

# Firm Heterogeneity, Location and Export Performance Empirical Evidence from Ukrainian Firm-Level Data

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**Abstract** This paper studies export performance of Ukrainian firms using the unique micro-level dataset for the years 2005 and 2013. We estimate probit regressions for pooled dataset for all years as well as for specific years of our sample. In addition, we distinguish between manufacturing and service sectors. Our empirical results show the positive link between the export status and total factor productivity, competition in the industry, firm size, capital intensity, ownership status, and foreign sourcing (imports). Moreover, firms located in Western part of the country are found to be more export-oriented compared to firms located in other regions.

**Keywords** Export activity, productivity, regions, Ukraine.

**JEL Classification** F14, P33

## Introduction

After the collapse of the Soviet Union in 1991 Ukraine emerged as an independent country and followed its own way of economic transition from central planning to a market economy. According to the World Bank Ukraine is classified as the lower-middle-income economy with post-communist past related to region of Commonwealth of Independent States. This way was different from the path followed by Central and Eastern European (CEE) countries which radically liberalized their multilateral and regional trade and integrated successfully with the European Union (EU).

However, compared to the new EU member states the Ukrainian transition resulted in relatively poor economic performance. The scope of economic and trade liberalization was significantly lower and structural and social reforms were less radical. The transformation eventually ended up with the market economy status that Ukraine obtained prior to joining the WTO on May 16, 2008. Nevertheless, the current macroeconomic situation in Ukraine is still characterized by the instability, a low level of financial development and considerable financial risk. The growth prospects are also not optimistic as shown by the recent think-tank reports such as CASE and Vienna Institute of International Studies.<sup>1</sup>

<sup>1</sup> Both institutions produced negative economic forecast for the war-torn country since the start of world financial crisis in 2008 (<http://www.case-research.eu/en/node/58857> and <http://wiiw.ac.at/how-to->

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The change in the political leadership and declarations for deeper economic reforms and signing the free trade agreement with the EU create new opportunities and prospects for economic recovery. In particular, increased integration with the EU facilitates the access of firms from Ukraine to foreign markets. The main goal of this paper is to study empirically the determinants of export performance of Ukrainian firms to see whether they are similar to those of the firms from the EU member countries, especially those that joined the EU in three subsequent waves of the Eastern Enlargement.

Therefore, in this paper we study empirically the nexus between total factor productivity and export performance of Ukrainian firms, having controlled for other firm characteristics. In addition, we compare the export performance of firms in manufacturing and services sectors located in different regions of Ukraine.

The structure of this paper is as follows. The next section summarizes the relevant literature. Then, we describe Ukrainian trade patterns and policy changes. In the following section we present the empirical methodology. Subsequently, we discuss the properties of the dataset. Then we present our empirical results. In the final section we summarize and conclude.

## Literature review

The majority of previous studies for Ukraine evaluating the effects of trade liberalization were traditionally based on aggregate trade flows data and gravity models (Movchan et al., 2010; Shepotylo, 2009; Nasadiuk, 2012). More recently the attention in the empirical trade literature has switched from the country-level to the firm-level studies of the determinants of successful export performance. However, this kind of empirical evidence for Ukraine is still relatively scarce.

Up to now the literature on Ukrainian enterprises based on firm-level data focused on determinants of long-term productivity. For example, Pivovarsky (2003) analyzed the impact of ownership concentration on the firm performance in Ukraine. Earle et al. (2014), using the panel of 7000 manufacturing enterprises, demonstrated that political favoritism, in the context of weak institutions, can have substantial redistributive impact on economic productivity. Kostenko (2014) confirmed that innovation activity had a positive impact on labor productivity of Ukrainian firms. Yemelyanova (2014) analyzed the impact of ownership structure on the effectiveness of Ukrainian enterprises.

Most recently, Shepotylo and Vakhitov (2015) employed a large database of Ukrainian firms in 2001–07 to identify the effect of services liberalization on total factor productivity (TFP) of manufacturing firms. The results indicated that an increase in services liberalization was associated with an increase in TFP. The effect was stronger for firms with high productivity, bringing about a reallocation of resources within an industry. Industry-level results showed that the effect of reallocation on industry productivity was almost as strong as the within-firm effect. The dynamic interaction of services liberalization and TFP through the investment channel reinforced the effect of reallocation. In particular, it is more pronounced for domestic and small firms.

Kim et al. (2015) documented a variation across observed firms' characteristics, and the accompanying macroeconomic volatility, often related to political turmoil for Ukrainian manufacturing firms. They used an annual firm-level data for the period from 2001 to 2009 and employed functional principal component analysis. The overall improvements in firm productivity in Ukraine's manufacturing in 2001–2009 were found to vary substantially by industry, trade status and with firm turnover, while regional effects were less important. However, no attempts were made to study the relationship between productivity and export performance using Ukrainian firm level data. Following the latest strand in the trade literature that focuses [stabilise-the-economy-of-ukraine-n-83.html](http://www.stabilise-the-economy-of-ukraine-n-83.html).

on firm heterogeneity, this paper contributes to the literature by analyzing the determinants of export performance of Ukrainian firms concentrating on the role of TFP. In contrast to the international trade literature which assumed that firms are symmetric the recent studies stress the firm heterogeneity in terms of productivity and its effect on export performance. In particular, Melitz (2003) argued that exporting is positively related to firm productivity.

