Holding Affiliation Effects on Performance and Growth: Analysis of Ukrainian Farms

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Abstract:

This paper aims to investigate productivity and profitability growth in the context of changing farm structure in Ukraine. We address the question of how different farm types, concretely holding enterprises and non-holdings have comparatively performed on the background of their different business strategies. We found that there are no significant differences in terms of productivity between them. Additionally, these results reveal that further research should include corporate level analysis of holdings in order to capture the effects of diversification, since internal management practices, peculiarities of organizational and governance structures as well as inter-subsidiary relationships may tangle the analysis of affiliation effects.

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This paper aims to investigate productivity and profitability growth in the context of changing farm structure in Ukraine. We address the question of how different farm types, concretely holding enterprises and non-holdings have comparatively performed on the background of their different business strategies. We found that there are no significant differences in terms of productivity between them. Additionally, these results reveal that further research should include corporate level analysis of holdings in order to capture the effects of diversification, since internal management practices, peculiarities of organizational and governance structures as well as inter-subsidiary relationships may tangle the analysis of affiliation effects.

1. Introduction

Over the past decade, vertically and/or horizontally integrated large-scale agricultural enterprises have become important players in Ukrainian agriculture. Being referred to as new operators (Liefert et al., 2010), agroindustrial formations (Petrikov, 2005), giant enterprises (Hockmann, 2005), new agricultural operators (Rylko and Jolly, 2005), mega-farms (Swinnen, 2009), agroholdings present "collectives of several juridical entities where one is the mother enterprise and the others have to accept the mother's decisions" (Koester, 2005, p. 105).

Ukraine's institutional environment marked by ongoing privatization and liberalization processes, , supply chain imperfections (Gagalyuk, 2012), significant reduction of subsidization (Liefert et al., 2010), "market failures related to availability of infrastructure, technology, and property rights" (Deininger & Byerlee, 2012, p. 712), limited access to funds (Balmann et al., 2013), politically supported enlargement of businesses (Swinnen, 2009) as well as farm management desire to exploit economies of size have been particularly conducive to the

development of large holding companies. Already at the end of 2013, these holdings[1] farmed more than 6 million hectares equivalent to some 27 percent of the total land farmed by agricultural enterprises. For the period of 2007-2013, total land operated by holdings increased by more than 3.5 times, while the largest representative of this group of enterprises operated 532 thousand hectares of farmland in 2013.

Whereas traditional, Western models of firm growth differentiate between organic and acquisitive types of growth (e.g. Davidsson & Delmar, 1997; Penrose, 1995; Yip, 1982), farm acquisitions present an ostensibly preferable growth mode for Ukrainian agroholdings. There are a few policy related reasons behind this choice of the growth mode. First, land as a key production asset was redistributed between former members of collective enterprises in early 2000s. Together with the moratorium on sale of agricultural land that was put into effect in the same period, this step made lease the only way for businesses to access farmland. Second, small size of land plots owned by former members of collective enterprises, i.e. 3.5 ha on average (Csaki & Lerman, 1997), made it particularly difficult for smaller types of production organization to assume the transaction costs related to land lease and operation. In addition, due to high potential to exploit economies of size, holdings enjoyed better access to finance than the other farm types and invested in modern technologies and infrastructure (Rylko & Jolly, 2005). These investments significantly contributed to yield increases in crop and livestock productions. Growth and investments were financed through loans from local and international banks, issue of bonds, listings on international markets and partly through private equity funds investments (Balmann et al., 2013).

Less constrained access to capital allowed agroholdings to respond to growing global demand for food, feed and fiber, thus capitalizing on booming agricultural prices. Further competition for growth opportunities resulted in higher rental prices for land and higher asset prices. Therefore, unsurprisingly, evidence of yield increases in holdings was accompanied by significant increases in production cost (UCAB, 2013). In addition, had there been no adjustment cost (Penrose, 1959) inherent in the agroholdings' growth process, they would presumably grow at an even higher rate. Altogether growing acquisition and adjustment costs may be subsumed as those bearing the major responsibility for productivity deficits. However, this issue remains largely unexplored as

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[1] Hereinafter we use the term "holding" describing a whole holding company, "holding enterprise" – a separate business unit (subsidiary) of a holding company, "non-holding" – an independent enterprise that do not belong to any holding structure, and "agricultural enterprises" – both holding and non-holding companies.

it is particularly unknown how agroholdings adjust to their own growth and whether they demonstrate lower productivity and profitability rates than those of other farm types. Detailed comparisons of productivity and profitability patterns of different modes of production organization would thus generate valuable insights into the drivers of growth from the perspective of different growth strategies, i.e. organic and acquisitive growth.

This paper aims to elaborate on the concerned comparisons by investigating farm productivity and profitability developments in the context of changing farm structure in Ukraine. We specifically intend to answer the following question: Do different growth strategies of farms affect their productivity and profitability? We use the 2010-2013 farm-level accounting data of agricultural enterprises provided by State Statistics Service of Ukraine, and apply treatment effect analysis by means of direct-covariate matching approach to carry out this empirical enquiry.

