LEARNING BY EXPORTING IN UKRAINE: DOES INTERNATIONAL TRADE IMPROVE PRODUCTIVITY?

by

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Abstract

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Entering export markets is a challenge, rewarding winners in numerous ways. One of them is productivity development through "Learning by Exporting". The main goal of this research is to investigate whether Ukrainian exporters receive productivity improvements from international trade and investigating persistence and magnitude of these effects for different export destinations and industries. Using firm-level data on Ukrainian firms and official customs data we found out that Ukrainian firms receive persistent and statistically significant productivity developments, meanwhile, learning as growth of productivity premium over time works only for exporters to high income countries. Exporters to Russia only reduce their productivity superiority while exporting to offshore countries gives only one-time positive productivity effect.

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GLOSSARY

ATT - Average effect of treatment on the treated, the difference between outcome measure of treated and non-treated unit estimated with propensity score matching

CIS - Commonwealth of Independent States, the regional union of countries, formed after Soviet Union collapse

FOB - free on board price, the price of a product including cost of its delivery to the nearest port

GDP - Gross domestic product

KZED - Ukrainian classifier of economic activity (2005 values are used for this research)

IMF - International Monetary Fund

LBE - Learning by Exporting

PPI - Producer Price Index

R&D - Expenditures on Research and Development

TFP - Total factor productivity, generally meant as the production function residual

WTO - World Trade Organization

EU-28 - European Union, consisting of 28 countries

VAT - Value added tax, indirect tax, used by Ukrainian government

Chapter 1

INTRODUCTION

What helps economies grow faster? Classic macroeconomic theory suggests that with fixed capital stock and population, the only feasible source of real GDP per capita growth should be the total factor productivity. Apart from the technology level, competition, and government regulation (Barro, 2009) being classic determinants of productivity growth, economic papers by Melitz (2003), Bernard(2004), and De Loecker (2007) mention international trade as one of the key factors improving productivity in developing countries. According to them, the main channels inducing productivity growth are "learning by exporting" and "reallocation towards more efficient firms". In our paper we are going to concentrate on the first effect, whose presence for countries in transition has been widely studied in the empirical literature since 1995 year. Nonetheless, there is no empirical justification for its presence in Ukraine, the country with approximately half of GDP going to export. That is why finding out whether Ukrainian firms benefit from international trade in terms of productivity provides further motivation for our research.

1.1. History and current state of Ukrainian trade

Ukraine has been intensively trading with other countries since its independence. With export share in GDP rising from 30% in 1991 to 52,6%[1] in 2016, it stays the 50th largest exporter in the World[2], known as the key supplier of maize, crude

[1] World Development Indicators, World Bank

[2] https://atlas.media.mit.edu/en/profile/country/ukr/

sunflower seeds, wheat, and iron ore. The key trading partners of Ukraine are CIS countries, Germany, China, Turkey, Poland, Italy, Spain, and India[3].

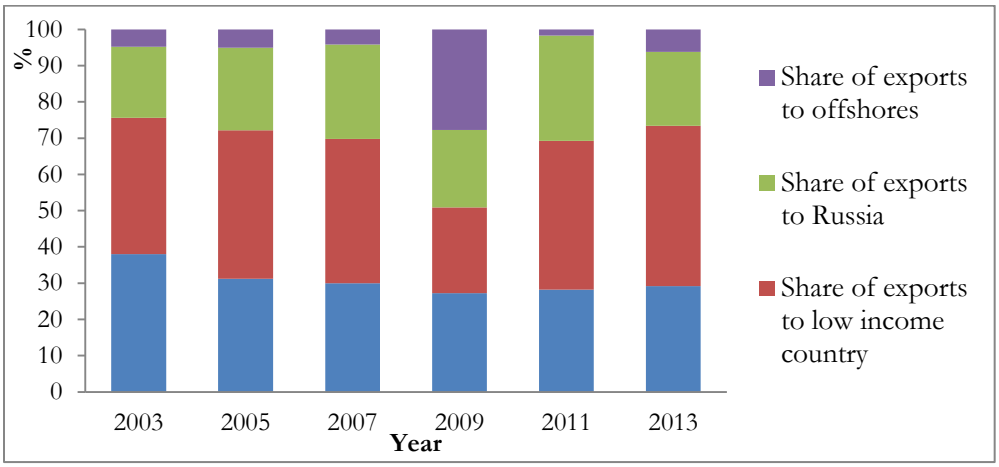


Figure 1. Geographical structure of Ukrainian exports in 2003-2013 years

Source: Official Customs Data

Figure 1 reveals that Russia stayed the leading importer of Ukrainian goods. Despite the trade war, it is still accountable for buying 8% of total exports from Ukraine in 2016 (although, this share has been dramatically plunging since the beginning of Trade War in 2014). Since entering WTO on May 16, 2008, Ukraine started to decrease exports to CIS countries, redistributing trade flows to European and Asian export markets. This resulted in 30%[4] rise in the level of exports, which has dramatically lowered during the World financial crisis, which also induced considerable decline in real GDP per capita and 100% devaluation of national currency. It took over 4 years to exceed the 2008th level of exports,

[3] https://wits.worldbank.org/CountryProfile/en/Country/UKR/Year/LTST/Summary

[4] World Development Indicators, Worldbank

while further worsening of economic relationships with Russia and the temporal loss of the Donbas region and Crimea peninsula have led to 20% decline in export volumes[5].

The geographical position of Ukraine allows it to trade with high income countries (including EU-28) with the same ease as with not high income countries (including Russia, Belarus, and other CIS countries). However, the Figure 1 reveals that share of export volumes coming to low- and middle-income countries was always higher than to countries with higher GDP per capita. The reasons for that are eligibility (as high income countries do not import production, not satisfying their domestic production standards) and low compatibility (as price competition in high income markets is always tougher than in not high-income ones). Apart from high income and not high-income countries the significant proportion of Ukrainian export volumes has been going through offshores. Viewing it as a way to minimize tax burden, exporters have been actively exploiting offshore countries as an intermediary for further reselling goods and services (especially during the productivity decline induced by Great Recession). Although such behavior was able to save companies from bankruptcy, it is very unrealistic that such behavior was capable to improve productivity.

Trade war with Russia has led to almost a double decline in the share of Russian exports and more than 20 bn. decline in the absolute amount of trade volumes[6] in 2014-2016 years. Although in relative terms, the share of exports to European and Asian countries has significantly risen, their absolute values have been steadily declining with average rates of 10% and 5% respectively[7]. Combined with the drastic decrease of export volumes, more than 10 years of steady current

[5] World Development Indicators, Worldbank

[6] http://ukrstat.gov.ua/operativ/operativ2015/zd/ztt/ztt_u/ztt1315_u.htm

[7] http://ukrstat.gov.ua/operativ/operativ2017/zd/ztt/ztt_u/ztt1217_u.htm

account deficit, and the rise in war risks, this have led to triple devaluation of national currency, hampering of economic activity and sharp decline in the welfare level of Ukrainians.

1.2. Trade as the source of additional productivity

Struggling with effects of demand shock and sharp decline of economic activity, Ukrainian exporting companies continue participating in international trade. Benefitting from relatively low labor costs, land, and energy utilization, firms maintain a sufficient productivity level to overcome international trade cost barriers and stay competitive in the foreign markets. In order to further develop competitiveness of production large exporting firms employ modern technologies and management practices thus becoming even more productive (Deininger et al., 2017). Furthermore, firms exporting to more developed countries pay higher attention to standardization, inputs quality, and product innovation in order to make their goods more attractive to buyers from those countries. However, it is still not clear whether it is a relatively high productivity, which drives firms to participate in international trade, or they export to improve their productivity. Therefore, the main objective of this research is testing whether export is beneficial for individual- and country-level productivity levels in Ukraine controlling for the possible endogenous productivity differences leading firms to trade.

The key questions which we are going to address are:

1) Do Ukrainian firms receive a productivity premium from exporting to high income countries controlling for their initial productivity supremacy?

2) Does export destination matter for firm-level productivity improvement?