A large number of empirical studies based on firm-level data compiled for many countries confirm this prediction. The existing empirical evidence shows that only a small fraction of the most productive firms are responsible for the majority of exports and most firms do not export at all concentrating their activities on domestic markets only. In particular, the positive link between foreign sales and productivity for the Baltic, Caucasus and Visegrad countries was confirmed in the recent study Cieslik, Michałek and Michałek (2014). First, they estimated probit regressions for the pooled dataset that included all three groups of countries, and then they disaggregated the sample into particular country groups to study the differences and similarities between these groups of countries. Their estimation results obtained for the whole sample indicated that the probability of exporting increases with the higher level of productivity and the measures of human capital, including the share of university graduates in total employment and spending on R&D activities. Moreover, the internationalization of the firms, proxied by the use of foreign technology licenses and the foreign ownership, was found to be positively related to the probability of exporting. Finally, they found that firm size was also a significant variable for the probability of exporting. These results were similar to the results presented in the EFIGE (2010) report obtained for the firms from the large EU countries. The estimation results obtained separately for specific country groups revealed a similar pattern in the case of the Visegrad countries and the Baltic states, although a smaller number of explanatory variables were statistically significant. However, in the case of the Caucasus countries only two explanatory variables were statistically significant: the firm size and the R&D variable, while the link between the level of productivity and the probability of exporting was not statistically significant. Thus, the firm size was the only explanatory variable which was statistically significant in the case of all groups of countries. This confirmed the importance of economies of scale for exporting.

Our study is based on the unique Ukrainian micro-level dataset for the years 2005 and 2013. In our study following the theoretical predictions of the Melitz (2003) model we devote special attention to the role of firm productivity in determining its export performance. In contrast to other studies for the CEE countries based on labor productivity we use TFP as a measure of overall productivity calculated by the Levinsohn-Petrin method. We are also able to distinguish between manufacturing and service firms and control for region-specific effects. In addition, we study the role of other firm characteristics such as internationalization measured by foreign capital participation and imported inputs. Finally, we are able to control for firm size, capital-labor ratio, private ownership, and the level of market concentration in the industry.

## **Ukrainian macroeconomic and external trade context**

Since the beginning of the 1990s Ukraine has been pursuing policies to transform its economy into market-oriented and open one. The lost decade in terms of economic growth of the 1990s was followed by 8 years of economic recovery in the 2001-2008 period disrupted by the economic and financial crisis. The further recovery did not materialize because of the unfavorable business policies of the Yanukovich government, political instability and military conflict which followed in 2014-2015. In 2014 Ukraine's GNI per capita amounted to USD3650 which was one of the lowest indicators in Europe (World Bank, 2015). At the same time it had one of the highest shares of shadow economy and tax evasion (IMF, 2015). The expected rate of inflation (46%

in 2015) is a characteristic of the country and was never brought down to low levels during the period of transition (IMF, 2015). Nowadays Ukraine is a service-based economy, since the share of services in GDP amounts to 63%, 25% - manufacturing and 12% - agriculture (World Bank, 2015). Accumulated human capital and presence of high value added industries (like aircraft-building) provide an opportunity to achieve better economic results.

The opening of the economy was one of the major reforms in the country. The liberal export and import regime of the 1990s allowed foreign competition. Increased competition in the internal market swept off many food, textile, durables and heavy industry enterprises, and restricted export capacities of Ukrainian companies. The export activity of the enterprises during the 1990s was determined by traditional comparative advantage sectors. This allowed an increase in exports of agricultural and raw materials of the newly opened Ukrainian economy. The exports of more advanced products have not been a strong component of Ukraine's economy. For example, in 2014 manufacturing and machine-building industries of the country (HS groups from 84 to 89) are quite modest exporters and constitute only 12% of the Ukrainian exports (Derzhkomstat, 2015).

The export activity of Ukrainian enterprises was motivated by i) the collapse of central planning and internal liberalization which allowed private enterprise and thus its interest in expanding abroad, ii) learning from importing as many enterprises could use imported components and iii) cooperation with foreign counterparts to create internationally competitive business environment in Ukraine (Havrylyshyn, 2007). The empirical application of the Melitz (2003) model can contribute to the better understanding of export behavior of the Ukrainian firms in the open market environment. Currently, in contrast to the central planning period, the export activity depends mostly on individual firm characteristics of Ukrainian enterprises.

One has to mention that Ukraine was a part of the value-added chains of the Soviet Union for over 70 years. This pattern is still leaving an imprint on the Ukrainian economy relations with the rest of the world. Ukraine's exports has been sent to major 3 destinations – Commonwealth of Independent States (CIS), European Union (EU) and Asia, while trade with Latin America and North America does not play an important role. The share of CIS countries has been traditionally large due to the long historical relations with the former Soviet Union republics. In 2014 the share of CIS in Ukrainian exports amounted to 32% while the share of EU countries – 31% of total Ukrainian exports.

The role of CIS countries has been increasing for the last 8 years due to ongoing trade liberalization with those countries, while the share of EU markets in total Ukrainian exports stagnated because of inter alia lack of trade liberalization with European countries. Moreover, the structure of the exports with two regions is very different. High value added machinery and manufacturing products are being sold in the CIS markets. The reason for that is common product standards and a long participation in the cooperation networks with post-Soviet economies. In contrast, the European direction of the Ukrainian exports is dominated with raw materials and agricultural products. In 2013 66% of total exports of Ukraine's machinery and equipment and 51% of chemical products were sold in the CIS, while the relevant figures for the EU were only 21% and 16% respectively (Derzhkomstat, 2015).