2. Role of agroholdings in Ukrainian agriculture

Holdings in agriculture are a relatively new and underexplored type of organization. In Ukraine, agroholdings became widespread starting from early 2000s. Their expansion can be generally divided into two stages (UCAB, 2013). The first stage lasted from 2005 to 2010 and was characterized by a rapid and sometimes aggressive accumulation of farmland and raising of outside capital. During this period, the land operated by holdings increased by approximately four times and amounted to four million hectares in total. The share of total agricultural land that was in use of these enterprises grew up to 18.1%. In addition, Ukrainian agricultural companies were able to raise about USD 1.4 billion through initial public offerings on international stock exchanges. Agroholdings such as MHP and Kernel raised the most – USD 368 million and USD 220 million, respectively (PwC, 2013).

The second stage that started in 2011 and is still lasting today is marked by greater attention of agroholdings to operation optimization. Access to funds facilitates investments in modernization and efficiency increases. This period is still characterized by stable increases of the farmland in hands of holdings (more than 25% of average annual increase till 2013, see Figure 1), but unlike in the previous period, holdings are much more selective with regard to land plots that they consolidate under own umbrella.
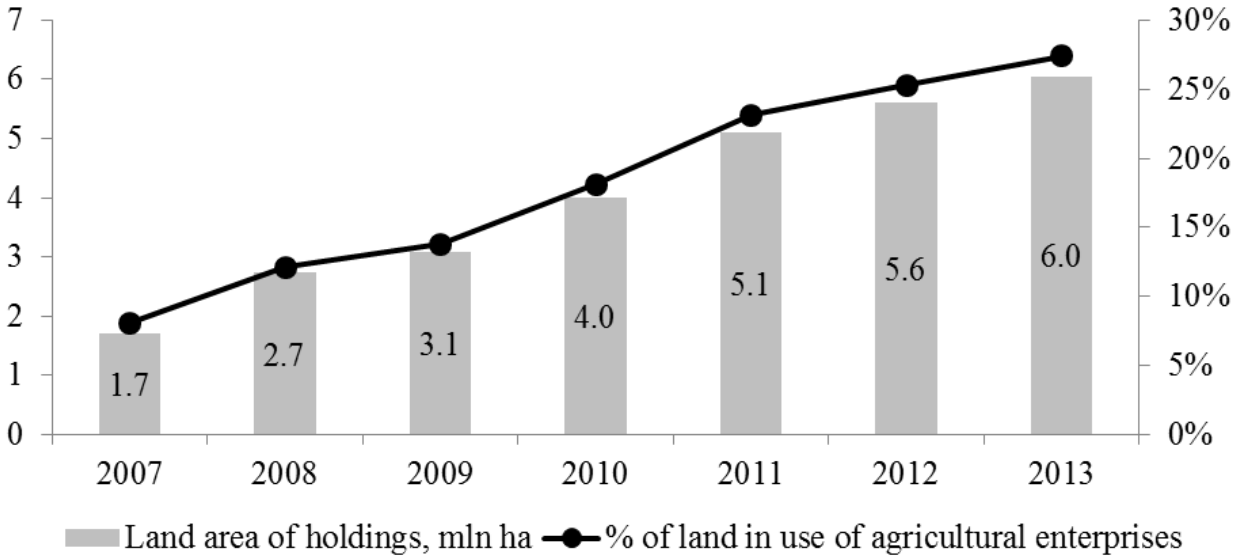
Figure 1. Land farmed by agricultural holdings in Ukraine

Source: UCAB (2015)

Holdings' share in total agricultural production is also growing. In 2014, they produced 20% of all crop products (vs. 19% in 2013) and 28% of animal products (vs. 25% in 2013) (see Figure 2).
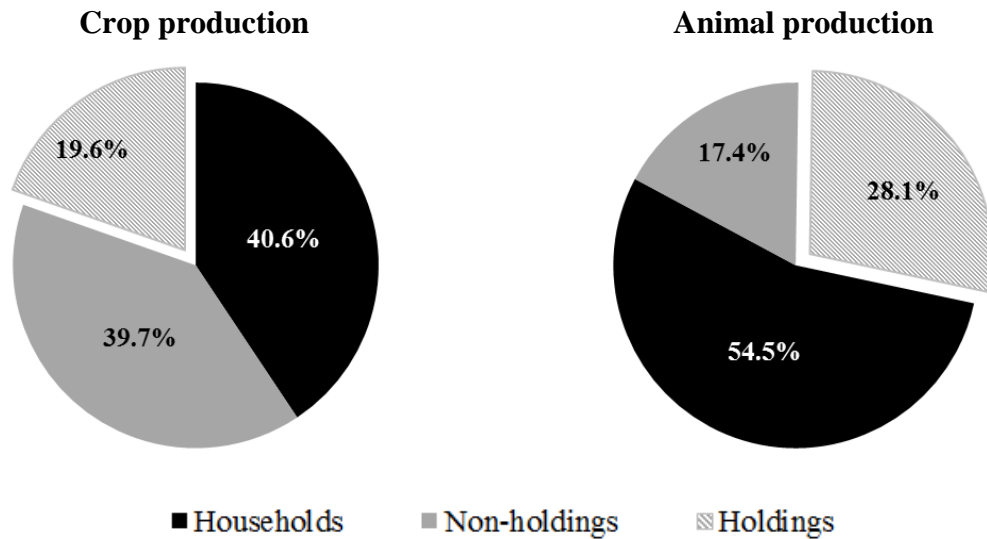
Figure 2. Shares of holdings in agricultural production, 2014

Source: UCAB (2015)