For our research we use Ukrainian firm level dataset with their export status and export volumes brought from Official Customs Data from 2001 to 2013. The initial hypothesis is that exporting has a positive and statistically significant effect on productivity growth, and that starting to export to high-income countries leads to persistent and significantly higher premium to productivity than exporting to not high-income countries. In order to test this hypothesis we use propensity score matching procedure, allowing to reduce selection effect by using starting to export as treatment and evaluating average treatment effect on the treated by matching starters to export to not-starters. In order to test persistence of the effects we use forwarded values of TFP as outcome variables and map resulting TFP for each year after starting to export. In order to compare high-income and not high-income exporters we conduct the same procedure for firms, starting to export to high income countries, firms, which start to export to not high-income countries, and firms, starting to export to offshores, comparing ATT coefficients and their significance levels by each year after the entry decision. Our findings reveal that exporting really induces productivity growth and that starting to export to not high-income countries leads to higher and more persistent productivity improvements than export to high income countries.

The second section provides the main theoretical and empirical findings in investigating the two-side relationship between export and productivity and which models were exploited for investigating these effects in the literature. The third section is devoted to designing the proper specification of propensity score matching procedure, issues related to choice of matching estimator, and TFP estimation. The fourth section provides description of data, which we use, how it is prepared and what was the evolution of key variables in the dataset. The fifth section will show the estimation results and the sixth section will describe how the obtained results can be put to use for trade-related policymakers and Ukrainian firms with outlining possible areas of further research in these fields.

Chapter 2

LITERATURE REVIEW

2.1. Theoretical findings

The relationship between firm's productivity and its participation in the international trade has been studied in two directions, "export selection" and "learning by exporting". The first one built on foundations of the Ricardian theory of the comparative advantage and Krugman's new trade theory reveals that extra productivity of exporters helps them overcome trading costs and enter international markets (Bernard et al., 2006). Bernard et al. (2007) show that exporting firms substantially differ from those producing for the domestic market as they are larger, have higher capital and labor intensities, resulting in higher wages and employment prospects for labor force. Melitz (2003) reveals that even if some industry has Ricardian comparative advantage in this country, only the most productive firms in these industries choose to trade. Moreover, he introduces the mechanism of market share reallocation from international trade, stating that as the country becomes more open to international markets and improves trading liberalization, it induces the expansion of exporting firms, causing not-exporting ones to shut down (as the resulting increase in demands for labor and capital soars wages and interest rates, further plummeting margins for less-productive non-exporters).

Another direction of trade literature, "learning-by-exporting" assesses the productivity premium firms get from participation in international trade. Such an impact on productivity is induced by various factors including growth in knowledge, skills, capital intensity levels, challenges with meeting certain qualifications and quality standards etc. Boermans (2010) suggests that firms,

which start trading with international countries, acquire knowledge from international experience, employ better managerial practices, information systems, obtain more recent information on market conditions, and improve supply chain networks. De Loecker (2013) reveals that exporting brings productivity gains through soaring of marketing investments, improving and innovating product quality, and developing economic interactions with foreign contractors. Atkin et al. (2004) indicate that exporting firms gain higher productivity and technical assessment so, even though using the same inputs their production achieves much higher level of technical efficiency. Foster-McGregor et al. (2013) view international trade as an important source of receiving information flows, helping firms to introduce the latest design features and production technology as trading firms freely share this information with each other. Anyway, better knowledge and optimization of business processes is not the entire set of factors, enhancing firm's productivity.

Another driver of productivity gains for exporting firms is higher innovation activity, necessary for staying competitive on international markets. Hahn and Park (2011) analyze Korean manufacturing plants, revealing that exporting firms experience a sufficient skill upgrading and increase in their R&D activities. In order to achieve that, trading companies pay relatively higher wages, inducing higher returns to education and competition for attaining the best and the most qualified employees. Salomon and Shaver (2005) suggest that exporting firms always gain from exporting because they acquire more diverse knowledge, thus laying grounds for new innovation initiatives. Almodovar et al. (2013) investigate that exporting has much higher and quicker effect on the scope of innovative activities than even foreign direct investments. Love and Roper (2015) reveal that although innovation and exporting provide a substantial positive joint effect on productivity, innovative activities cannot have a significant effect without the access to international markets the same way as exporting cannot increase its

productivity without further R&D efforts. In other words, exporting motivates firms to develop and innovate faster in order to cope with competitive challenges of external competition, but there will be no improvements in productivity if a firm does not invest.

Apart from inducing faster innovation and accumulation of knowledge, participation in foreign trade influences other factors necessary for productivity growth, including the most essential endogenous and exogenous ones, underlined by Syverson (2011):

1) Managerial talent: Firms participating in international trade pay higher wages to top managers thus increasing competition for vacancies and becoming able to employ managers with higher expertise;

2) Higher quality of inputs: paying higher wages to employees, exporting firms become able to employ more qualified workers, while larger innovative activities and relatively better performance improve the firm-level capital intensity and access to long-term financing (Smeets&Warzynski, 2013, De Loecker&Warzynski, 2009);

3) Firm structure: Seeking higher productivity for overcoming trading costs, exporters tend to employ more effective cost and organization structures, improving and optimizing their business processes and financing decisions;

4) Higher competition: Entering international markets leads to a large increase in the number of competitors, inducing firms to further improve their productivity and efficiency levels refusing worse-performing products in order to remain competitive both on domestic and international markets (Mayer et al, 2014);

5) Access to more flexible inputs markets: Trading firms are not restricted to domestic inputs, having broader access to international inputs markets, which might have lower prices and higher quality.

Therefore, firm's ability to enter foreign markets can be the source of additional benefits from trade, especially for firms from less-developed countries like Ukraine.

2.2. Empirical studies

The first economists to test the idea that firms can gain from trade, were Bernard and Jensen (1999), who used the plant-level data from American manufacturing firms in 1984-1992 to evaluate two-side causal effects between productivity and firm's exporting status. Although they found a statistically significant difference in performance indicators between exporters and those, producing for the domestic market, they did not find any causality between export status and productivity of the firm. Although the first year of entering international markets has led to sharp rise in productivity, after the second year this effect started to decline. These results were confirmed in a more recent paper where Bernard (2004) shows that although giving no long-run productivity premium, participation in international trade helps to reallocate resources from less efficient plants to more efficient ones (especially, those oriented to exports). Both studies also show that exporting firms have much higher rate of employment and shipments growth than non-exporting firms do.

Bernard and Jensen did a lot of work to show that "learning by exporting" did not work for the US, while their ideas inspired other economists to check whether this effect was present in a less-developed setting. Using plant-level data from Colombian, Mexican, and Moroccan firms, Clerides, Lach, and Tybout (1998) showed that higher productivity of exporters on those markets was merely high due to self-selection, rather than the result of past international trade activities. Aw, Chung, and Roberts (1999) used the firm-level data from manufacturing firms in Taiwan and South Korea to show that while firms from

Taiwan observed relative productivity improvements, in south Korea these effects were lower and the difference in productivity levels was mostly due to the self-selection effect. However, the results obtained by Blalock and Jertler (2004) were sharply contrasting to what was found in earlier works. They found that export starters faced 3-5% rise in productivity in the years following the entrance to international markets. Van Biesebroeck (2005) used the panel data from manufacturing plants in nine Sub-Saharan countries to confirm that firms participating in international trade increased their productivity advantage during the years following their entry to export markets. Alvarez and Lopez (2005) used Chilean firm-level data to confirm that exporting firms both experienced sharp rise in productivity during the first exporting year and that their productivity continued increasing because of learning by exporting effects. Fernandes and Isgut (2007) used Columbian firm-level data to reveal that unless the firm does not give up exporting, its productivity during the exporting years rises due to international trade activities. All mentioned researchers applied methods based on the estimating production function, but they were relatively weak in explaining exporting differences controlling for the endogenous productivity supremacy motivating firms to export.

Among the first economists, who tried to deal with endogeneity in exporters' productivity estimation through the usage of propensity score matching, were Girma et al. (2004). Using the data for the UK manufacturing plants they find that exporting leads to statistically significant exogenous productivity growth. De Loecker (2007) separately used the matching technique to estimate productivity premium of exporting firms controlling for endogenous exporters' productivity superiority. Using micro data from Slovenian manufacturing firms in 1994-2000, he shows that even though exporting firms are endogenously more productive, they experience productivity growth over time. Another finding was that firms, which export to high-income countries, receive much higher productivity growth

than those, exporting to middle- and not high-income countries, which further reveals that firms indeed learn by their export activities. These results were confirmed by more recent paper, where De Loecker (2012) improves the model by adding capital controls showing that exporting firms really gain from their export experience and such "Learning by exporting" effects do not diminish over time (in contrast to previous studies).