The new wave of liberalization of the Ukraine's external trade was marked by the accession of the country into WTO in 2008. However, the effect of this liberalization was blurred by the subsequent economic and financial crisis of 2008-2009 that brought the Ukrainian economy - dependent on exports of agricultural goods and raw materials and vulnerable to international price movements - into stagnation. At the same time Shepotylo and Vakhitov (2015) argue that liberalization of services market caused by country's entry to WTO greatly contributed to the rise of manufacturing sector productivity. They stressed the importance of role of services liberalization in economy's efficiency while direct liberalization of trade in goods had probably

a minor impact. The recent EU-Ukraine Association Agreement will offer new opportunities for Ukrainian companies to expand their manufacturing exports into European markets. The EU-Ukraine Association Agreement was signed on June 27th, 2014, but the implementation of its economic part is postponed until January 1, 2016. For agricultural goods, EU concessions have been made taking into account sensitivities of some agricultural goods. Thus, duty free tariff rate quotas have been granted to the Ukraine for cereals, pork, beef, poultry and a handful of additional products, while for others the progressive elimination by the EU of the custom duties will occur over a longer transition period (generally 10 years). This means that for particularly sensitive sectors, the scope of DCFTA liberalization is delayed and limited.

As regards non-tariff barriers (NTB) on trade in goods, the Agreement incorporates the fundamental WTO rules on NTBs, such as MFN and national treatment, prohibition of import and export restrictions, etc. Export duties will be prohibited from day one, with some temporary exceptions for some Ukrainian agricultural (sunflower oil) and metal products of minor importance (recycled metal).

In the meantime EU Autonomous Trade Preferences for Ukraine are in force (Regulation of EU Council and parliament № 1150/2014). According to this temporary regime 83.4% of tariff lines in agricultural products (CN 1-24 groups) are tariff free for Ukraine's trade in EU. 15.9% of Ukrainian agricultural products are eligible for zero tariff quota. This intermediate trade arrangement helped Ukraine to withstand the export slump in the Eastern markets. The volume of exports to the European Union in the first half of 2015 accounted for 67% of the same level in 2014 (Derzkomstat, 2015).

At the same time the exports of Ukraine's enterprises to the CIS countries decreased abruptly due to the change in political situation after the collapse of the Yanukovich government and signing of the agreement with EU. In the first half of 2015 exports of Ukraine to CIS amounted only to 44% of its level in the previous year. By the end of 2014 the share of exports to EU almost exceeded the share of CIS. At the same time Ukraine's GDP went down by 7% in 2014 and 9% in 2015. Once the political crisis is over, then CIS markets should be available for Ukrainian firms again. Thus the Ukrainian companies should be able to increase their exports to CIS markets like the other Central and Eastern Europe countries in the 2000s.

Ukraine's exports regional distribution which is uneven. In 2014 major exporting regions of Ukraine were Kyiv city (25% of the total exports), Dnipropetrovsk (19%), Donetsk (10%), Zaporizhya (8%), Odesa (4%), Poltava (4%), Kyiv region (4%) and Mykolajiv (4%). Most regions with the highest export revenues are located in the Eastern and Southern Ukraine. The joint share of the Western regions in export revenues, such as Lviv, Ivano-Frankovsk, Lutsk and Uzhgorod is less than 10% of the total exports. At the same time, these are Western regions which predominantly trade with EU. For example, the CIS share in Lviv region's exports was 25% in 2013 and the share of EU was 67%. The corresponding indicators for Eastern region Dnipropetrovsk were 36% and 18%. Kyiv city was more EU-oriented as EU represents 30% and CIS – 18% in the total exports of the city (Derzkomstat, 2015).

The liberalization of the economy did not bring substantial inflows of foreign direct investment into the country. In the mid of 2015 the accumulated FDI stock in the Ukraine's economy amounted to 42.831 bln USD, or only USD1000 per capita. The inflow of FDI in the financial sector follow the similar trend to other countries in the Central and Eastern Europe. The biggest transactions involving foreign capital were the purchases of UkrSotsbank by Raiffaisen Bank and Ukrsibbank by BNP Paribas. The purchase of steel-maker Zaporozhstal by Arcelor Mittal, international steel giant was the biggest industrial deal. A relatively small involvement of foreign direct investors in Ukraine may be explained by a close relationship between local

business and the government that limited takeovers of local firms.<sup>2</sup> Our paper attempts to fill the gap in the existing literature as it empirically examines the link between the productivity and export activity of Ukrainian firms.

### Methodology of the research

In this study we analyse empirically the firm-level determinants of export decisions. In particular, we focus on estimating the theoretical relationship between firm-level productivity and exporting postulated by the Melitz (2003) model for Ukrainian manufacturing and service firms. This approach is an equivalent of studying changes in the extensive margins. In other words, this means a positive effect on trade through an increase in the number of exporting firms or products exported. In addition, we take into account other firm and industry characteristics that may also affect export performance such as the firm age and the size of the firm, the role of foreign and private ownership, capital-labor ratios and the degree of competition within the industry.