Figure 3 illustrates yield developments in all types of corporate farms in Ukraine. The selection of crops, presented here, is dictated by their share in total production, which is equal to 89% of total crop production and 72% of total agricultural production by corporate farms (SSSU, 2015).
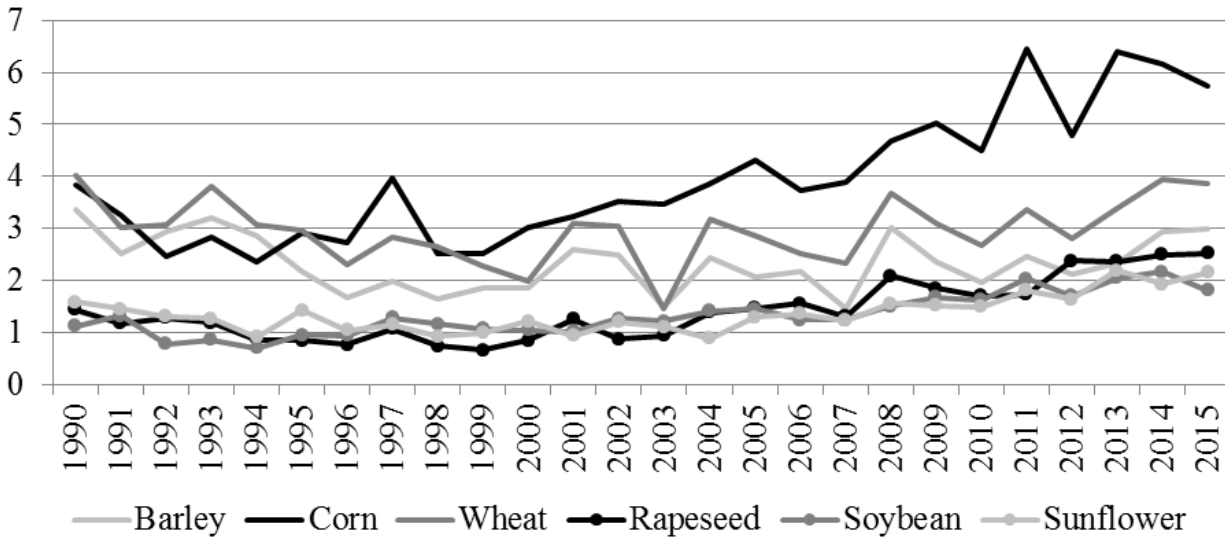
Figure 3. Yield of main crops in Ukraine, metric tons per hectare

Source: USDA

3. Data and Methods

The data used in this analysis is provided by the State Statistics Service of Ukraine and the Ukrainian Agribusiness Club (UCAB). It consists of ca. 37 thousand observations (farm-level accounting data) for the years 2010-2013 and contains information on affiliation of agricultural enterprises to holding structures. Thus, holding enterprises represent 9% of the total number of observations in the dataset.

To estimate the effect of holding membership (treatment) or, in other words, the effect of the change in the governance system from a non-holding farm to a holding enterprise, we employ matching procedure that originates from works of Rubin (1977) and Rosenbaum and Rubin (1983). It permits to estimate differences in endogenous (outcome) variables between treated and non-treated enterprises by matching them on observable (structural) variables (covariates).

In our study, treated enterprises are enterprises belonging to holdings, while non-holdings represent the group of controls. The outcome variables are various performance and structural adjustment measures (their descriptive statistics is presented in Appendix A). The differences in the outcome variables can be interpreted as unbiased treatment effect estimates, as this method is considered efficient in averting several key sources of bias, such as selection bias and simultaneity bias. As the method performs matching in a non-parametric or semi-parametric

mode, it requires fewer functional forms assumption and thus suffers less from potential functional form misspecification than parametric regression-based approaches (e.g., Imbens and Wooldrige, 2009).

From among the two main matching approaches – (i) propensity-score matching using estimated balancing scores and (ii) direct-covariate matching (DCM), we have chosen DCM, concretely nearest neighbor matching[2], for our analysis. This approach matches treated and control farms directly by selected covariates, which has the advantage of not needing parametric specification of the relationship between the treatment (holding membership) and outcome variables. It is characterized as the most straightforward matching approach (Sekhon, 2009) as an exact balance of covariates with little efficiency loss is possible and simple mean differences are used as impact indicators (Ho et al., 2007). Attractive property of this estimation procedure is also that it allows for arbitrary heterogeneity of the treatment effects (Lechner, 2002), their simple stratification for various farm groups (Kirchweger and Kantelhardt, 2015), and thus testing of more group-specific (interaction) hypotheses. However, to perform well, this method requires large number of observations and structural covariates with sufficient variance in both treatment and control enterprise groups used for observation pairing (for the list of selected covariates and their main statistics, see Appendix B). Our database satisfies both prerequisites and provides us with confidence regarding the appropriateness of this approach for our analysis.

We estimated the average treatment effects (ATE) in Stata statistical software using teffects nnmatch command. ATE is calculated as an average difference of observed and potential outcomes of the nearest neighbors. In simple words, we calculate the average difference in the outcome variables of the holding and non-holding enterprises with similar structural characteristics. These "neighbors" are determined with covariates' weighted function, calculated for each individual (StataCorp., 2015). For more details on the chosen methodological approach see, for example, Abadie and Imbens (2006, 2011) and Imbens and Wooldrige (2009).

