015	2016
Mean productivity	1.052	0.998	1.237	1.025	1.121	1.132	1.282
Median productivity	0.875	0.957	1.061	0.973	1.009	0.893	1.006

Source: own calculations

Note: higher values represent higher productivity, cumulative for firm

The dynamics of the estimated efficiency using semi-parametric approach and productivity using index method are consistent and resemble the same pattern as agricultural producers experience two consecutive TFP upswings – in 2012-2013, followed by the year 2016 TFP growth after two unfavorable years (see Table 8, Table 9 and Figure 6). TFP dynamics is partially consistent with SCB development, except for the years of 2014-2015, where rapid increase in the cost measure of competitiveness is observed, which is not supported by the productivity growth.

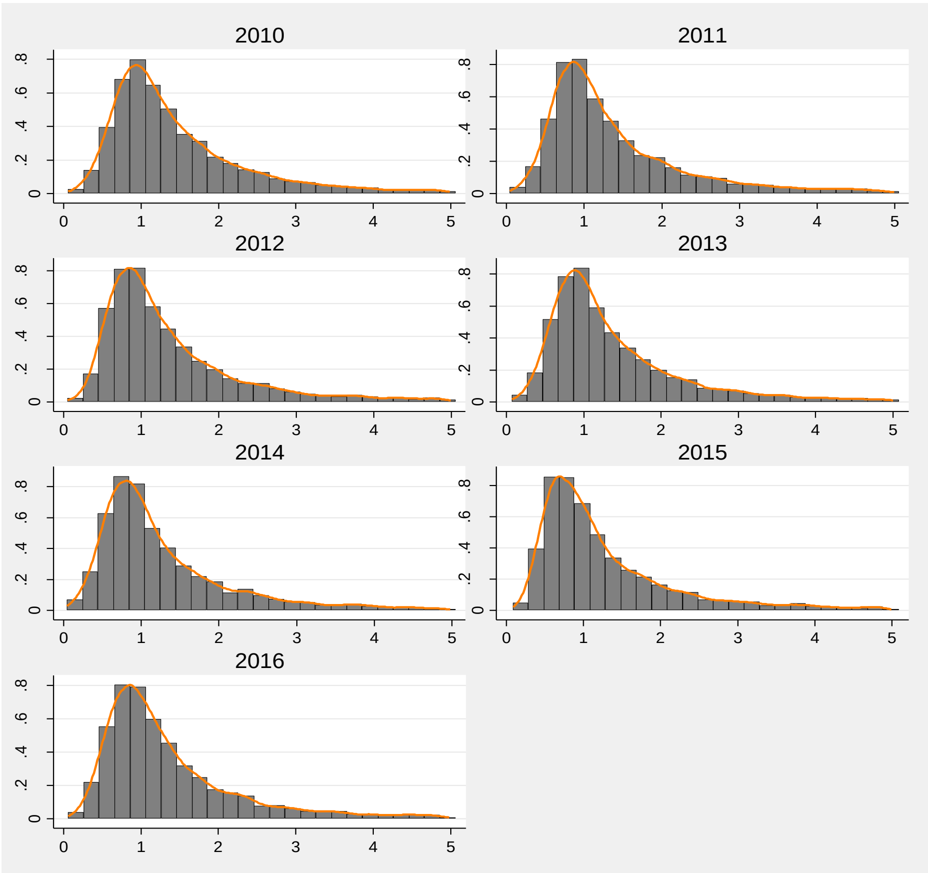

Figure 6. TFP (efficiency) dynamics by year, estimated via semi-parametric method by firm

Source: own calculations

Note: higher values represent higher productivity, cumulative for firm

The distribution of productivity (efficiency) estimated by semi-parametric approach, which measures mostly managerial efforts, shows significant divergence across Ukrainian agricultural producers. Alternatively, TFP estimated by index method reveals more consolidated distribution with shorter right hand-side tail (see Figure 7).

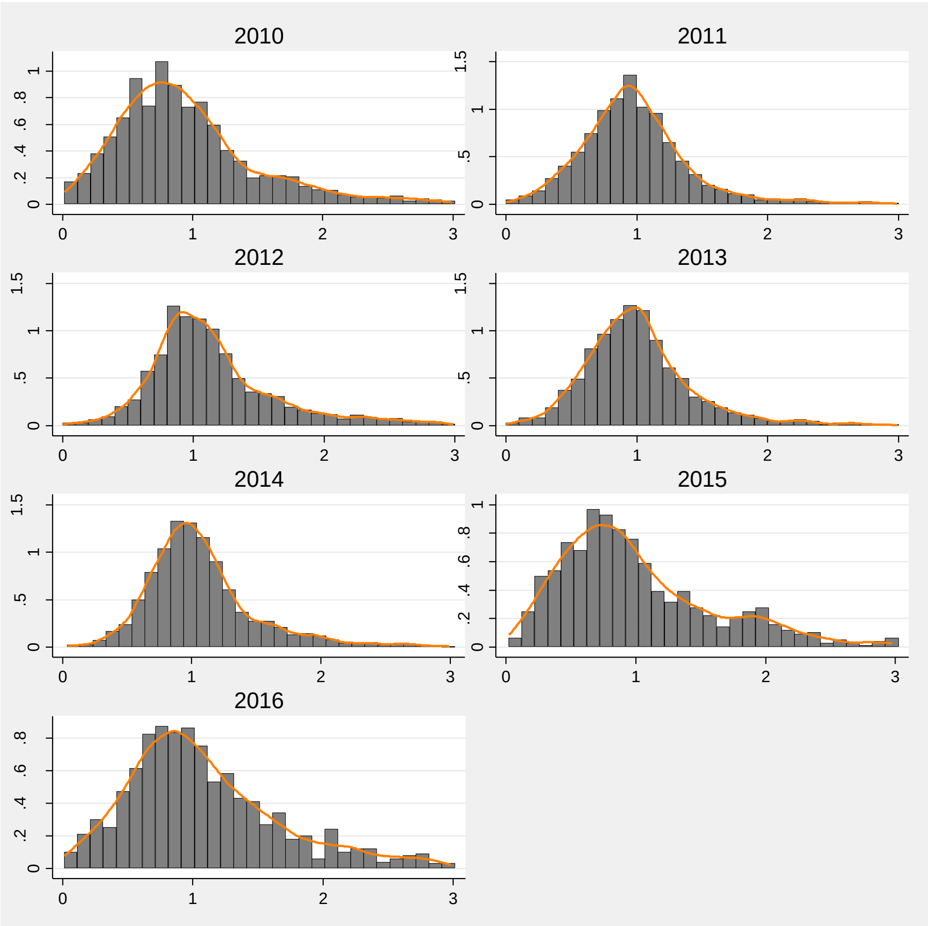

Figure 7. TFP dynamics by year, estimated via index method by firm

Source: own calculations

Note: higher values represent higher productivity, cumulative for firm

Chapter 5

ESTIMATION RESULTS

5.1 Empirical results

On obtaining empirical results about the competitiveness' levels of agricultural producers in Ukraine, we are interested in evaluating the effect of specific factors and scrutinize their contribution to the agricultural competitiveness in Ukraine[12]. As outlined in the methodology, we apply the fixed effects model[13] in order to abandon endogeneity for obtaining robust results, with Newey-West robust standard errors. Additionally, to avoid the biased results due to SCB truncated nature (SCB is truncated at 0) and to properly assess the relative importance of the factors, we use standardizing transformation of both - dependent and left hand-side variables. We calculate z-scores for the variables in the model, following conventional methodology of subtracting mean and dividing by the standard deviation. (discussed in the Chapter 3.5)