To investigate empirically the relationship between firm productivity, measured by its TFP and exporting, having controlled for the set of additional firm and industry characteristics, we employ the probit regression. We develop the following empirical model to investigate the impact of individual firm characteristics on firm export performance. Let  $Y_i^*$  be our dependent variable indicating the export status of firm  $i$ . According to this model the export status of  $i$ -th firm can be related to the set of individual firm characteristics  $X$  in the following way:

$$Y_i^* = X_i\theta + \varepsilon_i \quad (1)$$

where the error term  $\varepsilon_i$  is independent of  $X_i$  which is a vector containing explanatory variables that affect exports with the first term equal to unity for all  $i$ ,  $\theta$  is the set of parameters that needs to be estimated.

However, since the data on the volume of exports for Ukrainian firms is not available, we only observe their export status that is described by the binary variable  $Y_i^*$ .

$$Y_i = \begin{cases} 1 & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* = 0 \end{cases} \quad (2)$$

Hence, the probability whether a particular firm is engaged in export activity ( $Y_i^* > 0$ ), expressed as a function of firm characteristics is given by:

$$\Pr(Y_i=1|X_i) = \Phi(X_i\theta) \quad (3)$$

where  $\Phi(\cdot)$  denotes the standard normal cumulative distribution function (cdf).

### Data description

The data for our empirical study comes from several statistical sources. The main source of data is the State Committee of Statistics of Ukraine (<http://www.ukrstat.gov.ua>) for the period 2005-2013. The statistical information can be received for the purpose of scientific research. This data reflects the balance and income statement indicators related to fixed assets, total revenues, total labor cost, cost of materials, etc. Data on employment (total number of full-time workers) is received from employment authorities. Data on domestic and foreign ownership comes from the State Committee of Statistics of Ukraine. Data on export and import operations comes from External Economic Activity Database of the State Committee of Statistics of Ukraine. However, the export data is available only for two years: 2005 and 2013.

<sup>2</sup> Gorodnichenko and Grygorenko (2008) argue, however, that improvement in the productivity of firms controlled by oligarchs was higher in comparison to the average growth in 2001-2008.

The data is classified according to the KVED statistics which include both manufacturing and services. KVED is Ukraine's national classification developed by the agency State Committee for Technical Regulation and Consumer Policy to collect information on economic activity. There is KVED-2005 and KVED-2010 classification. Both of them are the equivalents of international industry classification standards. In the KVED 10 classification at 2-digit level KVED is comparable to (ISIC, Rev. 4 – 2008), at 4 digit level – to the EU classification (NACE, Rev. 2 - 2006). In the KVED-2010, active from January 1st, 2012 the number of services sectors has been increased (the higher level of disaggregation) in comparison to KVED-2005. Before that KVED-2005 classification was used.<sup>3</sup> In our analysis we converted all data to KVED-2005 classification in order to have the comparable set of data for 2005 and 2013.

The sectors in 2005 differ from the sectors in 2013 due to the change in the classification KVED which follows changes in international NACE classification. In 2005 Ukrainian enterprises reported according to the old classification system (3 agricultural sectors, 5 mining sectors, 23 manufacturing sectors and 28 services sectors).<sup>4</sup> In 2013 all the Ukrainian enterprises had to report according to the new system – KVED -2010 (3 agricultural sectors, 5 mining sectors, 25 manufacturing sectors, 56 services sectors). There are 310 482 enterprises in 2005 and 198 405 enterprises in 2013 in manufacturing and services together. The firms of various types of organizational forms are present – joint stock companies, limited liability companies, self-employed individuals. The enterprises are distributed among the economic sectors adequately to the structure of the economy of Ukraine. The regional location is also present and complies with the geographical distribution of the Ukrainian industry.<sup>5</sup> It should be noted that regressions are estimated for 2005 and 2013 years separately and jointly.<sup>6</sup>

The definitions of variables used in our empirical are reported in Table 1.

**Table 1 Definitions of variables**

VARIABLE	DEFINITION
export	Dummy variable indicating if an enterprise exports or not
lnTFP	Logarithm of total factor productivity calculated based on Levinsohn-Petrin input shares
lnSize	Logarithm of the total number of full-time employees
lnHHI	Logarithm of Herfindahl-Hirschman index for NACE 2-digit industry

<sup>3</sup> See: <http://www.dkrp.gov.ua/info/842>.

<sup>4</sup> For example, in 2005 4548 enterprises were big enterprises (employment more than 250 people), 14530 – medium enterprises (50-246 employees), 282966 enterprises – small enterprises (less than 50 employees). The number of firms for each year is reported in Table A1 in the Appendix.

<sup>5</sup> Only legal addresses of firms are available. For example, the biggest mobile operator Kyivstar has only one entry in the data set with the consolidated financial figures, located in Kyiv, the head-quarter's city. The data is available as reported to the statistics committee and government. There is no distinction between production and sales units.

<sup>6</sup> In our study of export performance we use data for individual enterprises from 2005 and 2013, but the dataset is not balanced. An enterprise can be present in all years from 2005 to 2013, but in most cases the enterprise is only active in several years inside 2005-2013 period. 36% of manufacturing firms operating in 2005 remained in 2013. 74% of manufacturing firms in 2013 were still active in 2005. 29% services enterprises in 2005 kept on operating in 2013. 43% of services enterprises in 2013 were active in 2005. 30% of firms (manufacturing and services pooled) operating in 2005 still operated in 2013. 46% of 2013 firms were still present in 2005.