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[2] This matching algorithm pairs each holding subsidiary farm with independent farms that show the smallest distance with regard to the selected matching covariates (nearest neighbours). The choice of the number of nearest neighbours is arbitrary; we follow the general recommendation of four. There are numerous alternative matching algorithms such as radius matching, calliper matching, or radius matching, but no clear guidance is provided in the literature on which approach is superior given data specifics or research objectives.

4. Results

We present and discuss the results of treatment effect analysis of Ukrainian holding enterprises and non-holdings with similar structural characteristics in 2010-2013. We first interpret total factor productivity (TFP) results and continue by describing the differences between treated and control groups.

As shown in Figure 4, average TFP changes demonstrate multidirectional dynamics for all production lines and organizational forms, but while cumulative change remains positive in crop production, it is negative in milk production.
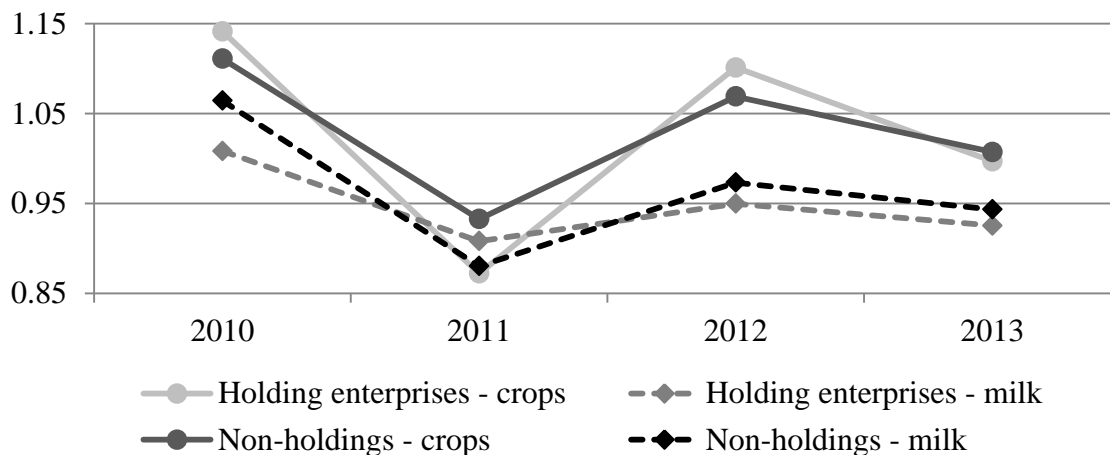
Figure 4. TFP change in Ukrainian agricultural enterprises

Source: own calculations

To scrutinize whether there are significant differences between holding enterprises and non-holdings, we further apply treatment effect analysis that compares companies with similar structural characteristics and avoids sample selection bias. The coefficients, presented in the tables below, show the degree of dependent variables change between holding enterprises and non-holdings during 2010-2013.

We find no significant differences in TFP change between holding enterprises and non-holdings, both in crop and animal production (see Table 1). However, additional specification of the model that allows capturing shares of animal production (AP) and milk production (MP) results in significant outcomes. For example, TFP change in crop production (CP) in holding enterprises, which at least have a small share of AP, is lower than in non-holdings. In contrast, holding membership results in an increase of TFP of MP by 0.097 between 2010 and 2013 among the enterprises with the share of MP in total production (TP) greater than 10%. Considering that the

enterprises with the share of MP lower than 10% had on average negative or very low profitability during the analyzed period (min: -13.1% in 2012; max: 1% in 2010; mean: -3.3%), while the enterprises with higher share of milk in production structure achieved comparatively higher profit rate (min: 3.4% in 2012; max: 19% in 2011; mean: 14.0%), we suggest that the enterprises with a low share of MP do not consider developing this production line in the future and, therefore considerably underinvest in it. This statement is supported by lower average depreciation (241 UAH vs. 344 UAH), material costs (2706 UAH vs. 3936 UAH) per head and, as a consequence, lower yields (2.9 t/head/year vs. 4.2 t/head/year) in the enterprises with a small share of MP.

Table 1. Treatment effect analysis of TFP change in holding enterprises and non-holdings in Ukraine

№	Dependent variable	Target population	Number of observations	Coefficient	P>|z|
1	TFP change in CP	All enterprises	1093	-0.020	0.608
2	TFP change in CP	Enterprises with share of AP in TP > 0%	699	-0.111	0.047
3	TFP change in MP*	All enterprises	464	0.076	0.199
4	TFP change in MP*	Enterprises with share of MP in TP >10%	378	0.097	0.067

Source: Own calculations

* without exact matches on regions

We further analyze financial performance of agricultural enterprises. According to our results (Table 2), holding enterprises achieved lower profitability in crop production than non-holdings with similar structural characteristics. This may be influenced by higher intensity of production in holdings together with a sharp decrease of crop prices in 2013. Interestingly, holding enterprises with at least some small share of AP in the structure of their production have much lower profitability difference in CP (-0.063 vs. -0.196) comparing to non-holdings. Moreover, non-holdings outperform holdings even more with the increase of CP share in total production. In animal production, holding enterprises outperform independent ones with regard to these variables. Greater specialization in AP as well as in MP decreases the difference in profitability of AP between holding and independent companies. This suggests that enterprises with diversified production achieve higher profit rates using own-produced raw materials (e.g. feedstuffs).