The extended models account for the heterogeneity of agricultural producers. Hence we construct two groups of agricultural producers, introducing dummy variables that capture the effect of firms' specialization. The first dummy points onto producers, specializing in crop production and obtain more than 75% of revenues from crop commodities. The second group identifies producers, specializing in livestock production and generating over 75% of revenues from livestock commodities. These two groups are not collectively exhaustive, since there are agricultural producers without such a strict specialization, which hence obtain '0' value considering both dummies.

[12] Cost competitiveness (SCB ratio) and productivity (efficiency) has been estimated at the firm level for 2010-2016, however regression analysis is performed on the data covering 2010-2014, since firm identifiers have changed after 2014 and are not consistent with the ones before 2014. Thus, we cannot consistently accompany observations for 2015-2016 in the panel regression.

[13] Conventionally, in order to address endogeneity we will use either fixed effect or random effect model. Haussman test with probability>chi2=0.000 strongly suggests on using fixed effect model

Table 10. Estimation results, FE model (1) with Newey-West standard errors

zSCB	(1) Full	(2) Full	(3) Base	(4) Base
zTFP	-0.085*	-0.075**	-0.087*	-0.088***
	(0.035)	(0.026)	(0.034)	(0.026)
zLabor	0.298	0.490	0.296	0.538
	(0.228)	(0.292)	(0.222)	(0.299)
zTFP X zLabor	-0.407	0.151	-0.416	0.079
	(0.317)	(0.346)	(0.316)	(0.360)
zInventories	0.121	0.472***		
	(0.095)	(0.120)		
zEnergy	-0.061	-0.117		
	(0.054)	(0.070)		
zLand	-0.419**	-0.374***	-0.417**	-0.345**
	(0.146)	(0.112)	(0.147)	(0.112)
zTFP X zLand	-0.427	-0.473**	-0.428	-0.498**
	(0.226)	(0.178)	(0.225)	(0.182)
zMPS	0.162***	0.199***	0.161***	0.195***
	(0.018)	(0.032)	(0.018)	(0.032)
zMPS_lagged	-0.054***	-0.116***	-0.053***	-0.114***
	(0.016)	(0.023)	(0.016)	(0.023)
zVAT	0.004	0.014	0.004	0.015
	(0.003)	(0.016)	(0.003)	(0.017)
zVAT_lagged	0.003	0.003	0.002	0.003
	(0.007)	(0.016)	(0.007)	(0.016)
zSubsidy		0.042**		0.045**
		(0.014)		(0.014)
zSubsidy_lagged		-0.002		-0.002
		(0.002)		(0.002)
zSize	-0.538***	-0.883***	-0.497***	-0.711***
	(0.127)	(0.197)	(0.115)	(0.184)
zSize_squared	0.290***	0.404*	0.283***	0.334
	(0.073)	(0.182)	(0.073)	(0.192)
zInflation	-0.054***	-0.092***	-0.057***	-0.100***
	(0.014)	(0.019)	(0.014)	(0.018)
zLPI	-0.062***	-0.042	-0.063***	-0.041
	(0.017)	(0.025)	(0.017)	(0.025)
zCommodity	-0.027*	0.011	-0.027*	0.012
	(0.012)	(0.016)	(0.012)	(0.016)
constant	-0.197***	-0.196***	-0.197***	-0.198***
	(0.019)	(0.026)	(0.019)	(0.027)
N	13333	5798	13333	5798
F-statistic	37.24	26.06	42.40	28.85

*Note: standard errors in parentheses, * p<.05; ** p<.01; *** p<.001, TFP (efficiency) estimated using semi-parametric approach*

The estimation results are quite robust across the estimated models. Most of the effects lie within the economic theory and support the initial hypotheses through the expected sign, except for the effect of land rental payments, which is discussed further. Since the data on direct subsidies is available for the limited number of firms, the models (2) and (4) have restricted sample in comparison to the models (1) and (3). We focus our interpretation on the third specification due to the largest overall significance of the regression (see Table 10 and Figure 8). The interpretation of results has opposite relationship with competitiveness across all estimated model, since lower SCB ratio represents higher competitiveness and vice versa.

Considering the results obtained, we can infer a significant and positive effect of productivity on the cost competitiveness of agricultural producers, observed in the market. In particular, one standard deviation of the efficiency (productivity) increases competitiveness by 8.9%.

Moving to the government support, the results obtained are robust in sign across all estimated models, but at the same time they are not fully consistent with the previous empirical works. The literature suggests on either consistent positive or consistent negative effect of the government support (Nivievskyi and von Cramon-Taubadel, 2008; Hadley, 2006). Albeit the model estimated suggests not only on a directional effect of industrial policy and trade policy measures, but also suggests no effect of some types of support.

The largest effect on competitiveness among government support measures has market price support – which enters the model in a form of individual value for the firm in a given year, weighted by firms' output and standardized. Net effect of one standard deviation of the market price support for current and lagged periods is negative and estimated at the level of 10.8%. Hence, the indirect support of agricultural producers is not an effective approach of competitiveness stimulus.

Considering direct government support in the form of VAT exemptions, there is no economically and statistically significant effect on the cost competitiveness of agricultural producers. However, alternative model specifications (2) and (4) that include the effect of direct outlays suggest on the negative effect of such support measure on the cost competitiveness. In particular, one standard deviation of increase in direct subsidies indicates a net effect of negative 4% and 4.3% across current and lagged periods in the models (2) and (4) respectively.

An alternative measure of the government support is general services support. The model accompanies infrastructure, proxied by LPI index, which has positive statistically and economically significant association with cost competitiveness, which is consistent with existing empirical evidence (Yee et al, 2004; Bernstein and Mamuneas, 2008). One standard deviation of infrastructure is associated with 6.3% increase in agricultural cost competitiveness. Considering the market price support and direct outlays, which have significant negative association with agricultural competitiveness and the direct support in the form of VAT exemptions that have no effect, general services seem to be an efficient instrument in terms of competitiveness stimulus. Infrastructure development is an important factor of cost optimization, as it decreases time and monetary costs of inputs and output delivery, and also may be considered as a key factor on the revenue side as it improves market access for the agricultural producers. However, these results should be interpreted with caution since the infrastructure variable does not have much variation, as it is included in the model on the macroeconomic level[14].