VARIABLE	DEFINITION
Import	Dummy variable indicating if an enterprise imports or not
lnKLratio	Logarithm of the capital to labor ratio
private	Dummy variable indicating private ownership of an enterprise
foreign	Dummy variable indicating foreign ownership of an enterprise <sup>1</sup>

<sup>1</sup>The ownership by foreign capital is derived from the name of the enterprise. If there is a phrase “with foreign investment” in the name, the dummy variable is 1.

The dependent variable is a dummy variable called export which is equal to 1 if the firm is receiving proceeds in the foreign currency from abroad, and 0 in the opposite case.<sup>7</sup>

The level of firm productivity was measured by TFP calculated on the basis of the Levinsohn-Petrin (2003) methodology. The levpct function in STATA used the following variables to calculate the input shares at the 2-digit sector level: total revenues (UAH), fixed assets at the end of period (UAH), the number of employees (the number of people), the cost of materials (materials, fuels, electricity, UAH).<sup>8</sup>

Input shares for the TFP estimation were calculated on the basis on the panel data of enterprises for the period from 2005 to 2013 year. The estimation procedure to calculate input shares is the same for manufacturing and services. To estimate the input shares in 2006 we have 331431 enterprises, in 2007 - 355902 enterprises, in 2008 – 339790 enterprises, in 2009 – 352805 enterprises, in 2010 – 296521 firms, in 2011 – 243 422 firms, in 2012 – 133 383 enterprises. The enterprises belong to manufacturing and services sector (sectors 15-95 of KVED-2005 classification).

The degree of competition within the sector was measured by the Herfindahl-Hirschman Index (HHI). This is a commonly used measure of market concentration in the empirical industrial organization literature. It is calculated for each of the available KVED-2005 sectors so that  $HHI = \sum_{i=1}^N \left( \frac{TR_i}{\text{sec}TR} * 100 \right)_i^2$ , where N – the number of enterprises in sector i, TR- the total revenues<sup>5</sup> of the enterprise i, secTR – the sum of total revenues of all enterprises in sector i. Sectors are ranging from 15 to 95 (manufactures and services) according to KVED-2005. The higher value of Herfindahl-Hirschman index is indicating greater level of industry concentration. The summary statistics for years 2005 and 2015 are reported in Tables 2a and 2b, respectively.

**Table 2a Summary statistics for 2005**

Variable	Obs	Mean	Std. Dev.	Min	Max
export	302044	0,0	0,2	0	1
Size	300690	23,5	492,7	0	121617
import	302044	0,0	0,2	0	1
KLratio	291394	1865,2	72779,6	0	1,66E+07
TFP	172696	1081,9	25393,0	0	3924225
HHI	302044	279,6	517,5	12,3	4653,5
foreign	302044	0,0	0,1	0	1
private	302044	1,0	0,2	0	1

<sup>7</sup> For example, in the case of the service sector financial institutions may have clients from abroad.

<sup>8</sup> The estimation of input shares was performed for all 2-digit sectors. Due to the limited number of observations some of the sectors were merged. The way in which sectors were merged is reported in the Appendix.



**Table 2b Summary statistics for 2013**

Variable	Obs	Mean	Std. Dev.	Min	Max
export	198405	0,0	0,1	0	1
Personal	119596	49,3	631,7	0	96477
import	198405	0,0	0,2	0	1
KLratio	118930	4876,6	75270,0	0	7842810
TFP	117477	1180,7	39177,4	0	9421698
HHI	198405	162,0	401,4	12,3	4653,5
foreign	189214	0,0	0,0	0	1
private	189214	1,0	0,2	0	1

The correlations between our explanatory variables for 2005 and 2013 are reported in Table 3a and Table 3b respectively.

**Table 3a Correlations between explanatory variables, manufacturing and services, 2005**

	export	Personal	import	KLratio	TFP	HHI	foreign	private
export	1							
Personal	0.0352	1						
import	0.3395	0.0368	1					
KLratio	0.0007	-0.0005	0.0018	1				
TFP	0.0205	-0.0012	0.0132	0.0084	1			
HHI	-0.0796	-0.0011	-0.092	0.0138	-0.0238	1		
foreign	0.0465	0.0025	0.0844	0.0067	0.0009	-0.0011	1	
private	0.0342	-0.0376	0.0453	-0.0083	0.0091	-0.033	0.0149	1

**Table 3b Correlations between explanatory variables, manufacturing and services, 2013**

	export	Personal	import	KLratio	TFP	HHI	foreign	private
export	1							
Personal	0.0565	1						
import	0.2712	0.0451	1					
KLratio	-0.0026	-0.0017	-0.0082	1				
TFP	0.0043	-0.0005	0.0074	0.0493	1			
HHI	-0.0161	0.0317	-0.0459	-0.0037	-0.0097	1		
foreign	0.0334	0.0064	0.0503	0.0101	-0.0002	0.0131	1	
private	0.0276	-0.0665	0.046	-0.0132	0.0047	-0.1154	0.0085	1

## Estimation results

In this section we present two sets of our empirical results. First, we present the pooled estimation results for both years and then separate results for particular years: 2005 and 2013.

In Table 4 we show pooled estimation results for both years of the sample. We start with the results obtained for all sectors in the economy. Then, we present results obtained separately for service and manufacturing sectors.