Since Girma et al. (2004) and De Loecker (2007) the idea of controlling for export selection using propensity score matching reached a considerable popularity in "Learning by Exporting" literature. Pisu (2008), who analyzed data from Belgian manufacturing firms, used propensity score matching and found, that neither exporters, nor exporters to more developed countries do not get productivity premium comparing to non-exporters (which is a bit similar for what Bernard and Jensen (1999) found in the US). Bigsten and Gebreeyesus (2009) used the plant-level panel data from Ethiopian manufacturing firms and applied propensity score matching to find a strong evidence of learning by exporting effect as well as the effect of self-selection for those who enter export markets. Haidar (2012) also used the propensity score matching while analyzing Indian firm level data and found that although more productive firms self-select to participate in international trade, they do not receive any significant improvement in productivity over the years following entry to export markets. Using Spanish firm-level data, Manjón et al (2012) revealed that even relaxing assumptions of productivity evolution and the role of export status, participation in international trade still provides Spanish firms with significantly positive annual productivity growth gains of about 3%. Valdec and Zrnc (2015) used the firm level data from Croatian manufacturing firms to find that exporting provides a statistically significant increase in productivity and sales growth (although this difference is not persistent).

Results of all above mentioned studies reveal that learning by exporting does not really work for firms in countries with more developed economies, but it can increase productivity for firms from less-developed countries, which provides higher justification for LBE hypotheses. The claim of export destination selectivity is intuitively very strong:

1) Residents of high income countries have more power to substitute goods of lower quality by those with higher quality, so the firm aiming to sell their goods in high income country should make more efforts to increase production quality (Atkin et al., 2014);

2) Higher purchasing power of high income countries residents increases competition among domestic producers and importers thus driving prices on manufacturing goods down. Therefore, firms aiming to maintain the sufficient margins selling goods at international markets, try to lower unit production costs by exploiting benefits from economies of scale and improving efficiency by the increasing in efficiency of inputs usage;

3) Higher competition drives producers to follow the latest productivity trends in the industry, making them actively invest in order to maintain the same level of productivity, and if it is possible - to outfit competitors.

Brambilla et al. (2011) reveal that Argentine manufacturing plants, exporting to high income countries, have higher proportions of skilled workers and pay higher wages than those, exporting to low-income countries (while by Syverson (2011) higher labor skill intensity with higher wages are both factors inducing productivity improvements). Crino & Epifani (2012) find significant negative correlation between revenue TFP and share of exports destined to low-income countries. Nicita et al. (2013) show that exporters to high-income countries have higher probability of survival, therefore, they are indeed more productive. Therefore, the substantial part of the learning by exporting investigation should

be devoted to measuring destination effects as well as simple evaluation of exporters productivity premium.

Despite the rich literature on learning-by-exporting, very few researches have been investigating these effects for Ukraine and other CIS countries. Golikova, Gonchar, and Kuznetsov (2011) studying the data from Russian manufacturing firms, identified that exporters (especially those who have been exporting for a long time), more heavily invest in R&D, have higher quality of management (as they employ managers with higher skills), and they stay more prone to implement IT technologies. Moreover, they discovered that exporting firms are more inclined to employ new technologies and develop. Bleaney, Filatochev, and Wakelin (2000) discovered a significant positive correlation between the exporting share of output and firm's employment in Ukraine, Russia, and Belarus. However, none of these papers estimated whether exporting firms from CIS countries receive productivity gains from participating in international trade. Our paper is an attempt to fill this gap in knowledge by evaluating learning by exporting effects using the firm-level data and thus identifying whether firms from CIS countries should be active in international trade and with whom it should trade for receiving productivity gains.

Chapter 3

METHODOLOGY

When we want to identify "learning" benefits from export activities, the main question is what "learning" means for firms? Is it a knowledge accumulation, research and development activities, or if is it the behavioral effect in better responding to market conditions. Nonetheless, one can easily see that applying the accumulated knowledge in combination with behavioral developments jointly lead to the increase in firm's productivity. This means that using the same amount of production factors, the firm starts producing higher output volumes. Therefore, the straightforward way to estimate productivity of a firm is to estimate the variation in firm's output net of variations in its key production factors. For example, for a Cobb-Douglas production function this procedure could look like this:

$$Y_{it} = K_{it}^{\beta_k} L_{it}^{\beta_l} e^{w} \qquad \rightarrow \qquad w_{it} = lnY_{it} - \hat{\beta}_k lnK_{it} - \hat{\beta}_l lnL_{it}, \qquad (1)$$

where Y is output of a firm (usually taken as sales volume);

K and L are volumes of capital and labor employed for production;

w is the desired level of total factor productivity.

Therefore, when we want to determine whether the firm learns from international trade or not, we need to look at the effect of exporting on w. However, there are a lot of issues, not controlling for which, we will not only get the biased estimates of productivity, but also overvalue the "learning" effect of international trade because of selection to export effects. In the next sections we

are going to address these issues and propose the ideas of how to get unbiased estimates by using the existing developments in the empirical literature devoted to production function estimation and randomization procedures for treating selection effects.

3.1. Dealing with endogeneity while estimating "learning effect"

The fact that productivity could be absolutely independent of firm's exporting status might have as well been reduced the task of estimating learning effects to simple fixed-effects regression of firm's productivity on its exporting status. However, as willingness of a firm to export is always empirically and theoretically connected with higher initial level of productivity, one cannot estimate the exogenous "learning" effect without controlling for the inevitable endogeneity problem. Therefore, the main task for all researchers, who have been working in this field is rather making up a properly randomized experimental design than choosing the right control factors for better regression specification.

When participants choose to take part in the experiment at their own will, there is no point in mentioning a random experiment (which is referred as a golden standard of experimental design). As only a truly random experiment is capable of revealing a true treatment effect on the group of participants, experiment designers try to randomize it using a variety of methods:

1) Subtracting time-invariant selection effects using difference-in-difference model;

2) Estimating a particular productivity threshold, after which most producers start exporting, using regression discontinuity tools;

3) Using propensity score matching to control for the selection effects by matching treatment group with the control group.

Although the first method was heavily used by economists in "learning by exporting" field including Bernard and Jensen (1999, 2004), the assumption that firm's ability to meet productivity requirements for entering international export market is time-invariant, remains quite weak. Seeking a particular threshold for productivity, after which firms choose to trade on external markets is also not that strong as our firm-level data reveals that a lot of Ukrainian firms choose to produce only for domestic markets even if their productivity is strong enough to overcome trade barriers. Therefore, the only feasible experimental design, which allows to estimate the effect of international trade activities on exporter's performance is the propensity score matching technique, developed by Rosenbaum and Rubin (1983) on the basis of Heckman's (1979) correction and which has already been actively used in evaluating "learning by exporting" effects.

The main assumptions of the propensity score matching include conditional independence assumption (factors, included into propensity score are not affected by treatment while the potential outcomes are independent of treatment conditional on propensity score covariates) and common support assumption (meaning that the fact of receiving treatment should be perfectly predictable given propensity score covariates) (Caliendo & Kopeinig, 2008). This means that propensity score matching cannot eliminate selection effects itself unless the specification of propensity score matching satisfies the underlined assumptions. Therefore, the procedure is incredibly sensitive to the factors chosen for propensity score estimation, as well as their interaction terms and polynomials, used for higher prediction power of the model. In order to evaluate learning by exporting effects De Loecker (2007) made use of the extended Melitz (2003) model of starting to export, specified in the following way:

$$\Pr\{Expstart_{i,0}=1\}=\Phi\{h(\omega_{i,-1}, k_{i,-1}, Private_{i,-1}, t, ind)\}, \quad (2)$$

where $Expstart_{i,0}$ is the fact that the firm decided to start exporting;

Φ is a cumulative distribution function of $\omega_{i,-1}$ (last year productivity);

$k_{i,-1}$ is the last year capital stock;

$Private_{i,-1}$ is the fact that the firm is not public;

t, ind - denotes time and industrial controls.