Additionally, there is statistically and economically significant relationship between size, measured in cumulative crop and livestock revenues by firm, and cost competitiveness. Empirical estimation supports the economies of scale effect, suggesting on the positive non-linear (concave) association between the variables. The firms are estimated to be the most competitive,

[14] Models are estimated, using Newey-West clustered standard errors, which should correct for the low variation.

when the average annual revenues are at the level of 30.8 mln UAH, which is twice bigger than the average firm. Hence empirical results are consistent with Hall and LeVeen (1978), who also stated positive association between size and competitiveness due to easier market access for a large firm.

Table 11. Profile of the optimal size producers versus market average

		Optimal size producers		Market	
		Mean	Median	Mean	Median
Land	ha	4,087.85	3,336.00	2,832.84	1,961.50
Crop_share	%	79.74	80.56	79.27	87.38
Yield_wheat	t/ ha	4.924	5.064	3.497	3.345
Yield_sunflower	t/ha	3.000	2.894	2.204	2.068
TFP (efficiency)	index	0.757	0.677	1.334	1.047
TFP (index method)	index	1.223	1.133	1.176	1.056
VAT_to_Revenue	%	1.807	0.000	3.533	0.000
Labour intensity	people/ha	0.034	0.029	0.028	0.023
Fertilizer intensity	UAH/ha	1.95	1.32	1.04	0.65

Note: optimal size producers are considered the observations with average annual revenue of 30.8 mln UAH +/- 2.5 mln UAH (values are insensitive to narrower interval); market is considered to consist of all producers (observations), which are used in model estimation

According to the estimated model, optimal size producer cultivates 4,088 ha of land, which is consistent with the empirical research for Ukraine (World Bank, 2013). Analyzing the profile of the optimal size producer, no distinguishing features in terms of specialization or product mix is observed. However, optimal size market players differ from market average considering key crop yields, efficiency/productivity and factor intensity (see Table 11). In particular, these producers are characterized by significantly higher yields, while using more input factors considering labor and fertilizers, backed by higher total factor productivity. Alternatively, technical efficiency of optimal size producers is considerably lower than the market median level, highlighting lower managerial efforts that could be explained by the increased organizational complexity of larger farms, which is consistent with empirical evidence (Cornia, 1978). Hence, crop yields are ensured by higher factors' utilization and total factor productivity.

The effect of pricing along with the global commodity market environment is also of an importance for the competitiveness of agricultural producers in Ukraine, showing positive association with the cost competitiveness. In particular one standard deviation of inflation contributes 5.7% to competitiveness with a positive sign, whereas global commodity market price dynamics contribute 2.7%.

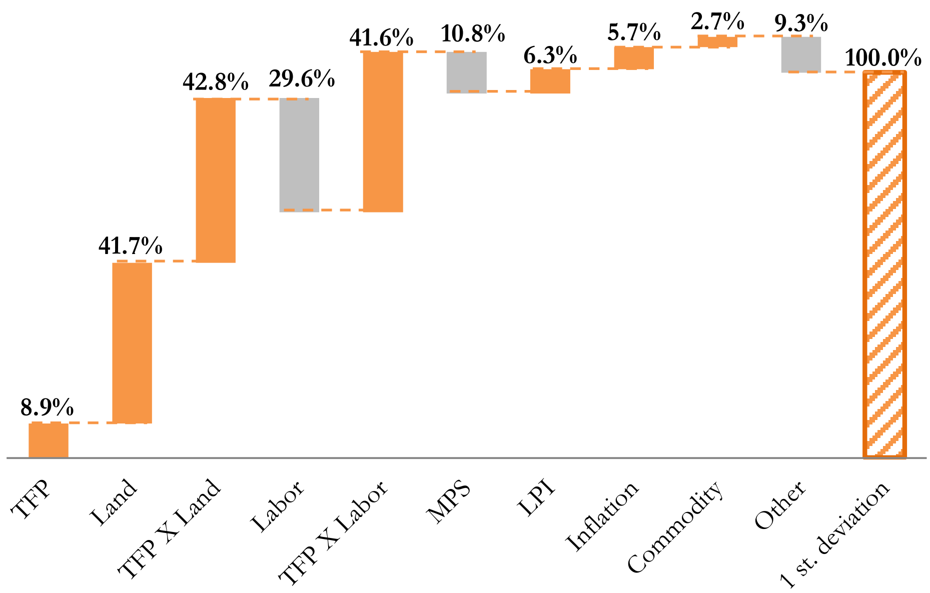

Figure 8. Cost competitiveness empirical decomposition

Source: own estimation

Note: 100% in the final column represents one standard deviation of cost competitiveness; decomposition is presented according to the empirical estimates of model (3)

Finally, we consider the effect of the inputs, in particular labor and land, used in the production process. Low labor costs are conventionally considered as one of the advantages for business activity in Ukraine. Empirical estimation supports this argument with the negative association between labor cost and cost competitiveness with 29.6% of negative contribution making it the largest counter-driver among the factors included. Albeit the interaction term of labor costs and productivity suggests the depletion of a negative effect of growing (real) wages on the competitiveness of agricultural producers for more productive firm[15]. Hence, the effect of growing labor costs given at mean productivity[16] is positive, contributing 41.6% to cost competitiveness. Cumulative effect of labor cost, given at mean productivity is equal to 12% of positive contribution.

The most significant driver of cost competitiveness is land in the form of rental payments, as suggested by the empirical estimation[17]. Since 82.7%[18] of farms operate solely on the rented land, the increase in rental prices, as a result of agricultural land sales ban lift, is expected to substantially contribute to the overall cost competitiveness of Ukrainian agricultural producers. Considering the ongoing debate, low rental prices in the conditions of land market moratorium are perceived by the market participants as the contributor to the agricultural competitiveness, which is not observed empirically. Alternatively, the growth of rental prices by one standard deviation contributes 41.7% to the cost competitiveness. Theory suggests on two channels of inputs effecting the operational activity of a productive unit, and, as a result, on the cost competitiveness: lower input prices are beneficial in terms of production costs, whereas higher input prices create the stimulus for the producers to use the resources more efficiently and thus – effect competitiveness in the long run. The estimated model suggests on the second channel prevailing in the Ukrainian market. Thus, low rental prices as a result

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[15] Overall statistical significance of Labor and interaction term of Labor and TFP is $p<0.001$ according to F-test

[16] Since the model is estimated given standardized variables, at mean value is equal to zero

[17] The alternative model, estimated on rental price per ha suggests 105% contribution to cost competitiveness. However, cost competitiveness (SCB) ratio decomposition (Nivievskyi, 2009) accounts for total monetary value of inputs, used in production. Thus, we use conservative estimates, which could be interpreted as minimum effect.