**Table 4 Estimation results for the pooled data set (2005 and 2013 jointly).**

	Pooled		Services		Manufacturing	
	1	2	3	4	5	6
lnTFP	0.108	0.139	0.147	0.121	0.023	0.166
	(35.20)**	(31.76)**	(39.33)**	(24.68)**	(3.44)**	(14.99)**
lnSize	0.226	0.233	0.198	0.228	0.222	0.228
	(60.36)**	(55.65)**	(40.80)**	(43.73)**	(32.64)**	(30.84)**
lnKLratio	0.044	0.063	0.052	0.066	0.049	0.046
	(16.32)**	(20.68)**	(16.01)**	(18.90)**	(8.48)**	(7.40)**
import	1.089	0.965	0.886	0.79	1.42	1.362
	(79.19)**	(65.68)**	(52.45)**	(44.56)**	(53.78)**	(48.23)**
private	0.835	0.615	0.657	0.632	0.613	0.509
	(22.73)**	(14.72)**	(14.47)**	(12.37)**	(8.57)**	(6.69)**
foreign	0.193	0.243	0.188	0.206	0.344	0.357
	(3.63)**	(4.37)**	(2.84)**	(3.05)**	(3.52)**	(3.47)**
lnHHI	0.061	0.214	-0.034	0.001	0.119	-0.265
	(13.71)**	(13.26)**	(5.62)**	-0.04	(8.29)**	(2.74)**
year05	-0.416	-0.494	-0.431	-0.555	0.331	0.427
	(34.25)**	(37.61)**	(29.62)**	(35.62)**	(13.65)**	(15.77)**
Constant	-4.148	-5.312	-3.916	-4.885	-3.93	-2.896
	(83.15)**	(57.84)**	(62.62)**	(36.79)**	(32.35)**	(6.22)**
Sectoral and regional effects	No	Yes	No	Yes	No	Yes
N	215416	215365	178852	178801	36564	36564
Pseudo R2	0.2199	0.2957	0.2009	0.2497	0.2525	0.3094

(Absolute value of z-statistics in parentheses) \* significant at 5%; \*\* significant at 1%

In column (1) of Table 4 we present baseline results for all industries (pooled service and manufacturing sectors) for 2005 and 2013 combined without controlling for industry and region

specific effects. It turns out that all explanatory variables are statistically significant already at the 1 per cent level of statistical significance and display the expected signs. In particular, the estimated coefficient on the TFP variable is positive which means that the probability of exporting increases with individual firm's TFP. This result is in line with the main prediction of the Melitz (2003) model. In addition, we find the probability of exporting is positively related to the firm's capital-labor ratio. This means that the probability of exporting increases with individual firm's capital intensity. Moreover, the estimated coefficient on the firm size variable also displays a positive sign. This means that the probability of exporting increases with the larger number of employees reflecting mostly firm-level economies of scale. This result is in line with many other empirical studies on firm-level determinants of export performance.

The export performance of Ukrainian firms depends also on their internationalization. In particular, the probability of exporting is positively related to firm's import status. This means that the probability of exporting is higher for the firms that are also importers. Moreover, firms with foreign capital ownership are more likely to export which is in line with the results of earlier empirical studies for other countries. In addition, also privately owned firms are more likely to export similar to other CEE countries. Finally, we find that the market structure also matters for export performance. In particular, the probability of exporting increases with the higher value of the HHI. This means that higher market concentration (i.e. domination of large firms in the market structure) in the industry increases the probability of exporting. The estimator coefficient on the dummy for the year 2005 demonstrated negative sign indicating that the propensity to export of Ukrainian firms has increased in 2013 in comparison to year 2005.

In the column (2) we report the pooled results controlling for industry and region specific effects. The results are the same as in column (1) in terms of statistical significance of coefficients of estimators and the values of estimators are quite similar to the ones reported in column (1). The majority of estimated coefficients on dummy variables of sectors and regions were statistically significant.<sup>9</sup>

In the column (3) we report the pooled results for the services sector. The value of coefficients and their statistical significance is similar to the results reported in columns (1) and (2) with the only exception of the market concentration variable.

In column (4) we report estimates for the services sector having controlled for industry and region specific effects. These results are similar to the results reported in column (2). This is not surprising given the fact that service firms constitute the majority of enterprises in the pooled sample. In the column (5) we report the results for the manufacturing sector only. The results are very similar to the ones in columns (1) and (3)<sup>10</sup>.

In column (6) we report the results for manufacturing firms controlling for industry and region specific effects. It turns out that estimated parameter on TFP variable displays an expected positive sign and is statistically significant at the 1% level. It confirms the main prediction of the Melitz model regarding the positive relationship between firm productivity and export performance of firms within particular industries in the manufacturing sector.

In Table 5 we report the values of estimated individual effects for specific regions obtained from specifications reported in columns (2), (4) and (6) of Table 4, respectively.

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<sup>9</sup> The estimation results for individual region-specific effects are reported in separate Table 4.

<sup>10</sup> We also investigated the relationship between exporting and relative TFP. The relative TFP was defined as individual TFP related to the mean TFP in the industry. In this case the relationship between exporting and relative TFP was positive and statistically significant. These additional results can be obtained from the authors on request.