Although, this model does not fit well with the available data (as we do not have the public status of the firm), we decided to proxy private status by investment dummy (whether the firm invested last year or not) and use this model for the purpose of the robustness check. The choice of proxy is justified by Asker et al (2012) findings that public firms invest significantly less. Saxa (2008) also used it in order to evaluate treatment effects of starting to export for testing Learning by Exporting hypothesis in Czech Republic. In order to increase the predicting capacity of the model we also decided to increase the number of propensity score covariates by controlling for last year size of the firm ($l_{i,-1}$) (as Valdec & Zrnc (2015), Saxa(2008), Boermans (2010), and Masso & Vahter (2011) have done), its age (as Masso & Vahter (2011) and Boermans (2010) have done), and wage level as total labor expenses divided by the size of the firm (as Boermans (2010)). In this case the model specification can be described in the following way:

$$Pr\{Expstart_i,0=1\}=\Phi\{h(\omega_{i,-1}, k_{i,-1}, Invest_{I,-1}, l_{i,-1}, age, t, ind)\} \qquad (3)$$

In order to properly increase the prediction capacity, the Φ includes the full set of interactions and polynomials of covariates with time and industry controls. The essence of "matching" in the case of learning by exporting is in comparing the productivity outcomes for the "treated" firm, which started to export with the firm that already exports or did not start to export. The next step to go after estimating the logit regression, specified above, is the exact performing of

matching. The simplest way of doing that is by doing a Nearest neighbor matching, which is simply evaluating the cumulative effect of exporting (treatment) on firms, involved into international trade by applying the estimator, specified in De Loecker (2007):

$$\beta_{LBE}^{s} = \frac{1}{N_s}\sum_{i}\left(\sum_{s=0}^{S}\omega_{is}^{1} - \sum_{s=0}^{S}\sum_{j\in C(i)} w_{ij}\omega_{ij}^{C}\right) \quad (4)$$

where β_{LBE}^{s} denotes the cumulative "learning" effect on productivity, N_s is the number of firms in each particular sector, ω_{is}^{1} is the estimated productivity of the treatment group (exporters), ω_{ij}^{C} is the productivity of non-exporting firms, used as a control group.

The weights denoted as $w_{ij}=\frac{1}{N_i^s}$ return 1 if j belongs to the set of control units and 0 otherwise. This way every exporting firm is matched with the N_i^s control firms in order to evaluate the productivity premium received by exporters. For the purposes of robustness check, we will also use caliper matching algorithm, which is very similar to the nearest-neighbor procedure, but, in contrast, it specifies the maximum distance between propensity scores of treated and non-treated units (thus, if the distance between propensity scores of treated and non-treated is higher than the specified value, the method will not include it into ATT estimation).

One of the fundamental properties of learning is that the learner does not only obtain the productivity premium in the year of learning but that learner's productivity remains substantially higher even during the years after learning. The same case is for "learning by exporting" effects. Even in the US, where "learning

failed" by Bernard & Jensen (1999), firms had substantial productivity gains from the first year of export entry but these effects were not persistent after the next 3 years. Therefore, it is overly optimistic to judge on "learning by exporting" effect just by evaluating ATT from starting to export on TFP without checking the persistence of this productivity premium. Using the panel structure of our data, we are able to check persistence of these effects by measuring LBE effects using levels of TFP for export starter and forwarded TFP levels for the next 6 years and comparing their significance levels as well as their magnitudes.

3.2. Effects of export destination on productivity

One of the possible reasons why Bernard and Jensen (1999) did not identify the long-term productivity gains for exporters in comparison with non-exporting companies is that firms from the US have nothing to learn from markets, which they export to. In contrast to firms from developing countries, which put a large amount of effort to sell goods in international markets, firms from developed countries receive their benefits only from the economies of scale and higher revenues. So the next question to be addressed is that if Ukrainian firms really learn from exporting, does exporting to high-income countries provide higher productivity improvement than exporting to low-income countries.

De Loecker (2007) was one of the first to estimate effects of export destination for a developing country (as he evaluated these effects using the data before post-communist Slovenia entered European Union in 2004). He did that just by evaluating β_{LBE}^{S} for exporters to high-income countries and those, exporting to low-income countries separately. His results show that β_{LBE}^{S} for firms starting to export to high-income countries is considerably higher than $\beta_{LBE}^{S}$for firms, starting to export to low-income countries. Although this methodology is vulnerable to potential selectivity problems (as there is a large amount of

literature, showing that exporters to high income countries are larger in size, pay higher wages, and have higher output volumes than exporters to low income countries), we will be using the same methodology as we cannot find the one, which would satisfy our needs better. That is, we will evaluate propensity scores of firms, starting to export to high income, not high income, offshore countries, and Russia, mapping their ATTs on productivity for the starting year and for 6 following years comparing significance and volume of them.

3.3. Productivity identification

The empirical literature on the production function and productivity effects estimation revealed several weaknesses in evaluating productivity as a residual from the production function of labor and capital, including:

1) Simultaneity between output and production factors resulted from the direct influence of companies' next period sales decisions on their choice of inputs;

2) Selectivity between output and production factors as a result of dependence of companies' choice of inputs decisions and its willingness to stay solvent;

3) Heterogeneity in output making it not directly observable from the firm-level statistical data (Griliches & Mairesse, 1998).

While the solution to the third problem has the best resolution in using sales as the measure of output, the two latter were the reason for the vast area of literature concerning TFP estimation. One of the best solutions was offered by Olley & Pakes (1996), who used an exit variable as a control for selectivity and the level of investments as a proxy for known by the firm unobservable productivity determinants. However, due to scarce availability of investments in the existing datasets, production function coefficients were still estimated with

bias, which inspired Levinsohn & Petrin (2003) to produce another estimation algorithm, which used material costs instead of investments and value added as sales minus material costs as an output measure. However, the multicollinearity problem and no control for attrition led Ackerberg et al. (2015) to develop their own non-parametric version of Levinsohn & Petrin method, which we will use for TFP estimation. Even though these methods are different by their nature, they are built on the same assumptions, described by Ackerberg et al. (2015):

1) Strict monotonicity: Either investment or material costs should be strictly monotonically increasing in the level of productivity;

2) Scalar unobservability: Productivity should be a single unobservable, which influences capital and labor coefficients and which is not known to researchers while being known to firm;

3) Timing: the optimal amount of labor is chosen at the current period and it does not influence firm's future profits (thus, non-dynamic), while the level of investment and capital remain dynamic. Though being questioned by Ackerberg at all (2015), this assumption still resides in most of papers related to the production function estimation;

4) Markov's productivity dynamics: Dynamics of firm's productivity is described by the first order Markov process, it is known to firm and it grows over the firm's existence.

The choice of Levinsohn & Petrin method, corrected by Ackerberg (2015) is justified by the fact that across all years only 70% of firms in the dataset have reported non-zero investments. Our vector of free variables will include labor and material costs while our vector of state variables will include the book value of fixed assets, age of the firm and firm's export status. As the structure of inputs and specifications of the production process are different for each industry, we decided to estimate production functions and productivity residuals separately for each double-digit KZED, where participants operate.

Chapter 4

DATA DESCRIPTION

4.1. Data preparation

As most of empirical researchers who tested learning-by-exporting hypotheses, we use the firm level data for both exporters and non-exporters. The firm-level dataset includes the data from 2001-2013 company's financial statements with the set of exporting activity indicators, calculated using Official Customs Data. Both datasets include the data on more than 17000 firms, approximately 26% of which were involved in international trade.

In order to produce unbiased estimates and remove outliers we decided to make the following changes to the dataset:

1) The data on sales, fixed assets, material assets, and export volumes are deflated using PPI State Statistics Service of Ukraine estimates for 2001-2013;

2) We removed all micro-firms, which had less than 10 workers in any of years as well as firms employing above 99% percentile of labor, capital, and export volumes. We also removed firms with sales volume less than 200 th. UAH, book value of capital assets below 50 th. UAH, and annual material expenses below 20 th. UAH;

3) We kept only manufacturing firms (with KZED values from 15 to 37) in order to evaluate "learning by exporting" effects only for those firms, which were actually involved in production. We removed firms, which changed their KZED number during 2001-2013 year as well as those, which entered the dataset several times for some reasons;

4) We also added the dummy of whether the firm exports or not by using official customs data, aggregated by firm identification number and year.

After that, using volumes of exporting to high-income and not high-income countries, we generated dummies for starting to export, starting to export to high income countries, not high-income countries, to offshores, and to Russia. In order to not count firms exporting before 2002 year, only firms who started to export after 2003 year, are considered as starters.

The properties of main variables in the dataset, which we are going to use for the research are described in the Table 1 The definition of high income and not high income countries was brought from World Bank Country and Lending Groups webpage[8]. The definition of offshore countries was brought from IMF list of offshore financial centers[9].