[18] For 16038 farms out of 19396 , share of rented land in total cultivated land is equal to 100%

of non-developed land market create a substantial gap for the competitiveness development.

The effect of land rental payments, given at mean efficiency (productivity), represented in the model (3) by the interaction term between land rental payments and efficiency (productivity), is positive 42.8%[19] contribution to one standard deviation of the cost competitiveness. Thus, more productive firms would have a better potential for competitiveness increase at the global market under the conditions of land market liberalization.

The cumulative effect of the land market environment given at mean productivity is estimated at the level of positive 84.5% contribution to the cost competitiveness of the Ukrainian agricultural producers.

According to the empirical research (Nivievskyi and Nizalov, 2016) rental prices in Ukraine are at least 10 times lower in comparison to fully liberalized market conditions, including capital availability and absence of land ownership fragmentation, and around 2 times lower in comparison to the liberalized land market after the moratorium lift. Hence, the effect of land market liberalization is expected to increase average farms' cost competitiveness by 19%[20], whereas full liberalization is expected to have an effect of 190.1% increasing the competitiveness of Ukrainian agricultural producers in almost three times.

We have also estimated the same model specifications using total factor productivity estimates, calculated via the index approach (see Table 12).

[19] The coefficient of interaction term could be interpreted as 42.8% contribution to competitiveness only if TFP is equal to zero, which in our model with standardized variables corresponds to mean value.

[20] The mean value of rental price per ha is 683 UAH with the standard deviation of 3043 UAH. Hence, two times increase in rental prices corresponds to 0.225 of one standard deviation. This number, combined with the expected effect of 84.5% considering one standard deviation in rental prices, gives us the expected effect of 9.3% contribution to competitiveness.

Table 12. Estimation results, FE model (2) with Newey-West standard errors

zSCB	(5) Full	(6) Full	(7) Base	(8) Base
zTFP	-0.043***	-0.018	-0.044***	-0.027
	(0.012)	(0.016)	(0.011)	(0.015)
zLabor	0.394	0.524	0.384	0.597*
	(0.223)	(0.269)	(0.220)	(0.268)
zTFP X zLabor	-0.193	0.296	-0.195	0.239
	(0.298)	(0.272)	(0.296)	(0.273)
zInventories	0.071	0.460***		
	(0.100)	(0.128)		
zEnergy	-0.045	-0.050		
	(0.055)	(0.071)		
zLand	-0.293*	-0.229*	-0.293*	-0.188
	(0.118)	(0.112)	(0.118)	(0.113)
zTFP X zLand	-0.208	-0.283	-0.208	-0.296
	(0.179)	(0.160)	(0.178)	(0.160)
zMPS	0.164***	0.203***	0.164***	0.199***
	(0.019)	(0.033)	(0.019)	(0.033)
zMPS_lagged	-0.045**	-0.121***	-0.045**	-0.119***
	(0.017)	(0.024)	(0.017)	(0.024)
zVAT	0.003	0.014	0.003	0.015
	(0.003)	(0.016)	(0.003)	(0.017)
zVAT_lagged	0.003	0.004	0.003	0.004
	(0.007)	(0.016)	(0.007)	(0.016)
zSubsidy		0.040**		0.043**
		(0.013)		(0.014)
zSubsidy_lagged		-0.002		-0.002
		(0.002)		(0.002)
zSize	-0.327*	-0.859***	-0.302*	-0.594**
	(0.149)	(0.223)	(0.130)	(0.196)
zSize_squared	0.216**	0.366*	0.210**	0.269
	(0.076)	(0.176)	(0.076)	(0.184)
zInflation	-0.049***	-0.093***	-0.052***	-0.099***
	(0.014)	(0.019)	(0.014)	(0.019)
zLPI	-0.062***	-0.042	-0.062***	-0.040
	(0.018)	(0.027)	(0.018)	(0.027)
zCommodity	-0.030*	0.013	-0.030*	0.014
	(0.013)	(0.017)	(0.013)	(0.017)
constant	-0.152***	-0.167***	-0.151***	-0.154***
	(0.016)	(0.027)	(0.016)	(0.027)
N	12556	5559	12556	5559
F-statistic	33.76	23.75	38.34	26.13

*Note: standard errors in parentheses, * p<.05; ** p<.01; *** p<.001, TFP estimated using index approach*

The results are consistent in sign and differ slightly in magnitude, considering productivity estimate. The alternative model accompanies total factor productivity estimate, unlike technical efficiency used in the first model, which may explain the differences of results obtained[21]. However, the results across both models suggest the common determinants having close magnitude effects.

5.2 Empirical results, considering heterogeneity of the market

On considering the effects of left hand-side variables on the competitiveness of agricultural producers, assuming homogeneous impact across the market, we further expand our analysis by considering the association between the independent variables and SCB ratio separately for crop and livestock producers (see Table 13). Accounting for market heterogeneity of the agricultural market, we obtain distinct key determinants for the producers specialized in either crop or livestock production.

Productivity has a statistically significant effect on specialized crop producers, contributing 7.2% to cost competitiveness. Consistently with the market average, the competitiveness of crop producers is exposed to MPS changes, which contributes net negative 15.5%, when direct support has no statistical and economic significance. Infrastructure though, which could be perceived as general services support proxy, shows more economically significant effect compared to the market average, contributing positive 9.7% to the cost competitiveness of the crop producers. The estimate of LPI effect for livestock producers is comparable in magnitude to crop producers, however is not statistically significant.

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[21] Total factor productivity denotes the ratio of output to input (Y/X), whereas technical efficiency (input) denotes the ratio of actual (X) to minimum possible (potential) (X*) input use. Thus as TFP=Y/X and TE=X/X*, X=TE*X* and TFP=Y/(TE*X*)=(TFP*)/TE, hence TFP=/=TE

Table 13. Estimation results, fixed effect model with Newey-West standard errors considering crop and livestock producers

zSCB	(9) Base	(10) Crop	(11) Livestock
zTFP	-0.087*	-0.072	-0.140
	(0.034)	(0.041)	(0.349)
zLabor	0.296	0.528	-1.021
	(0.222)	(0.285)	(1.572)
zTFP X zLabor	-0.416	-0.448	0.281
	(0.316)	(0.377)	(3.082)
zLand	-0.417**	-0.436*	-0.146
	(0.147)	(0.204)	(1.269)
zTFP X zLand	-0.428	-0.430	-1.155
	(0.225)	(0.315)	(2.226)
zMPS	0.161***	0.156***	0.084
	(0.018)	(0.027)	(0.075)
zMPS_lagged	-0.053***	-0.010	-0.082
	(0.016)	(0.026)	(0.051)
zVAT	0.004	0.001	0.043
	(0.003)	(0.001)	(0.064)
zVAT_lagged	0.002	-0.005	1.221
	(0.007)	(0.031)	(1.313)
zSize	-0.497***	-0.361*	0.709
	(0.115)	(0.147)	(1.121)
zSize_squared	0.283***	0.212**	-1.392
	(0.073)	(0.077)	(1.361)
zInflation	-0.057***	0.003	-0.338***
	(0.014)	(0.019)	(0.091)
zLPI	-0.063***	-0.097***	-0.094
	(0.017)	(0.028)	(0.060)
zCommodity	-0.027*	-0.050**	-0.032
	(0.012)	(0.019)	(0.094)
constant	-0.197***	-0.167***	0.074
	(0.019)	(0.021)	(0.311)
N	13333	8206	970
F-statistic	42.40	22.72	6.04