Table 2. Treatment effect analysis of financial performance in holding enterprises and non-holdings in Ukraine

№	Dependent variable	Target population	Number of observations	Coefficient	P>|z|
5	Profitability of CP*	All enterprises	5787	-0.125	0.000
6	Profitability of CP*	Enterprises with 100% CP	2940	-0.196	0.000
7	Profitability of CP*	Enterprises with share of CP <100%	2847	-0.063	0.040
8	Profitability of AP	All enterprises	1676	0.066	0.073
9	Profitability of AP	Enterprises with share of AP <50%	1197	0.080	0.038

Source: own calculations

* without exact matches on regions

Several studies that focus on firm growth measurement (e.g. Davidsson et al. 2006, Flamholtz & Randle, 2007) consider sales, employment and assets as growth indicators. Agriculture, considering its peculiarities, makes some changes to the rules, applicable to other branches of economy. For example, mechanization of agricultural production leads to a substitution of labor by machinery. This trend is applicable to our data as well, so we cannot consider employment as a reliable growth indicator. Some studies measure farm size using land (e.g. Weiss, 1999; Monke, Avillez & Ferro, 1992; Yamauchi, 2016), while others treat it as "certainly an inadequate indicator of farm size" (Koester, 2005, p.103), since land use intensities deviate substantially depending on the production line. Moving further, Flamholtz & Randle (2007) argued that it is better to consider sales, because it is a fast-responding indicator. For example, managers respond on sales growth by acquiring more labor and technologies.

Since our method does not limit us in number of outcome variables, we are presenting results both for sales (total, crop and animal production) and land. However, data constraints do not allow analyzing assets. Nevertheless, holding enterprises show higher growth rates than non-holdings in absolute terms using different growth representations (see Table 3).

Table 3. Treatment effect analysis of growth indicators in holding enterprises and non-holdings in Ukraine

№	Dependent variable	Target population	Number of observations	Coefficient	P>|z|
10	Total production value – absolute growth	All enterprises	2544	4135.567	0.000
11	Total production value – relative growth	All enterprises	2544	0.385	0.000
12	Crop production value – absolute growth*	All enterprises	5227	2583.041	0.000
13	Crop production value - relative growth*	All enterprises	5227	0.412	0.007
14	Animal production value – absolute growth	All enterprises	2539	1139.033	0.004
15	Animal production value – relative growth	All enterprises	2539	-0.792	0.228
16	Arable land – absolute growth*	All enterprises	5822	223.080	0.015
17	Arable land – absolute growth*	Enterprises with arable land >= 2091 ha[3]	2114	227.768	0.022
18	Arable land – relative growth*	All enterprises	5822	0.065	0.169
19	Arable land – relative growth*	Enterprises with arable land >= 2091 ha	2114	0.048	0.020

Source: own calculations

* without exact matches on regions

In 2007-2013, holdings demonstrated rapid expansion. Total land in operation of these enterprises increased from 1.7 million hectares in 2007 to 6.04 million hectares in 2013 (UCAB, 2015). At the same time, holdings have paid considerably higher land rents − 14% more than an average payment in 2013. Our results do not indicate significant difference in relative growth of rent payment over the analyzed period between holding enterprises and non-holdings (see Table 4), while absolute growth in holding enterprises was on average by 0.095 thousands UAH higher (ca. 29% of average land rent payment in 2010). At the same time, holding enterprises that are not purely specialized in crop production paid 25% higher land rents than non-holdings in 2013. Significantly higher growth of material costs in CP by holding enterprises, both in absolute and relative terms, demonstrates their orientation toward intensive use of inputs (see Table 4). At the

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[3] Median value of arable land per company in 2010

same time, enterprises that combine both CP and AP have even larger difference in material costs than pure CP concentrated enterprises. Noteworthy, holding enterprises with profitability of CP lower than 0% tend to have higher intensity than non-holdings. On the other hand, their profitable counterparts have lower intensity difference..

Total labor costs in CP in holding enterprises tend to increase more than in non-holdings, while in AP differences are insignificant. This is a sign of higher competition (for skilled labor) in CP. Depreciation figures demonstrate lower relative growth in holding enterprises than in non-holdings in CP. Although this may imply that non-holdings invest more in capital assets. However, another observation shows that holding enterprises grow significantly in use of third-party services (especially in CP). Thus, holding enterprises may optimize the use of capital assets across different business units of a holding whereas the assets themselves may be on the balance sheet of a mother company. Another reason why third-party services are so popular among holding enterprises is that they have better access to machinery leasing. In this case, accounting data of holding enterprises does not reflect depreciation of the assets that are leased.

Table 4. Treatment effect analysis of costs growth in holding enterprises and non-holdings in Ukraine

№	Dependent variable	Target population	Number of observations	Coefficient	P>|z|
20	Land rent per ha – absolute growth*	All enterprises	3044	0.095	0.000
21	Land rent per ha – relative growth*	All enterprises	3044	-0.240	0.527
22	Material costs in CP – absolute growth*	All enterprises	5822	2587.160	0.000
23	Material costs in CP – absolute growth*	Enterprises with share of CP – 100%	2948	2523.586	0.001
24	Material costs in CP – absolute growth*	Enterprises with share of CP < 100%	2874	3269.877	0.000
25	Material costs in CP – relative growth*	All enterprises	5822	1.240	0.005
26	Material costs in CP per ha– absolute growth*	Enterprises with profitability of CP <= 0%	470	0.575	0.000
27	Material costs in CP per ha– absolute growth*	Enterprises with profitability of CP > 0%	2398	0.284	0.000
28	Labor costs in CP – absolute growth	All enterprises	3138	198.808	0.016