[8] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

[9] http://www.imf.org/external/NP/ofca/OFCA.aspx

Table 1. Statistical properties of variables in the dataset

Variable	Number of observations	Mean value	Standart deviation	Mini mum value	Maximum value
Sales volume, th. UAH	84,826	36,535.5	386,793.1	200	30,900,000
Firm size, employees	84,826	144.00	465.5	10	36,827
Book value of fixed assets, th. UAH	84,826	10,466.98	183,084.7	50	31,300,000
Material expenses, th. UAH	84,826	22,364.11	274,992.7	20	29,700,000
Volume of export to high income countries, th. USD	26,195	1,493.93	21,700.0	0	2,040,000
Volume of export to offshores, th. USD	26,195	295.33	6,981.2	0	556,000
Volume of export to Russia, th. USD	26,195	1,730.69	26,300.0	0	3,160,000
Total export volume, th. USD	26,195	5,474.57	66,400.0	0	3,630,000
Age, years	84,826	3.47	3.3	0	12
Export status	84,826	0.31	0.46	0	1
The firm exports to high income country	26,195	0.56	0.50	0	1
The firm exports to not high income country	26,195	0.62	0.49	0	1
The firm exports to offshore	26,195	0.07	0.25	0	1
The firm exports to Russia	26,195	0.49	0.50	0	1

From the summary above one can see that the sample mostly consists of large firms with more than 100 employees, the value of fixed assets worth more than 10 mln. UAH, and sales volumes reaching up to 31 bln. UAH. Only 61% of observations contain reported non-zero investments, while only 31% of them contain data on international trade activities. The average presence of firms in the dataset is 3.5 years, with only 10% of them, present throughout the whole sample. Across observations with non-zero exports, 56% report exporting to high-income countries, 78% report exporting to not high-income countries, while only 7% report exporting to offshores. Almost half of all firms have been exporting to Russia, which is not strange given its status as Ukrainian strategic trade partner before 2014. We will use these data for both evaluating levels of TFP and for matching export starters to other firms in the dataset using propensity score matching.

4.2. Sample composition

The final dataset contains 84826 observations across 2001-2013 years. The total number of firms under study is 17463, from which 4501 firms exported at least once, 3276 firms exported to high income countries, 3958 firms exported to not high-income countries, 2788 firms exported to Russia, and 840 firms at least once exported to offshores.

Table 2. Sample composition

Year	Number of firms	Number of exporters	Number of exporters to high income countries	Number of exporters to not high income countries	Number of exporters to offshores	Number of exporters to Russia
2002	6,685	1,940	1,132	1,003	106	934
2003	6,897	2,068	1,254	1,099	111	962
2004	7,317	2,248	1,299	1,289	89	1,047
2005	7,620	2,210	1,277	1,281	98	1,016
2006	7,768	2,167	1,231	1,276	112	974
2007	7,849	2,324	1,312	1,425	97	1,033
2008	7,675	2,309	1,265	1,468	96	1,055
2009	6,836	2,235	1,221	1,387	263	992
2010	6,558	2,238	1,217	1,462	278	1,091
2011	4,500	2,045	1,090	1,430	147	1,149
2012	4,315	2,034	1,117	1,463	181	1,159
2013	4,635	2,377	1,215	1,690	188	1,412
Total	17,463	4,326	3,276	3,627	840	2,788

Dynamics of the firm number, the total number of exporters, and exporters by different export destinations in the dataset is provided in the Table 2. The maximum number of exporting firms is observed for 2007 year, the year prior to the Great Recession, which led to double devaluation of hryvnia and bankruptcy of a large number of firms. After that the number of firms started to decline, reaching a trough during 2011 year, when it dropped by 30% in a single year.

These attrition effects can be observed from the 2.5 times increase in the number of exporters to offshores, indicating that aiming to survive more firms started to use offshore countries to reduce tax burdens. Even though 2008 was the year of entering WTO for Ukraine, the number of exporters significantly dropped due to Global financial crisis.

When talking about the dynamics of exporters to different destinations, one can observe that during 2001-2013 years the share of exporters to high income countries dropped on 7.2%, while the share of exporters to not high-income countries soared on 13%. Although the high income share was accelerating over 2002-2003 years, it started to drop afterwards, as Ukrainian companies started to explore new export destinations. The share of exports to offshore countries appears to be low, sharply increasing during economic downturns and after entering WTO in 2008. The maximum number of exporting firms is observed for the 2013 year, which is consistent with the economic theory (as overvalued exchange rate of hryvnia in 2013 and higher level of productivity motivated more Ukrainian firms to start exporting). The number of firms exporting to Russia has been almost the same throughout all 12 years observed, the only rapid rise was for the 2013 year.

Overall, the data reveal that Ukrainian exporters do not prefer high income export destinations. Hence, they do not view exporting as some kind of learning experience, which allows to increase their productivity, the level of knowledge, and expertise. They tend to allocate their export volumes to not high-income countries because it imposes less requirements on product quality levels and because the group of not high-income countries includes CIS countries, which had close economic relations with Ukrainian firms from the times of the Soviet Union. The sample is an unbalanced panel with a significant amount of year variation, which we are going to capture by adding the year fixed effects into both TFP estimation procedure and while doing the matching analysis.

4.3. Are exporters really different from non-exporters?

Empirical studies, related to international trade, show that the level of productivity is not a single factor, by which exporters remain substantially different from firms, not participating in international trade. The need to produce higher output for selling it on international markets still require exporters to employ higher amounts of capital and more employees, which is also observed for the Ukrainian data. The comparison of median values of capital, size, and output for exporting and non-exporting firms can be observed on the Figure 2

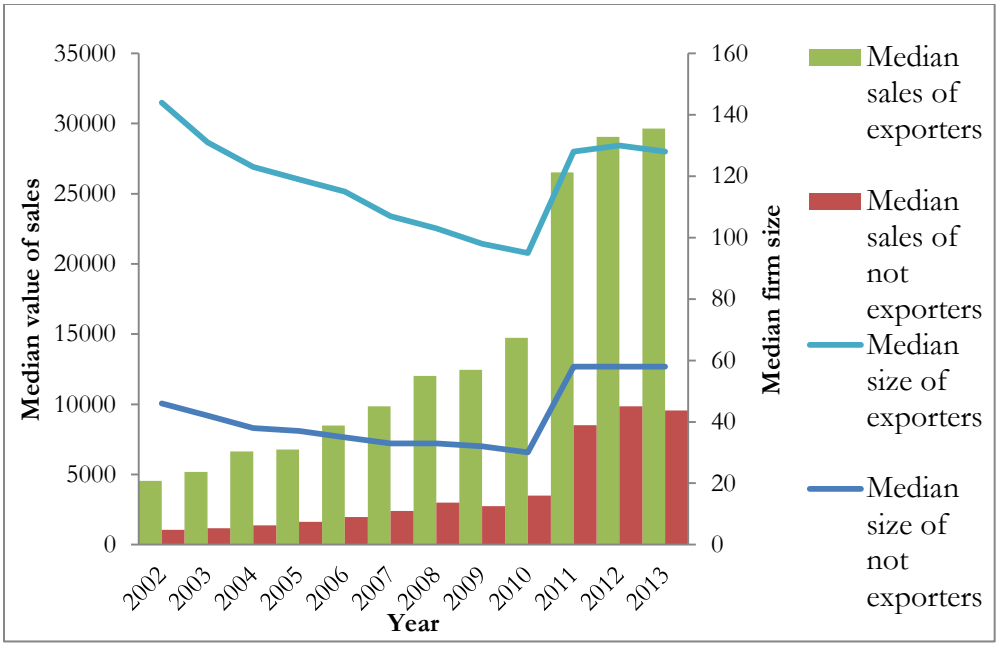


Figure 2. Comparison of exporters and non-exporters by sales volumes and size in 2002-2013 years

The Figure 2 reveals that exporters are usually larger in size, produce four times higher output, and employ five times higher book value of fixed assets comparing to non-exporters. The Figure 3 reveals that firms, which start exporting, increase

their output and labor levels twice, while employing thrice higher book value of fixed assets comparing to firms, which didn't start to export. That is why, the attempt to use current year sales, value of fixed assets, and current firm size will result in failure to meet balancing requirements (as starting to export immediately substantially change volume of capital, labor, and output, their inclusion to propensity score will violate unconfoundedness property). This fact combined with the tendency of the firm to plan entry to export markets beforehand (as Ukrainian exporters still need to collect a large amount of documents to start exporting), motivates inclusion of lagged values of capital and firm size rather than their current values to evaluation of propensity score.