*Note: standard errors in parentheses, * p<.05; ** p<.01; *** p<.001, TFP (efficiency) estimated using semi-parametric approach*

The strongest driver of the crop producers competitiveness is land payments effect, which contribute 86.6% given mean productivity, which is slightly higher than to overall market contribution of 84.5%. Hence, land market liberalization is expected to have a stronger effect on crop producers, which is explained by stronger utilization of land factor in the production process. The competitiveness is expected to increase by 19.5% [22]given doubled rental prices as a result of land market reform, and by 194.9% given 10 times land rental payments increase induced by the full market liberalization, as outlined by Nivievskyi and Nizalov (2016).

The economy of scale is not observed for specialized livestock producers, however it exists for crop producers according to empirical estimation. Hence, size exhibits non-linear association with cost competitiveness, suggesting the optimal size of the crop specialized farm to be 22.2 mln UAH in annual average revenues, which is 1.5 times higher in comparison to the average crop specialized producer. Considering the differences between optimal size crop producer and average crop specialized producer, we observe the pattern, resembling the differences under the market homogeneity assumption, namely higher total factor productivity and higher factor intensity, which contribute to higher yields per hectare.

Pricing is a statistically and economically significant factor, considering both types of producers. Crop producers mostly benefit from global commodity price growth, which contributes 5% to the cost competitiveness, whereas livestock producers' competitiveness is positively associated with inflation, which most likely reveals the effect of domestic currency devaluation, which contributes positive 33.8% being the most economically and statistically significant competitiveness driver for livestock producers.

In order to assess the robustness of the results obtained for the specialized crop or livestock producers, we run sensitivity analysis, varying the share of crop or livestock revenues in total revenues, which is considered to be specialization parameter. The base share is 75% for both types of producers (see Table 14 and Table 15).

[22] The mean value of rental price per ha is 683 UAH with the standard deviation of 3043 UAH as for the market as a whole. Hence, two times increase in rental prices corresponds to 0.225 of one standard deviation. This number, combined with the expected effect of 86.6% considering one standard deviation in rental prices, gives us the expected effect of 19.5% contribution to competitiveness.

Table 14. Sensitivity analysis for crop producers

zSCB	(12) Crop 60	(13) Crop 70	(14) Crop 75	(15) Crop 80	(16) Crop 90
zTFP	-0.071*	-0.066	-0.072	-0.059	-0.067
	(0.034)	(0.040)	(0.041)	(0.046)	(0.057)
zLabor	0.408	0.494	0.528	0.469	0.497
	(0.248)	(0.270)	(0.285)	(0.301)	(0.388)
zTFP X zLabor	-0.401	-0.438	-0.448	-0.481	-0.593
	(0.337)	(0.368)	(0.377)	(0.388)	(0.453)
zLand	-0.448*	-0.442*	-0.436*	-0.451*	-0.501*
	(0.178)	(0.197)	(0.204)	(0.204)	(0.236)
zTFP X zLand	-0.441	-0.422	-0.430	-0.462	-0.582
	(0.270)	(0.303)	(0.315)	(0.316)	(0.380)
zMPS	0.162***	0.150***	0.156***	0.133***	0.120***
	(0.022)	(0.026)	(0.027)	(0.028)	(0.029)
zMPS_lagged	-0.025	-0.018	-0.010	-0.010	0.003
	(0.021)	(0.024)	(0.026)	(0.029)	(0.033)
zVAT	0.000	0.000	0.001	0.000	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
zVAT_lagged	-0.018	-0.007	-0.005	-0.014	-0.013
	(0.024)	(0.029)	(0.031)	(0.027)	(0.028)
zSize	-0.419***	-0.369**	-0.361*	-0.247	-0.186
	(0.125)	(0.138)	(0.147)	(0.159)	(0.186)
zSize_squared	0.261***	0.221**	0.212**	0.183*	0.153
	(0.076)	(0.076)	(0.077)	(0.081)	(0.105)
zInflation	-0.010	-0.002	0.003	0.017	0.017
	(0.017)	(0.018)	(0.019)	(0.020)	(0.025)
zLPI	-0.080***	-0.099***	-0.097***	-0.120***	-0.123***
	(0.024)	(0.027)	(0.028)	(0.029)	(0.032)
zCommodity	-0.041**	-0.051**	-0.050**	-0.058**	-0.065*
	(0.016)	(0.018)	(0.019)	(0.020)	(0.025)
constant	-0.176***	-0.169***	-0.167***	-0.153***	-0.177***
	(0.019)	(0.020)	(0.021)	(0.022)	(0.030)
N	9920	8842	8206	7431	5541
F-statistic	34.08	27.65	22.72	22.76	17.14

*Note: standard errors in parentheses, * p<.05; ** p<.01; *** p<.001, TFP (efficiency) estimated using semi-parametric approach*

The results estimated for different specialization criteria of crop producers are consistent in their sign and magnitude. The effect of productivity fluctuates between 5.9% - 7.2%, reaching the maximum in the group of specialized producers defined by 75% share criteria. The effect of land payments consistently increases its positive contribution reaching its maximum in the group of most specialized producers, whereas the magnitude of labor costs, as the core competitiveness counter-driver, diminishes with the specialization criteria increase.