**Table 5 Region specific effects for the pooled dataset (2005 year and 2013 year)**  
(Absolute value of z statistics in parentheses)

<b>Regions</b>	<b>Pooled</b>	<b>Services</b>	<b>Manufacturing</b>
Kyiv	0.022 (0.60)	0.133 (2.80)**	-0.127 (1.97)*
Zhytomyr	0.365 (7.01)**	0.541 (8.20)**	0.059 (0.68)
Chernihiv	0.228 (3.95)**	0.342 (4.54)**	0.040 (0.43)
Cherkasy	0.242 (4.53)**	0.356 (5.20)**	0.046 (0.52)
Vinnytsia	0.246 (4.72)**	0.403 (6.13)**	-0.024 (0.28)
Kirovograd	0.136 (2.13)*	0.147 (1.72)	0.093 (0.91)
Khmelnyskyi	0.175 (3.15)**	0.193 (2.60)**	0.107 (1.22)
Rovno	0.240 (4.23)**	0.390 (5.54)**	-0.044 (0.45)
Poltava	0.127 (2.48)*	0.313 (5.02)**	-0.290 (3.06)**
Summy	0.251 (4.53)**	0.392 (5.66)**	0.004 (0.04)
Lutsk	0.401 (7.49)**	0.497 (7.45)**	0.226 (2.41)*
Ternopil	0.120 (1.87)	0.230 (2.72)**	-0.058 (0.57)
Dnipropetrovsk	0.069 (1.66)	0.192 (3.69)**	-0.163 (2.25)*
Mykolajiv	0.192 (3.54)**	0.294 (4.41)**	-0.016 (0.16)
Chernivtsi	0.428 (6.91)**	0.453 (5.45)**	0.362 (3.72)**
Kharkiv	0.185 (4.47)**	0.308 (5.86)**	-0.028 (0.40)
Odesa	0.208 (4.72)**	0.290 (5.26)**	0.114 (1.47)
Zaporizhzhе	0.166 (3.60)**	0.280 (4.85)**	-0.049 (0.61)
Kherson	0.238 (4.11)**	0.388 (5.58)**	-0.113 (1.01)
Ivanofrankivsk	0.402 (7.73)**	0.472 (6.95)**	0.267 (3.17)**
Lviv	0.199 (4.64)**	0.270 (4.91)**	0.077 (1.09)
Donetsk	-0.045 (1.04)	0.050 (0.91)	-0.233 (3.18)**
Uzhgorod	0.607 (11.88)**	0.649 (9.77)**	0.525 (6.25)**
Luhansk	0.119 (2.43)*	0.211 (3.39)**	-0.044 (0.55)
N	196419	161349	35070
Pseudo R2	0.2889	0.2465	0.2983

\* significant at 5%; \*\* significant at 1%

The highest values of estimators for the region specific effects for pooled data reported, in column (1), are obtained for Uzhgorod, Chernivtsi, Ivano-Frankivsk and Lutsk which all are located in Western Ukraine. This means that the probability of exporting for companies located in the Western part of Ukraine is higher compared to the firms located in other regions of the country.<sup>11</sup> Interestingly, a higher number of statistically significant estimated parameters on region specific effects is reported for the companies in the services sector than for the manufacturing firms. Surprisingly, the traditional manufacturing regions, that account for majority of exports and are located in the Eastern part of the country, such as Dnipropetrovsk and Donetsk, do not display positive and statistically significant effects for manufacturing firms. Also the capital city of Kyiv, which is the largest agglomeration in Ukraine, is not export-oriented in terms of manufacturing, but rather in terms of services. This probably means that Kyiv is an important services hub. The Table 6 reports the results obtained for year 2005 and 2013 separately.

**Table 6 Estimation results separately for 2005 and 2013**  
(Absolute value of z statistics in parentheses)

	2005			2013		
	Pooled 1	Services 2	Manufacturing 3	Pooled 4	Services 5	Manufacturing 6
lnTFP	0.131 (22.85)**	0.117 (18.64)**	0.167 (12.01)**	0.135 (16.09)**	0.144 (15.81)**	0.099 (4.54)**
lnSize	0.204 (37.77)**	0.191 (27.04)**	0.216 (24.60)**	0.283 (38.87)**	0.283 (33.74)**	0.287 (18.73)**
lnKLratio	0.066 (16.03)**	0.067 (13.60)**	0.057 (7.62)**	0.059 (12.26)**	0.062 (11.78)**	0.034 (2.71)**
import	0.949 (49.97)**	0.771 (33.21)**	1.33 (38.29)**	0.882 (34.80)**	0.752 (25.83)**	1.36 (24.56)**
private	0.501 (10.02)**	0.519 (8.43)**	0.447 (5.08)**	0.817 (9.68)**	0.864 (8.44)**	0.714 (4.55)**
foreign	0.228 (3.45)**	0.177 (2.20)*	0.367 (3.04)**	0.22 (1.97)*	0.219 -1.63	0.249 -1.17
lnHHI	0.073 (1.66)	0.082 (1.9)	0.271 (5.24)**	-0.443 (2.90)**	-1.351 (1.66)	0.088 (1.09)
_cons	-4.987 (15.31)**	-5.022 (15.51)**	-4.668 (14.69)**	-2.312 (2.80)**	3.591 (0.64)	-4.396 (8.19)**
N	113157	87953	25204	83162	73296	9866
Pseudo R2	0.2938	0.2611	0.2961	0.2753	0.2213	0.3136

\* significant at 5%; \*\* significant at 1%

<sup>11</sup> These results are related to the findings of Kim et al. (2015) who documented highest increases in productivity in Western regions.