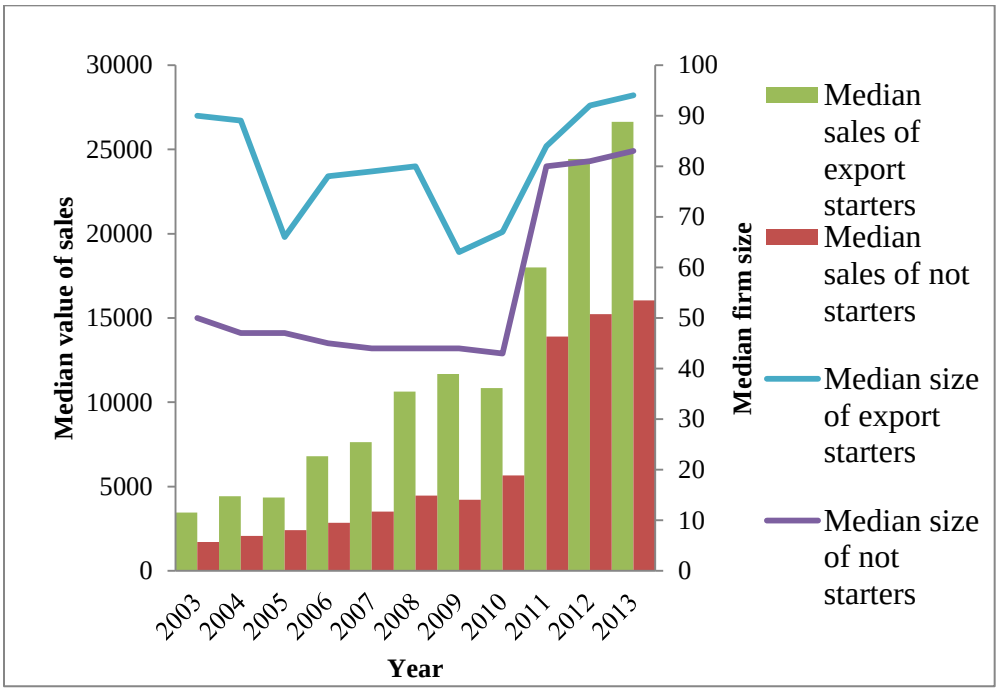


Figure 3. Comparing starters to export and non-starters by output, capital, and labor in 2002-2013 years

Chapter 5

ESTIMATION RESULTS

5.1. TFP estimation

After cleaning the data, removing outliers, and industry shifters, we applied Ackerberg-Caves-Phrazer correction of Levinsohn-Petrin method (2015) to evaluate the total factor productivity by each 2-digit 2005 KZED number. The Figure 4 shows that TFP values are normally distributed across the whole sample with mean value close to 2.055, the minimum value of -7.71, and the maximum value of 10.62. The Figure 4 shows that values of TFP happen to be mostly positive and increasing over the years in the sample.

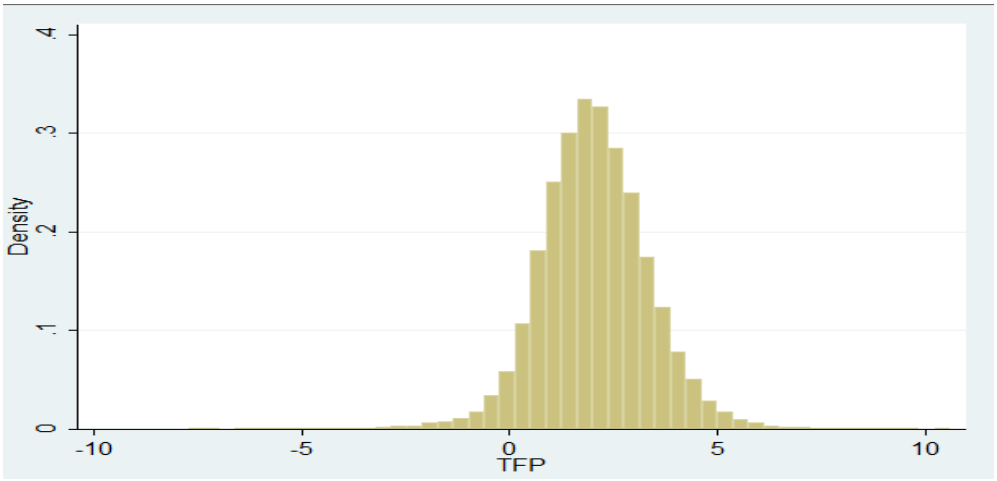


Figure 4. Distribution of TFP in the sample

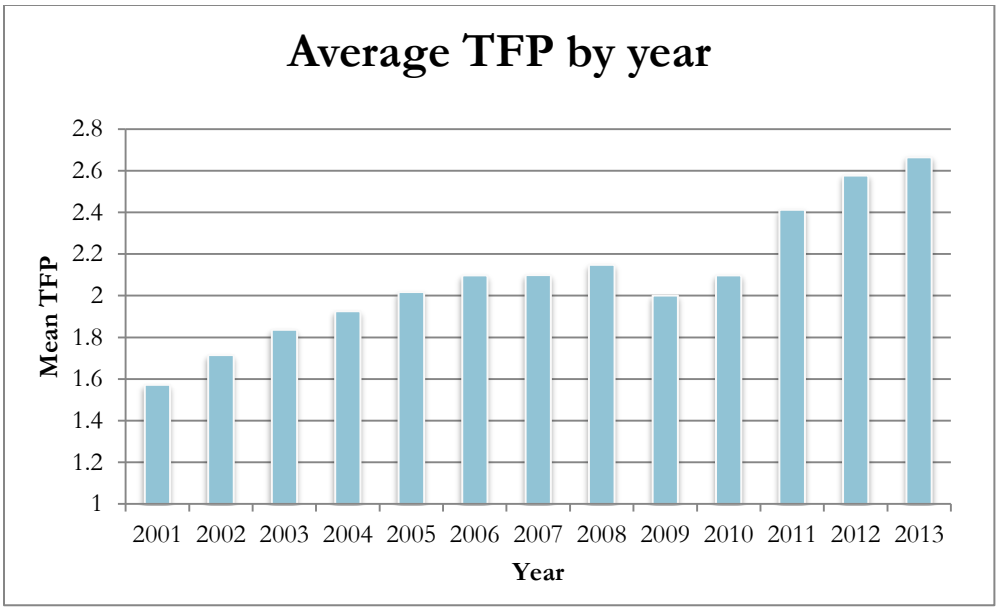


Figure 5. Evolution of TFP in 2001-2013 years

As one can observe, since 2001 the TFP level of Ukrainian firms has grown on 69%. Although, the steady productivity growth has stopped during the depth of the Great Recession, it has revived during 2011 year, reaching the maximum level in 2013 year. This is also consistent with the Figure 6 and modern trade theory as the number of exporting firms has always been growing hand in hand with country- and industry-wide productivity level. The Figure 5 reveals that the average TFP level of exporters was always 30-50% higher than for not exporters. However, this difference was smoothed during 2011-2013 years after Great Recession has led to exit of less productive non-exporting firms.

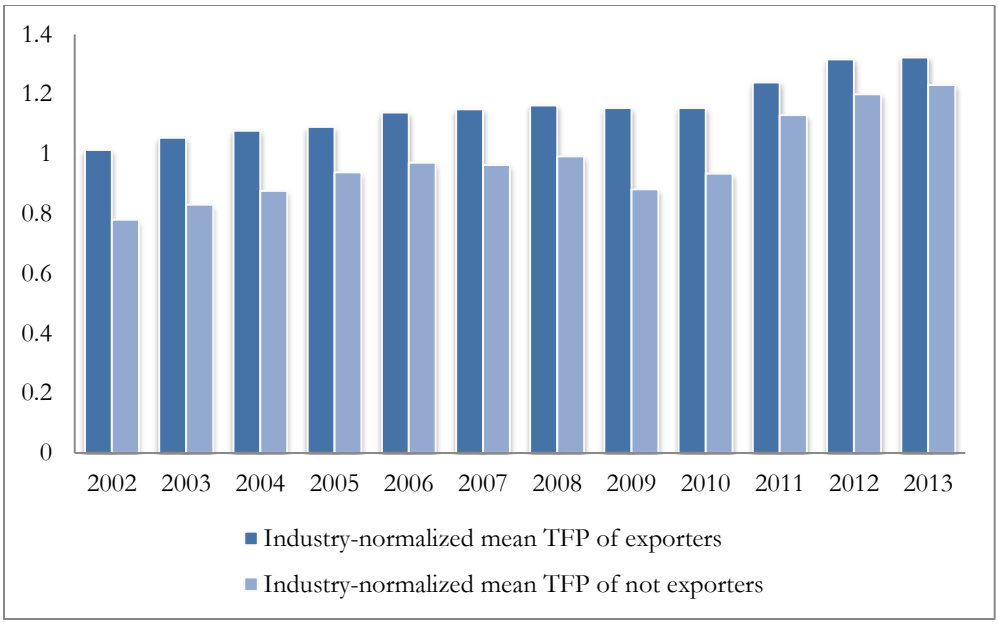


Figure 6 - Industry-normalized average productivity levels by export status in 2002-2013 years