Table 15. Sensitivity analysis for livestock producers

zSCB	(17) Livestock 60	(18) Livestock 70	(19) Livestock 75	(20) Livestock 80	(21) Livestock 90
zTFP	-0.103	-0.003	-0.140	-0.221	-0.267
	(0.161)	(0.229)	(0.349)	(0.349)	(1.071)
zLabor	-0.729	-1.189	-1.021	-0.711	-3.699
	(0.806)	(1.355)	(1.572)	(1.613)	(3.841)
zTFP X zLabor	-0.557	0.107	0.281	0.769	5.760
	(1.549)	(2.521)	(3.082)	(3.377)	(5.820)
zLand	-0.347	0.069	-0.146	-0.547	-0.285
	(0.610)	(0.884)	(1.269)	(1.129)	(1.869)
zTFP X zLand	-0.493	-0.419	-1.155	-1.686	-3.956
	(1.133)	(1.584)	(2.226)	(2.348)	(5.745)
zMPS	0.091	0.069	0.084	0.061	0.202
	(0.048)	(0.062)	(0.075)	(0.091)	(0.124)
zMPS_lagged	-0.104**	-0.092*	-0.082	-0.065	0.038
	(0.034)	(0.044)	(0.051)	(0.059)	(0.135)
zVAT	0.048	0.041	0.043	0.021	5.520**
	(0.074)	(0.066)	(0.064)	(0.013)	(2.117)
zVAT_lagged	0.020	0.197	1.221	-0.355	0.978
	(0.018)	(0.168)	(1.313)	(0.638)	(1.272)
zSize	0.077	0.448	0.709	-0.309	-1.520
	(0.637)	(1.120)	(1.121)	(1.645)	(4.096)
zSize_squared	-0.549	-1.055	-1.392	-0.292	-1.576
	(0.570)	(1.167)	(1.361)	(1.802)	(4.150)
zInflation	-0.264***	-0.292***	-0.338***	-0.377***	-0.351
	(0.054)	(0.076)	(0.091)	(0.113)	(0.311)
zLPI	-0.073	-0.090	-0.094	-0.097	-0.106
	(0.039)	(0.051)	(0.060)	(0.074)	(0.101)
zCommodity	-0.025	-0.023	-0.032	-0.045	-0.024
	(0.047)	(0.074)	(0.094)	(0.126)	(0.344)
constant	-0.083	0.086	0.074	-0.189	-0.248
	(0.120)	(0.257)	(0.311)	(0.309)	(0.714)
N	1794	1215	970	744	375
F-statistic	13.04	8.33	6.04	5.92	4.11

*Note: standard errors in parentheses, * p<.05; ** p<.01; *** p<.001, TFP (efficiency) estimated using semi-parametric approach*

When indirect market support loses its importance while moving to the most specialized producers, general services support, revealed by infrastructure variable in the model increases the magnitude of the positive association with cost competitiveness up to 12.3% in the last group.

Crop producers are also exposed to the global commodity market dynamics, with the positive association between commodity prices and cost competitiveness of Ukrainian crop producers, which consistently growth reaching 6.5% for the group of producers with the specialization criteria of 90% crop share.

Despite statistically significant scale effect for crop specialized producers, returns to scale effect decreases its magnitude[23], reaching the highest level for moderately specialized producers in the group with specialization criteria of 75%. The most specialized groups reveal the lowest optimal size, which could be explained by the absence of potential synergy between the production processes that could counter-balance growing organizational complexity.

The categories estimated for livestock specialized producers, similar to crop producers, also include the specialization criteria of revenue share in the total revenue per firm. The key determinants of cost competitiveness for the specialized livestock producers are government indirect support in the form of MPS for less specialized livestock producers, and inflation that captures domestic macro environment along with domestic currency devaluation effect. Both variables contribute positively to the livestock producers' competitiveness. In particular market price support two period cumulative contribution varies from 1.3% to 2.3% considering respectively 60% and 70% specialization criteria, and eventually diminishes after the third group of livestock producers. The direction of effect differs from the overall market, where MPS has negative association with cost competitiveness, indicating the

[23] Optimal size for 60% share group 0.802 standard deviations (with the mean value of 14.5 mln in average annual revenues, which deviates no more than 3.6% across all groups), for 70% group - 0.775, for 75% group – 0.851, for 80% group – 0.675, for 90% group – 0.608.

net effect of 10.3%. This could be explained by supportive nature of indirect support for livestock producers with positive market price differential, when the majority of crop producers are taxed by such an instrument of agricultural policy through the negative MPD for the key crop commodities[24]. Pricing and macro stability, entering the model through inflation variable, also contribute positively to the cost competitiveness of the livestock specialized producers, increasing the magnitude along with specialization growth, and reaching the maximum of 37.7%.

On analyzing the sensitivity of the estimated models for crop and livestock producers, depending on the chosen specialization parameter and obtaining consistent estimates in sign and magnitude, we expand our analysis to the commodity level to understand which commodities are mostly exposed to the key factors affecting the competitiveness of agricultural producers.

The models estimated at the commodity level for crop commodities (see Table 16) suggest on economically significant effect of indirect market price support, infrastructure (general services support), global commodity price dynamics and specialization of production. Whereas, production processes of most individual crop commodities are less exposed to the trade policy measures implemented by MPS, it is opposite for sunflower seed production. Considering sunflower seed production, market price support shows positive net effect of 13.2%, which reveals the consequence of current agricultural policy. According to MPD dynamics, sunflower seed is exposed to a large negative government (dis)support in a form of export tariff for the sake of sunflower oil industry support, which is a downstream industry for seed production. Hence, the absence of price distortions in a form of MPS could further promote sunflower seed producers' competitiveness in the global market.

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[24] PSE OECD: http://www.oecd.org/agriculture/topics/agricultural-policy-monitoring-and-evaluation/

Table 16. Models for competitiveness of the key crop commodities' production processes

zSCB	(22) Wheat	(23) Barley	(24) Maize	(25) Rye	(26) Oat	(27) Sunflower
zTFP	0.920	1.431	-0.473	-2.833	-0.408	0.559
	(1.167)	(0.994)	(0.375)	(1.564)	(1.519)	(0.538)
zLabor	1.370	0.816	-0.100	-1.842	-1.196	0.310
	(1.425)	(1.205)	(0.475)	(2.004)	(2.148)	(0.770)
zTFP X zLabor	0.086	0.203*	0.047	0.600**	-0.091	0.012
	(0.153)	(0.096)	(0.041)	(0.226)	(0.218)	(0.053)
zLand	-1.126	-0.693	-0.410**	2.324*	-0.643	-0.491
	(0.586)	(0.398)	(0.149)	(0.920)	(0.711)	(0.269)
zTFP X zLand	-0.081	0.968	-0.265	3.664**	-0.224	-0.110
	(0.774)	(0.603)	(0.215)	(1.408)	(1.143)	(0.418)
zMPS	-0.019	0.094	0.074**	-0.044	-0.129*	-0.209***
	(0.069)	(0.058)	(0.028)	(0.073)	(0.063)	(0.038)
zMPS_lagged	-0.066	-0.033	-0.055	-0.187**	-0.172***	0.077**
	(0.056)	(0.044)	(0.030)	(0.060)	(0.050)	(0.027)
zVAT	0.337	-0.062	0.003	0.090	-0.081	0.007**
	(0.578)	(0.066)	(0.002)	(0.096)	(0.085)	(0.003)
zVAT_lagged	0.176*	-0.242	0.013	-0.157	-0.027	-0.007
	(0.076)	(0.388)	(0.013)	(0.390)	(0.056)	(0.029)
zSize	-0.008	0.757	0.161	-0.397	0.422	-0.183
	(0.684)	(0.512)	(0.221)	(0.789)	(1.038)	(0.322)
zSize_squared	0.062	0.216	-0.013	1.066	-0.317	0.208
	(0.486)	(0.339)	(0.132)	(0.814)	(1.582)	(0.146)
zInflation	-0.112	-0.002	0.017	-0.024	-0.066	0.272***
	(0.066)	(0.039)	(0.027)	(0.069)	(0.063)	(0.028)
zLPI	-0.273***	-0.436***	-0.092**	-0.259***	-0.150**	-0.190***
	(0.066)	(0.050)	(0.028)	(0.057)	(0.049)	(0.025)
zCommodity	-0.059	-0.222***	-0.123***	-0.047	-0.096	0.013
	(0.078)	(0.037)	(0.022)	(0.062)	(0.050)	(0.021)
wheat_share	-2.384***					
	(0.328)					
barley_share		-5.310***				
		(0.416)				
maize_share			-2.381***			
			(0.138)			
rye_share				-2.092**		
				(0.739)		
oat_share					-5.778***	
					(1.126)	
sunflower_share						-1.217***
						(0.154)
constant	0.421***	0.698***	0.471***	0.396**	0.193	0.478***
	(0.118)	(0.074)	(0.038)	(0.153)	(0.165)	(0.056)
N	1977	3880	9209	2002	2772	9330
F-statistic	15.85	34.81	47.02	7.78	3.87	32.95