The comparison of the results obtained for specific years with pooled results presented in Table 6 reveals no major differences both in terms of statistical significance and the value of estimators. In particular, the estimated parameter on TFP variable is similar to the one in the pooled specification results. This means that the positive relationship between productivity and exporting is present in 2005 and 2013 subsamples (column (1) and column (4)). It can also be noted that this relationship is present in both services and manufacturing sectors (columns (2)-(3) and columns (5)-(6)).

There are also quite clear similarities between variables such as size, the capital labor ratio, import status and private ownership. The major differences exist in the estimated parameters on foreign ownership and the Herfindahl-Hirschman index. Foreign ownership became statistically insignificant in 2013. The Herfindahl-Hirschman index is not significant in 2005 for services and 2013 for services. It seems that the positive impact of concentration in the manufacturing sector that was present in 2005 disappeared in 2013.

## Conclusions

In this paper we investigated the determinants of export performance of Ukrainian firms. The study is based on the firm level data including both manufacturing and services sectors. The study covered two years - 2005 and 2013. We estimated probit regressions for the pooled dataset that included both years and both sectors. Next, we distinguished between manufacturing and service sectors. We also analyzed the region specific effects.

Our estimation results indicate that the probability of exporting is positively related to the level of total factor productivity in all estimated specifications, having controlled for the other firm and industry specific characteristics. These results are in line with main predictions of the Melitz model which stressed the link between firm-level productivity and export. The other significant variables affecting the probability of exporting include the firm size, capital labor ratio, ownership status, and foreign sourcing (imports). In particular, we found the positive relationship between the firm size and exporting, as well as between capital labor ratio and exporting, suggesting some evidence of existence of economies of scale at the firm level. In addition, we found that internationalization of firms measured by the presence of foreign capital and imports increased the probability of firm's exporting. This means that further trade liberalization in Ukraine, in particular with the EU countries, should positively contribute to the improvement in firm imports and export performance.

Moreover, in the majority of estimated specifications we found that private companies outperformed state-owned firms in terms of exporting. The estimated parameter of market concentration in the manufacturing sector was positive and statistically significant only in some specifications. These results suggest that the determinants of exports performance of Ukrainian firms are similar to the determinants of the firms from European Union. Moreover, we found that determinants of export performance are very similar for manufacturing and service firms. Finally, we found that firms located in Western regions of the country, despite their smaller role in overall exports, were more likely to export in comparison to firms located in other regions.

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## Appendix

**Table A1 The numbers of firms in each year in the period 2005-2013.**

Year	Freq.	Percent.	Cum.
2005	310,482	12.12	12.12
2006	331,431	12.94	25.05
2007	355,902	13.89	38.94
2008	339,790	13.26	52.21

<b>Year</b>	<b>Freq.</b>	<b>Percent.</b>	<b>Cum.</b>
2009	352,805	13.77	65.98
2010	296,521	11.57	77.55
2011	243,422	9.50	87.05
2012	133,383	5.21	92.26
2013	198,405	7.74	100.00
Total	2,562,141	100	

**Table A2. TFP for industry, including merged ones, UAH**

<b>Activity code</b>	<b>Sector</b>	<b>mean</b>	<b>Number</b>
15&16	Food, beverage and tobacco	263.4	33406
17&18 &19	Textile, garments, leather and leather footwear	10.4	25444
20&21	Wood and paper	25.9	17177
22	Publishing, printing industry, reproduction of printed materials	356.2	23965
23	Manufacture of coke, refined petroleum products and nuclear fuel	779.4	807
24	Chemical Industry	81.8	7402
25	Rubber and plastic industries	77.7	8603
26	Manufacture of other non-metallic mineral products	55.6	13187
27	Metallurgy	717.0	2456
28	Recycling of metal	85.7	13365
29	Manufacture of machinery and equipment	54.8	20855
30	Production and office computers	87.3	1695
31	Manufacture of electrical machinery and apparatus	77.2	8459
32	Production of equipment for radio, television and communication	78.4	2868
33	Manufacture of medical apparatus and instruments; exact measuring devices, optical devices and watches	41.7	6260
34	Vehicle production	38.8	2110
35	Manufacture of other transport equipment	60.7	3138
36	Manufacture of furniture; other production	47.8	9342
37	Treatment of wastes	660.5	3096



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40	Electricity, gas and water	1138.6	5733
41	Collection, purification and distribution of water	103.3	6849
45	Construction	79.9	107360
50	Trade in vehicles and their repair	258.5	24020
51&52	Wholesale and retail trade	712.5	562806
55	Hotels	24.7	37021
60	Ground transportation	93.9	25710
61	Water transport	572.3	611
62	Air transport	54.5	565
63	Supporting and auxiliary transport services	189.7	20172
64	Post and communication	359.5	7099
65	Financial intermediation	265.4	4233
66	Insurance	380.4	2481
67	Support Banking, finance and insurance	6223.5	4601
70	Real estate	549.8	70438
71	Hiring without attendants	53.7	6172
72	Activities in the field of information	0.0	34414
73	Research and development	206.0	15957
74	Services are mainly legal persons	0.0	172949
75	Public administration	114.4	777
80	Education	0.0	13651
85	Health care and social assistance	40.9	15345
90	Sewage disposal, street cleaning and refuse disposal	66.0	6086
91	Social activities	305.2	266
92	Activities in recreational, cultural and sporting	254.1	14548
93		47.6	14135
95		0.0	46

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