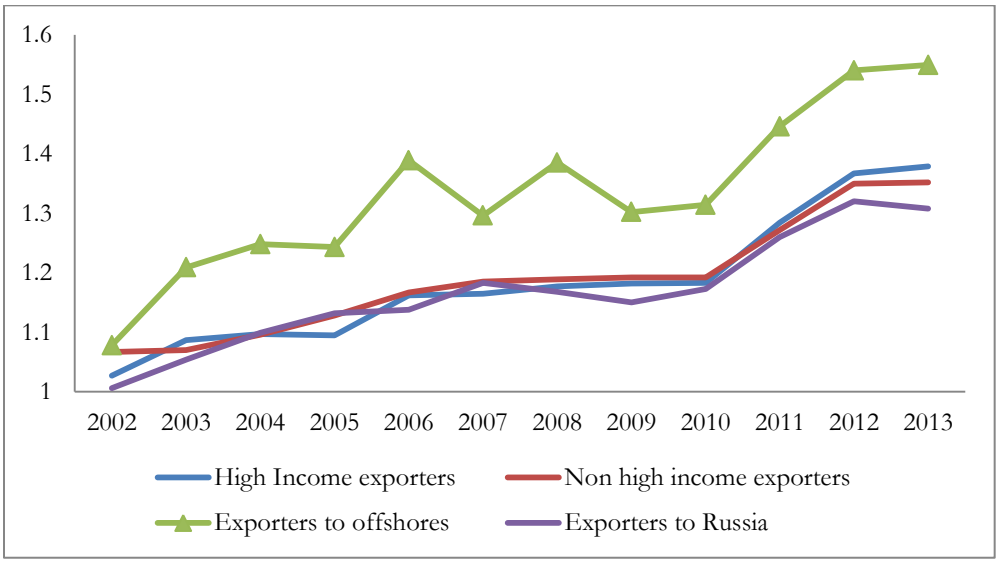
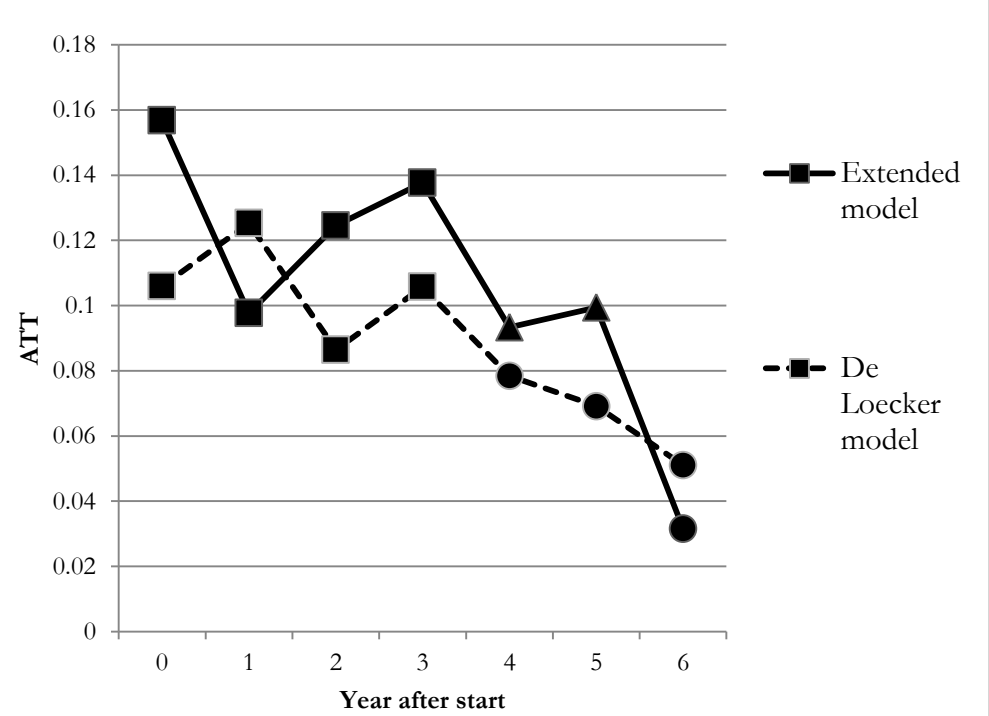


Figure 7. Trajectories of industry-normalized average productivity across export destinations in 2002-2013 years

Although the prevalence of mean TFP level for exporters is consistent with the modern trade theory, the effects of export destinations appear less straightforward. Not high-income exporters on the average have 4.94% higher productivity levels, while exporters to offshores have 7% higher level of TFP than exporters to not high-income destinations and 12% higher TFP than exporters to high-income export destination. Starting from 2004 exporters to Russia have been showing much higher mean productivity level than exporters to other not high-income countries. However, exporters to offshore destinations remain the leaders in terms of mean productivity levels. Although, this is pretty consistent with the fact that a lot of firms exploit offshore subsidiaries and operations with them to lower tax liabilities and free up more value for productivity enhancing capital expenditures, this comparison cannot reveal causal differences, induced by starting to export to a particular export destination. The further section will describe the causal productivity premiums from export activities, obtained as an average treatment effect on the treated via propensity score matching.

5.2. Valuing causal productivity premium for exporters

In order to make our analysis more robust we decided to evaluate and check persistence of the ATT coefficients using 2 models: one - designed by De Loecker (2007), and the extended model, specified in the section 3, which also controls for the last year firm size, and current age of the firm. Although the second one fits better with the data, the first one has stronger theoretical background. The average treatment effects on the treated for both models obtained with assigning caliper of 0.0001 and estimated for both the TFP of the export entry year and the 6 consecutive years, following export entry, are provided on the Figure 8.



Note: square markers indicate values, significant for 95% confidence level, triangle markers indicate significant values at 90% confidence level, circle markers indicate not significant coefficient values.

Figure 8. ATT coefficients by the year after entering export markets estimated with caliper matching

Figure 8 is absolutely consistent with findings of Bernard and Jensen (1999). As soon as the firm starts exporting, its productivity level faces a sharp rise, which gradually ceases over the next 3 years. De Loecker model (2007) shows that this premium becomes statistically insignificant after the fourth year of exporting while the extended model shows that this drop of significance occurs at the sixth year while the fourth and the fifth year effects remain significant at the 90% confidence level. Nonetheless, the message of both models is the same: even after

the third year after entering export markets, firms stay much more productive than firms which did not start exporting.

Using the extended model we have also estimated ATTs for each 2-digit kzed code by 2005 classification and underlined which producers face one-time productivity effect (just the starting effect), for which industries this effect is persistent and which industries face no significant learning by exporting effect via the Table 3.