*Note: standard errors in parentheses, * p<.05; ** p<.01; *** p<.001, TFP (efficiency) estimated using semi-parametric approach*

Table 17. Models for competitiveness of the key livestock commodities' production processes

zSCB	(28) Beef	(29) Pork	(30) Poultry	(31) Milk	(32) Eggs
zTFP	-0.027	-0.013	-0.090	-0.190***	-0.246
	(0.041)	(0.079)	(0.320)	(0.042)	(0.323)
zLabor	0.479	-0.088	-0.164	0.480	-0.096
	(0.394)	(0.365)	(1.670)	(0.340)	(1.138)
zTFP X zLabor	-0.084	-0.904	1.134	-0.269	2.414
	(0.509)	(0.567)	(2.486)	(0.486)	(1.703)
zLand	-0.046	0.176	0.059	-0.014	-0.281
	(0.191)	(0.265)	(0.918)	(0.148)	(0.838)
zTFP X zLand	-0.043	0.195	-1.147	-0.063	-1.540
	(0.287)	(0.440)	(1.546)	(0.227)	(1.618)
zMPS	-0.165***	-0.040	0.173*	0.219***	0.072
	(0.026)	(0.027)	(0.072)	(0.022)	(0.050)
zMPS_lagged	-0.081***	0.002	0.203**	-0.083***	0.099
	(0.024)	(0.023)	(0.070)	(0.021)	(0.055)
zVAT	0.503**	-0.009*	1.072	1.131**	0.222
	(0.171)	(0.004)	(0.868)	(0.408)	(0.704)
zVAT_lagged	0.002	.019*	-0.762	-0.002	1.213*
	(0.005)	(0.009)	(0.598)	(0.005)	(0.586)
zSize	-1.068***	-0.584**	-0.622	-1.202***	-2.134
	(0.211)	(0.211)	(0.974)	(0.175)	(1.192)
zSize_squared	0.464*	0.197	0.452	0.406***	2.257*
	(0.197)	(0.139)	(0.917)	(0.122)	(1.090)
zInflation	-0.234***	-.206***	0.205*	-0.247***	0.200
	(0.028)	(0.025)	(0.083)	(0.023)	(0.155)
zLPI	-0.055**	-0.006	-0.011	-.114***	-0.028
	(0.020)	(0.021)	(0.068)	(0.019)	(0.097)
zCommodity	-0.104***	-0.015	0.014	0.017	0.075
	(0.022)	(0.016)	(0.064)	(0.018)	(0.084)
beef_share	-1.707***				
	(0.237)				
pork_share		-1.026***			
		(0.157)			
poultry_share			-1.879		
			(1.080)		
milk_share				-1.709***	
				(0.132)	
eggs_share					-0.580
					(0.397)
constant	0.011	-0.036	0.119	0.104**	0.196
	(0.036)	(0.035)	(0.142)	(0.036)	(0.172)
N	8461	8205	730	7713	485
F-statistic	30.03	14.7	3.62	103.36	4.14

*Note: standard errors in parentheses, * p<.05; ** p<.01; *** p<.001, TFP (efficiency) estimated using semi-parametric approach*

When sunflower seed production competitiveness has association with indirect support, wheat production is exposed to VAT exemptions, which decrease wheat producers' competitiveness by 51.6% considering one standard deviation. Since wheat producers are among the largest receivers of non-discretionary tax benefits, empirical analysis support the decision of the abandonment of automatic VAT exemptions for exporters, which was introduced on 1st January, 2017.

On considering conventional measures of direct and indirect government support, we move on to infrastructure, which could be considered as general services support. It appears to be significant for all of the key crop commodities and contributes from 9.2% to 43.6%, which is significantly higher in comparison to the market average estimated in base (3) model. The same is observed for the global commodity prices – the magnitude of estimated association between price index and cost competitiveness is significantly larger, reaching the maximum of 22.2% contribution compared to 2.7% in the base (3) model.

Table 18. Commodity shares in farms' output

	Crop commodities					
	Wheat	Barley	Maize	Rye	Oat	Sunflower
Mean share	0.205	0.093	0.161	0.059	0.025	0.293
Median share	0.184	0.712	0.108	0.021	0.006	0.256
Skewness	1.23	1.94	1.69	3.44	6.11	0.74
	Livestock commodities					
	Beef	Pork	Poultry	Milk	Eggs	
Mean share	0.105	0.097	0.090	0.233	0.286	
Median share	0.054	0.027	0.010	0.178	0.039	
Skewness	2.99	3.31	3.26	1.100	0.87	

Albeit the most contributing factor to the cost competitiveness is the farms' specialization. The effect varies from 12.2% to 57.9% increase in cost competitiveness with the corresponding increase of a share of a particular commodity in firms' output by 10 pp. The strongest effect is observed for oat and barley, which are usually the left-overs of crop production and occupy small share in firms' output, thus their production process may be suboptimal and does not receive enough attention from the producers, while having a strong optimization potential. (see Table 18).

The models estimated for livestock commodities (see Table 17) show significant effect of indirect market price support, infrastructure and inflation for all livestock commodities, while exhibiting economies of scale effect for beef, milk and pork producers' competitiveness.

Empirical estimation suggests on the positive effect of market price support for beef and pork producers, contributing 8.4% and 3.8% to cost competitiveness respectively. However, beef and pork are almost not affected by the market price support, as MPD for these commodities is close to unity, meaning no price distortions. In contrast to beef and pork, poultry is the most supported commodity considering MPS over the period of 2010-2014, and, according to empirical estimation, has the strongest negative association between cost competitiveness and MPS, when the latter contributes negative 37.6% to one standard deviation of poultry producers competitiveness.