№	Dependent variable	Target population	Number of observations	Coefficient	P>|z|
29	Labor costs in AP – absolute growth	All enterprises	3138	-25.821	0.686
30	Depreciation in CP – absolute growth	All enterprises	3420	99.785	0.077
31	Depreciation in CP – relative growth	All enterprises	3126	-1.186	0.016
32	Depreciation in AP – absolute growth	All enterprises	3420	-1.687	0.957
33	Depreciation in AP – relative growth	All enterprises	2741	-0.601	0.185
34	Third-party services in CP – absolute growth	All enterprises	3138	853.081	0.000
35	Third-party services in CP – relative growth	All enterprises	2902	6.739	0.006
36	Third-party services in AP – absolute growth	All enterprises	3138	-13.997	0.774
37	Third-party services in AP – relative growth	All enterprises	2128	0.751	0.506

Source: own calculations

* without exact matches on regions

Analysis of production structure shows that holding enterprises tend to increase their specialization in the so-called "cash" crops (i.e. wheat, barley, corn, sunflower, soybeans, and rapeseeds). Thus, we observe higher rate of decrease in production of niche crops, especially in enterprises with smaller land area. Additionally, holding enterprises decrease their shares of animal and milk production. These changes show that holding become more targeted towards export-oriented crops that means lowering the dependence of farming results on possible negative effects of country specific economic conditions (e.g. exchange rate fluctuations, inflation, lowering of purchasing power on domestic market).

Table 5. Treatment effect analysis of production structure in holding enterprises and non-holdings in Ukraine

№	Dependent variable	Target population	Number of observations	Coefficient	P>|z|
38	Share of niche crops in CP	All enterprises	3372	-0.088	0.000
39	Share of niche crops in CP	Enterprises with arable land >= 2091 ha	1451	-0.050	0.000
40	Share of niche crops in CP*	Enterprises with arable land < 2091 ha	1921	-0.120	0.000
41	Share of AP in TP	All enterprises	3362	-0.057	0.000
42	Share of MP in TP	All enterprises	3362	-0.029	0.002

Source: own calculations

* without exact matches on regions

5. Discussion and conclusions

Treatment effects analyses for the sample of Ukrainian agricultural enterprises demonstrate that there are no significant differences in terms of productivity between holding enterprises and non-holdings. As long as prices for products are substantially higher than production costs such as it was the case in 2011 and 2012, a high yield strategy may pay off. However, in periods with low prices, as in 2013 and in years with low yields, high intensities have less potential to pay off. Nevertheless, our results essentially demonstrate that, apart from the business level, analyses of agricultural holdings' performance have to take place also at the corporate level. One reason for this is that corporate-level assessments may help to understand how holdings' business diversity helps to allocate input costs in the course of growth. As our results show, diversified production portfolio that includes animal production may compensate for the effects of price shocks in crop production on the one hand. On the other hand, holdings' animal production may be a factor of their lower productivity growth in crop production. Because feedstuffs account for a major share in animal production cost (UCAB, 2013), holdings that have animal production in their structure may aim at self-sufficiency in producing feedstuffs and, as our results are signaling, the related make-or-buy decision may be often inappropriate. Additionally, vertically integrated sugar-manufacturing or oil-crushing holdings may procure raw materials from their subsidiary farms at lower prices. This results in lower productivity and profitability figures at the farm level.

Another reason why the analysts' focus should be directed toward corporate level is that the debt capital that is considered to significantly affect holdings' productivity and profitability (Zinych

and Odening, 2009), is normally generated at the corporate level. This enables improved access to capital given enormous size of the whole holding structure and, therefore, corporate financial performance is of highest priority for holdings.

A further reason why our analysis calls for more attention toward holdings' corporate structures is that their rapid expansion strategies are associated with high acquisition costs of additional land or whole farms. Newly acquired farms may require high adjustment costs and initially demonstrate lower productivity levels than the farms that have been acquired before. Indeed, lower profitability growth in crop production may be due to low technical efficiency of holdings. Even if the difference from non-holdings is not high, the generally low level of technical efficiency is a problem. On average, holding farms are 30% less efficient than the most productive enterprises. Such a low efficiency score is particularly critical for farms operating with high intensities.

However, high intensity has not per se a negative impact. Rather high intensities improve productivity as long as these go along with the use of best technologies and know-how. Negative impacts on productivity can be interpreted in the way that enterprises, which have grown recently due to acquisitions of land or whole enterprises, first need to invest and implement effective management practices. Moreover, in the context of the whole sample, we found that being member of a holding had no specific negative effect, either in crop production or in milk production. Accordingly, deficits of holding enterprises are likely to result from specific adjustment costs. Holding enterprises in crop production are not less profitable per se. Rather, they are less profitable if they operate with high intensities, high land costs and high labor costs. This again implies that growth is related to adjustment costs.

Our findings are particularly important if discussed in the context of research on strategic management. One of the distinctive features of strategy research is an underlying interest in the performance of the firm as opposed to other fields where economic performance is a key issue, e.g. (agricultural) economics and industrial organization.

Our results seem to be of importance for policy makers as well. The fact is that, at the current level of intensity in holdings, one of the possible growth opportunities for them is further expansion in farmland, their large size notwithstanding. On the one hand, this raises concerns with respect to the future of other farms, in particular small non-holdings. On the other hand, if opportunities of extensive growth for agricultural holdings are limited, further productivity

improvements in this type of producers will be possible through adjustments based on opportunity cost of production factors, primarily labor.