In addition to MPS, beef and milk producers are also exposed to discretionary government support levels. In particular, direct support in a form of tax benefits has negative association with the cost competitiveness of beef and milk producers, contributing negative 50.1% and 112.9% to one standard deviation of cost competitiveness respectively. Hence, current policy of cattle headcount increase and beef industry promotion, which is implemented via direct subsidies, is ineffective method of support considering commercial farms, which negatively affects the potential of industry competitiveness.

Apart from government support, effect of infrastructure, which is a highly economically significant factor for crop commodities competitiveness and market average competitiveness, has economically and statistically significant effect only for cattle industry considering beef and milk production. This phenomenon could be explained by the production site peculiarities of poultry industry which does not necessitate large fodder base, in contrast to beef and milk production, and could be situated in the relative vicinity to the final consumer. This argument, however, does not explain economic insignificance of infrastructure for pork production.

The effect of pricing is also economically significant. But unlike crop commodities, livestock commodities are mostly exposed to inflation, which accompanies the effect of macroeconomic stability and domestic currency devaluation, rather than global commodity markets dynamics. The association between inflation and cost competitiveness is mostly positive, ranging from 20.5% to 24.7%, with exception for eggs production.

The empirical analysis, performed on the detailed 2010-2014 panel of micro-level farms' data, enabled us to decipher the core drivers of competitiveness of agricultural producers considering aggregated (market) level, market segments (crop and livestock producers) and commodity level production processes. It showed the dramatic importance of land market environment and farms' productivity improvements being the prerequisites for positive competitiveness development and successful participation of Ukrainian producers in the global commodity markets.

Chapter 6

CONCLUSIONS

On conducting the research on the cost competitiveness of Ukrainian agricultural producers, we may indeed conclude about growing competitiveness of Ukrainian crop and livestock producers. Cost competitiveness, measured via cost-benefit ratio in social prices (SCB ratio), shows an explicit upward trend since 2010 considering key crop and livestock commodities with wheat, sunflower seed and milk being the most competitive ones. Overall, cost competitiveness increased by 26.7% during the analyzed period. In this thesis we try to determine the key drivers and their contribution to agricultural cost competitiveness development, using a detailed 2010-2014 panel of farm-level accounting data in Ukraine.

Estimated model suggests two most economically significant drivers of cost competitiveness of Ukrainian agricultural producers, namely efficiency (productivity) and land rental payments, which serve as a proxy for land market environment. In contrast to cost measure of competitiveness, estimated efficiency (productivity) shows no explicit directional improvements and is rather stable over the estimated period. Albeit it is considered as one of the main determinants of the competitiveness in the theoretical model, proven by the empirical estimation obtained. A pure effect of technical efficiency (productivity), measured by semi-parametric and index approaches, is estimated at the level of 8.9% (4.4%) - meaning that efficiency (productivity) explains 8.9% (4.4%) of one standard deviation of cost competitiveness.

Additionally, the estimated models suggest a vital effect of the land market environment, where the positive impact of high rental prices on competitiveness could be observed. The pure effect of one standard deviation of land rental payments, given at mean productivity, is 84.5% contribution to cost competitiveness. Hence, given current background of low land rental prices, primarily due to an existing ban on sales and purchases of agricultural land, competitiveness of agricultural producers suffers from the absence of necessary stimuli for the efficient resource use. Land market liberalization via lifting land sales moratorium could promote competitiveness of Ukrainian agricultural producers by 19% of one standard deviation, while full market liberalization including the absence of land ownership fragmentation and capital availability could triple the cost competitiveness increasing it by 190% as a result of agricultural prices growth in 2 and 10 times respectively, as outlined in Nivievskyi and Nizalov (2016).

When land (rental payments) as a production factor contributes positively to the cost competitiveness of agricultural producers creating stimuli for the efficient resource use, labor input affects the cost competitiveness with negative 29.6% contribution to one standard deviation of competitiveness. Hence, low labor costs that are conventionally perceived as an advantage for business activity in Ukraine, indeed contribute to the current level of competitiveness of agricultural producers. However, considering at mean productivity, the effect reverses and cumulatively accounts for 12% of positive contribution to one standard deviation of cost competitiveness. Such an effect suggests that more productive firms' would suffer less from growing (real) wages of Ukrainian workers and would be more likely to preserve competitive global market position.

Government support shows rather ambivalent association with the cost competitiveness, suggesting a negative effect of the market price support along with direct discretionary subsidies, and no effect of the direct support in the form of tax benefits. The net effect of market price support is estimated at the negative 10.8% contribution to one standard deviation of cost competitiveness. Whereas market price support is usually a result of trade policy measures (e.g. tariffs, quotas, NTMs and bans), industrial policy is effectively implemented through direct support mechanism in the form of subsidies and tax benefits. According to empirical estimation, direct budgetary outlays contribute negative 4% to cost competitiveness, whereas tax benefits do not have any association with the agricultural competitiveness. Hence, conventional government support could be considered as rather ineffective instrument of competitiveness promotion.

However, the estimated models suggest the positive association between the infrastructure, which may be considered as a proxy for general services support, and the cost measure of competitiveness for all segments of the agricultural market, considering crop and livestock producers. One standard deviation of LPI on average contributes 6.3% to the cost competitiveness, showing the effectiveness of general services support in contrast to conventional measures, which are discussed above.

We also observe positive effect of pricing, which enters the model via two distinct variables, namely inflation, which additionally proxies domestic macroeconomic environment and accompanies domestic currency devaluation effect, and global commodity price index. The former contributes on average 5.7% to one standard deviation of crop competitiveness, while the latter 2.7%. However, the association of these variables and cost competitiveness differs for the market segments of crop and livestock producers. When the specialized crop producers are mostly exposed to the global commodity market movements, livestock producers' competitiveness has strong association with domestic price level.

Estimated model suggests statistically and economically significant scale effect, unveiling non-linear positive association between the cost competitiveness of Ukrainian agricultural producers and firms' size, expressed in average annual revenues. The derived optimal farms' size is 30.8 mln UAH in annual revenues which corresponds to 4088 ha of cultivated land, whereas for specialized crop producers the threshold is lower and estimated to be 22.2 mln UAH in average annual revenues. Such optimal size producers have distinguishing features of higher key crop yields per hectare of cultivated land, backed by stronger factor intensity and productivity, compared to the market average.

The results of this research could be useful for both areas – for policymakers on the one side and also for industry representatives. Policymakers should consider the estimated impact of policy instruments on the observed farms' competitiveness, considering the market price and direct support being non-efficient instruments of competitiveness promotion. Government should concentrate their efforts on promoting productivity growth, rather than providing financial support that distorts input and output prices. Apart from this, the land market design and land market environment should be considered as a key direction for future reforms. Lifting of the agricultural land moratorium could promote cost competitiveness growth through the channel of more efficient utilization of available resources. Producers alternatively should consider the improvements in productivity (efficiency) as a key priority. Higher efficiency (productivity) would decrease the negative effect of wage growth in Ukraine and promote competitiveness under the conditions of land market liberalization.

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