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Appendix A. Descriptive statistics of used dependent variables

Dependent variables	Non-holdings			Holding enterprises		
	obs.number	mean	st.dev.	obs.number	mean	st.dev.
TFP change						
TFP change in CP	4256	1.030	0.270	428	1.028	0.319
TFP change in MP	1912	0.965	0.228	244	0.948	0.278
Financial performance						
Profitability of CP	7774	0.175	0.463	741	0.035	0.326
Profitability of AP	3418	-0.120	0.392	350	-0.011	0.526
Growth indicators						
Total production value – absolute growth	6680	1892.122	7297.409	751	13870.300	71510.510
Total production value – relative growth	6645	1.921	11.400	741	3.555	16.506
Crop production value – absolute growth	6680	1565.986	5574.247	751	8826.898	33890.030
Crop production value - relative growth	6468	1.986	9.061	690	4.085	17.641
Animal production value – absolute growth	6680	326.227	4344.747	751	5043.399	62621.900
Animal production value – relative growth	3302	1.803	29.060	392	1.600	7.148
Arable land – absolute growth	6680	0.746	1030.574	751	352.786	6112.124
Arable land – relative growth	6530	1.170	3.519	732	1.235	1.994
Costs growth indicators						
Land rent per ha – absolute growth	5693	0.362	2.193	634	0.361	1.458
Land rent per ha – relative growth	5693	2.980	14.850	634	3.620	17.034
Material costs in CP – absolute growth	6680	2305.741	5748.782	751	11504.420	29133.800
Material costs in CP – relative growth	6543	3.091	19.486	714	4.163	15.074
Material costs in CP per ha– absolute growth	6436	1.806	34.630	721	0.648	8.772
Material costs in CP	6384	2.330	7.566	696	3.058	10.886

Dependent variables	Non-holdings			Holding enterprises		
	obs.number	mean	st.dev.	obs.number	mean	st.dev.
per ha– relative growth						
Material costs in MP per head– absolute growth	1510	0.660	17.397	180	1.447	2.010
Material costs in MP per head– relative growth	1510	1.639	1.732	180	1.627	0.981
Labor costs in CP - absolute growth	6680	202.341	605.782	751	857.818	3017.007
Labor costs in AP - absolute growth	6680	58.360	412.583	751	470.435	2835.584
Depreciation in CP – absolute growth	6680	121.278	736.877	751	492.024	3188.812
Depreciation in CP – relative growth	5825	4.118	39.039	621	4.841	44.317
Depreciation in AP – absolute growth	6680	10.962	244.830	751	257.330	3936.479
Depreciation in AP – relative growth	2695	2.725	12.835	342	5.565	36.981
Third-party services in CP – absolute growth	6680	308.395	1624.580	751	1827.683	7280.538
Third-party services in CP – relative growth	5862	6.863	63.783	697	10.056	57.171
Third-party services in AP – absolute growth	6680	18.248	312.037	751	113.483	5881.517
Third-party services in AP – relative growth	2290	4.177	22.908	320	6.886	25.126
Production structures						
Share of niche crops in CP	8290	0.135	0.260	799	0.076	0.186
Share of AP in TP	8151	0.147	0.276	793	0.183	0.322
Share of MP in TP	8151	0.054	0.150	793	0.052	0.124

Appendix B. Descriptive statistics of used independent variables

Independent variables	Non-holdings			Holding enterprises		
	obs.number	mean	st.dev.	obs.number	mean	st.dev.
Variables representing size of companies						
AP value 2010	8307	1256.326	7167.110	871	16897.520	97081.160
Arable land 2010	8307	1539.368	1889.019	871	5334.730	11386.640
Arable land growth 2010-2013	6680	0.746	1030.574	751	352.786	6112.124
CP value 2010	8307	3672.998	6585.493	871	16269.990	39436.640
Grains harvested area 2010	7597	861.458	1028.592	787	3162.081	8282.373
Herd size 2010	11823	34.328	123.259	931	136.134	519.000
Labor in AP 2010	8307	13.935	34.388	871	64.476	207.438
Labor in CP 2010	8307	31.125	46.745	871	100.668	254.428
Labor total 2010	8307	45.059	65.210	871	165.145	388.441
Revenues from services 2010	8307	138.321	1044.809	871	760.221	3254.167
Total land area 2010	8307	1637.079	1961.545	871	5571.928	11890.620
TP value 2010	8307	4929.666	10223.420	871	33167.600	105527.300
Structural variables						
Share of AP in TP 2010	8179	0.178	0.288	860	0.216	0.326
Share of CP in TP 2010	8179	0.822	0.288	860	0.784	0.326
Share of harvested area in total area 2010	7787	24.640	692.308	810	0.926	4.237
Share of MP in AP 2010	4036	0.303	0.345	452	0.342	0.340
Share of MP in TP 2010	8179	0.052	0.120	860	0.053	0.053
Share of niche crops in CP value 2010	8307	0.194	0.296	871	0.175	0.284
Costs						
Depreciation in AP 2010	8307	51.680	322.370	871	625.753	3498.081
Depreciation in CP 2010	8307	263.501	654.009	871	918.347	2109.671
Labor costs per employee 2010	7910	11.283	8.469	809	12.994	11.086
Labor costs total 2010	8307	375.691	795.643	871	1374.542	3691.768
Land rent per ha 2010	7071	0.306	0.436	771	0.404	1.286
Material costs and depreciation in AP per employee in AP 2010	4116	69.535	124.683	450	121.921	203.685
Material costs and	7845	138.202	324.370	805	375.218	2469.952

Independent variables	Non-holdings			Holding enterprises		
	obs.number	mean	st.dev.	obs.number	mean	st.dev.
depreciation in CP per employee in CP 2010						
Material costs and depreciation in CP per hectare 2010	7847	7.162	92.367	820	2.790	13.385
Material costs in CP 2010	8307	2595.423	4760.389	871	13269.790	31536.750
Material costs in MP 2011	8307	241.737	925.592	871	914.227	3664.349
Mineral fertilizers costs 2010	6715	719.092	1389.206	751	4316.111	10558.480
Service costs in CP per ha 2010	6903	0.441	2.691	790	0.659	1.170
Share of services in material costs and depreciation in CP 2010	7968	0.179	0.184	830	0.272	0.206
Financial performance						
Profit in AP 2010	8307	-48.387	1053.183	871	2039.648	32685.490
Profitability in AP 2010	4083	-0.111	0.799	458	-0.023	0.512
Profitability in CP 2010	7892	0.308	0.524	809	0.186	0.513
Productivity						
AP value per employee in AP 2010	4000	87.847	166.253	446	174.748	279.587
Arable land per employee in CP 2010	7756	93.586	146.648	801	154.132	454.565
CP value per employee in CP 2010	7720	255.823	546.291	784	526.761	2747.749
CP value per material costs and depreciation in CP 2010	7813	2.160	2.078	803	1.937	1.403
Crop yield 2010	7715	13.195	168.853	795	4.525	11.103
Labor in CP per CP value 2010	8307	0.021	0.091	871	0.011	0.032
Milk yield 2010	2143	37.231	183.064	260	38.050	17.715
State support (VAT reimbursement and subsidies)						
Share of subsidies in TP value 2010	8179	0.015	0.164	860	0.013	0.103
Share of subsidies in TP value 2011	8356	0.025	1.476	900	0.003	0.027
Share of subsidies in TP value 2012	8145	0.011	0.373	847	0.001	0.007
Share of subsidies in TP value 2013	8151	0.004	0.106	793	0.002	0.014

Independent variables	Non-holdings			Holding enterprises		
	obs.number	mean	st.dev.	obs.number	mean	st.dev.
Share of VAT reimbursed in CP value 2010	8307	453.940	36578.910	871	0.019	0.056
Share of VAT reimbursed in CP value 2011	8567	550.307	50932.750	925	16079.270	489031.000
Share of VAT reimbursed in CP value 2012	8299	1353.022	110533.900	852	0.044	0.106
Share of VAT reimbursed in CP value 2013	8290	3636.244	200239.600	799	0.032	0.070
Share of VAT reimbursement in AP value 2010	4036	0.050	0.149	452	0.057	0.085
Share of VAT reimbursement in AP value 2011	3915	0.049	2.240	432	0.013	0.042
Share of VAT reimbursement in AP value 2012	3596	0.036	0.591	384	0.030	0.065
Share of VAT reimbursement in AP value 2013	3377	0.069	1.540	344	0.031	0.062
Subsidies 2010	8307	71.300	792.888	871	757.698	6976.088
Subsidies 2011	8567	58.787	1009.365	925	234.233	2412.309
Subsidies 2012	8299	74.297	2560.451	852	80.796	444.034
Subsidies 2013	8290	26.852	249.863	799	151.695	1697.204
Subsidies in AP 2010	8307	12.836	131.034	871	181.730	2607.828
Subsidies in AP 2011	8567	9.318	396.538	925	51.944	1031.806
Subsidies in AP 2012	8299	45.519	2486.812	852	57.757	379.097
Subsidies in AP 2013	8290	15.600	135.230	799	116.792	1604.091
Subsidies in CP 2010	8307	37.482	720.915	871	135.206	690.626
Subsidies in CP 2011	8567	24.230	735.781	925	5.545	82.928
Subsidies in CP 2012	8299	17.922	529.877	852	9.642	109.681
Subsidies in CP 2013	8290	5.406	140.168	799	5.871	92.571

Independent variables	Non-holdings			Holding enterprises		
	obs.number	mean	st.dev.	obs.number	mean	st.dev.
VAT reimbursement 2010	8307	243.398	793.870	871	1268.821	7099.076
VAT reimbursement 2011	8567	246.894	850.120	925	1340.203	5832.907
VAT reimbursement 2012	8299	466.096	3624.423	852	2235.249	10457.990
VAT reimbursement 2013	8290	541.862	7174.897	799	2435.227	10317.170
VAT reimbursement in AP 2010	4036	0.050	0.149	452	0.057	0.085
VAT reimbursement in AP 2011	3915	0.049	2.240	432	0.013	0.042
VAT reimbursement in AP 2012	2596	0.036	0.591	384	0.030	0.065
VAT reimbursement in AP 2013	3377	0.069	1.540	344	0.031	0.062
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VAT reimbursement in CP 2011	8567	550.307	50932.750	925	16079.270	489031.000
VAT reimbursement in CP 2012	8299	1353.022	110533.900	852	0.044	0.106
VAT reimbursement in CP 2013	8290	3636.244	200239.600	799	0.032	0.070