Table 3. Industry differences in learning by exporting

LBE effects	Industry	2-digit KZED
Negative effect	Skin and skin articles	19
	Cars, trailers and semitrailers	34
	Medical and measuring equipment	33
	Office equipment and computers	30
	Radio and telecommunications equipment	32
Insignificant or no effect	Fur and fur articles	18
	Wood and wood articles	20
	Paper and paper mass	21
	Refining and nuclear materials	23
	Plastic and rubber products	25
	Other non-metal mineral products	26
	Metallurgical production	27
	Completed iron articles	28
	Electric machinery and equipment	31
	Other transportation equipment	35
	Furniture	36
	Waste treatment	37
Single-time effect	Textile	17
Persistent effect	Food and bewerages	15
	Publishing and printing activities	22
	Chemical industry	24
	Machinery	29

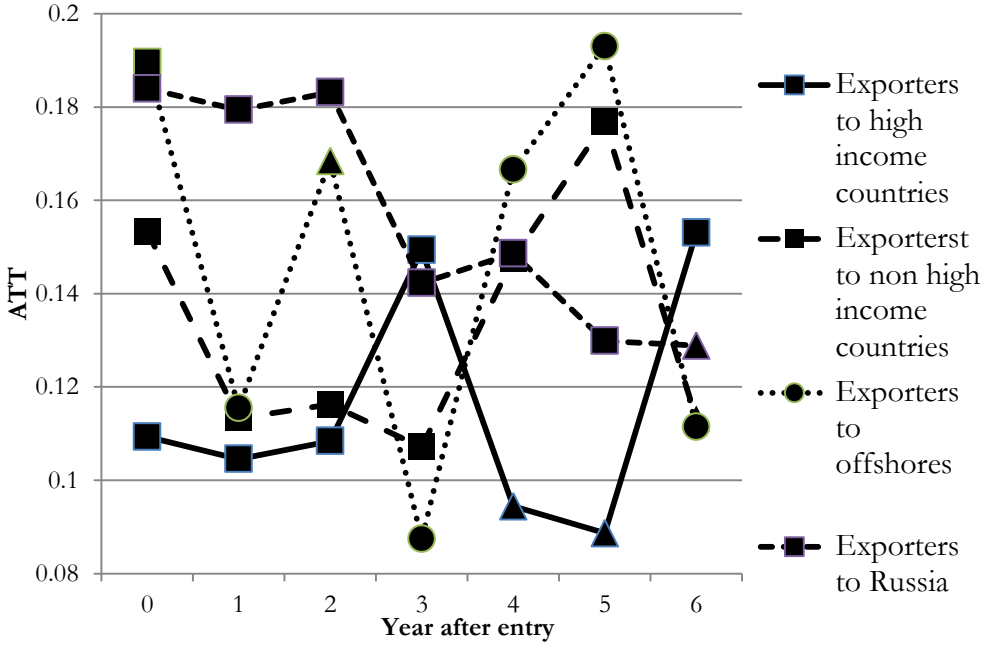
The negative effect means that the productivity premium for these industries is negative (even though the significance of these coefficients remains quite low). Insignificant effect means that the ATT was insignificant, while single time effect indicates statistically significant positive ATT only after the first year of exporting and rapid ceasing of significance later. The persistent effect means that shown industries maintained productivity premium positive and statistically significant at 90% confidence level throughout most of the years after starting to export. Therefore, learning by exporting exists for Ukrainian firms, especially for those in food and beverages, publishing and printing, chemical, and machinery industries.

5.3. Trajectories of productivity gains across export destinations

The next step of our analysis is in checking whether the same learning effects are observed for export starters to high income, not high income countries, Russia, and offshores. Using the same extended model and incorporating variables, indicating starting to export to high income, not high income, offshore export destinations, and Russia we have estimated the average effect of treatment on the treated on TFP of the starting year and on its levels during 6 subsequent years after the start. These ATT estimates are provided on the Figure 9.

Firms, starting to export to high income export destination gain 10% rise in productivity during the first year and this productivity premium is the lowest comparing to starters to other export destinations. However, starting from the second year, they rapidly grow their productivity level and become undoubted leaders comparing to other exporters. During the next year their productivity premium drops and becomes statistically insignificant before again skyrocketing to the leading level during the sixth year. It looks like exporting to high income export destination is the only type of exporting, leading to long-run productivity supremacy although short-term gains are not that high. Therefore, if Ukrainian

firm is strong enough to not exit after 6 years, it can reckon on productivity leadership by choosing high income export destinations.



Note: square markers indicate values, significant for 95% confidence level, triangle markers indicate significant values at 90% confidence level, circle markers indicate not significant coefficient values.

Figure 9. ATT coefficients by the year after entering high income, not high income, offshore, and Russian export markets estimated with caliper matching

Exporters to not high-income countries face another productivity trajectory. After a rapid rise in productivity resulted from entering not high-income market, the firm ceases its TFP level and keeps it on the comparably low level during the next 3 years. However, after a trough during the third year, its productivity rapidly rises up, reaching a peak during the fifth year. But this productivity supremacy

lasts only till the sixth year of trade, when this premium is the lowest and loses significance. Exporters to Russia are not only the leaders in the starting productivity premium, but they retain steady productivity leadership during the next 2 years. However, instead of growing their productivity, they start losing their productivity supremacy so that the productivity premium drops and loses statistical significance after the fifth year. It is clear that comparing to exporters to other export destinations, who exceed their first year productivity premium after the fourth year, exporters to Russia do not enhance their productivity, which undermines learning by exporting effects for them. Figure 9 also reveals that exporting to offshores for tax burden elimination leads only to the first year statistically significant productivity gain. After that productivity premium loses significance so that we cannot count next year productivity improvements as statistically different from 0. Therefore, the only category of exporters, who show the clear evidence of "learning" are exporters to high income countries. They start with lower level of productivity gains but improve them significantly in contrast to firms, choosing other export destinations and just benefitting from short-term TFP improvements.

Chapter 6

CONCLUSIONS

So, do exporters really obtain more from exporting than just increasing output volumes due to higher demand? Ukrainian data reveals that yes, apart from growth in production factors usage, Ukrainian exporters also improve their productivity. Moreover, these effects are persistently high and statistically significant even after the third year of trade (although ceasing starting from the fourth year). The usage of propensity score matching algorithm reduces the endogeneity from selection to exports done on the basis of the current productivity level. Another important finding is that the level of resulting productivity premium largely depends on industry where the firm operates and the export destination. Persistent learning by exporting effects are observed for food and beverages, machinery, publishing, and chemical industry.

Exporting to high income countries does not induce large short-term productivity gains at the beginning while due to learning they succeed in improving their starting TFP and maintain productivity leadership during the third and the sixth year of exporting. In contrast, exporters to not-high income countries, have higher immediate gains from starting but they succeed in overcoming that level only during the fifth year (losing supremacy during the next year). Exporting to Russia brings the highest level of immediate productivity improvement, but they never reach their starting productivity premium, reducing productivity gains in each of the following years. Exporting to offshores leads only to one-year productivity supremacy while latter productivity improvements remain insignificant. Therefore, when firm owners want to start exporting and they want to choose the starting destination, they should make a strategic decision of whether benefit from short-term productivity excellence induced by exporting to

Russia or other not high-income countries or to receive less substantial short-term productivity improvement from exporting to high income country but skyrocketing it during the next three years.

Although our research is not the first in the learning by exporting field, it still largely contributes to the literature. At first, De Loecker model of export entry (2007) is extended by controlling for size of the firm, its age, and investment level, which not only increase the predicting capacity of the propensity score but are helpful in explaining productivity differences of export entrants. This research is also the first, which apart from estimating learning effects separately for high- and not high-income countries, also evaluates effects of exporting to offshores. Finally, this research is the first one, doing learning by exporting analysis for Ukrainian firms using propensity score matching methodology. This research can be improved upon by adding 2014-2016 year data, which exactly refers to the period of intensifying trade with European Union and the same time, lowering exporting to Russia and CIS countries due to Trade War. The search for better balancing propensity score specification which accounts for other factors, not affected by treatment, is also the issue, which I hope, will be resolved in the nearest future.

Results of this research can be useful for both policymakers in the area of trade and international economics and for Ukrainian business. The data-driven fact that exporting leads to productivity improvements can become a strong argument for the management of Ukrainian companies to start exporting. Moreover, it can motivate forward-looking managers to overlook their trading portfolios to increase trading volumes with the EU, the US, and other high income countries, while lowering shares of not high-income exporting in order to get long-term productivity differences. The fact that seeking tax escapes from trading through offshores does not improve productivity of the firm can be used both for management of corporations to doublethink before taking these actions and for

the government as a motivation to impose export tariffs to trading flows, going to offshore countries.

Although business people should think more on how they get higher productivity improvements, the clear recommendation for policymakers should be to motivate firms to enter export markets. However, we do not think that it is efficient to motivate firms to export by offering more lucrative loan options or by heavily subsidizing business in export-oriented industries. The productivity does not grow when firms get the ability to trade because cheap finances and governmental help allows them lowering FOB prices. Ukrainian firms should be intrinsically motivated to trade, and the key role of the government in this case should be to create favorable conditions instead of supplying financial resources. For now on this process can be accelerated by reducing requirements of selling foreign currency, obtained as external revenues, and by reducing the level of bureaucracy and the number of agencies, which the firm should visit for getting access to international markets. Another issue is by providing informational support to firms, aiming to start selling to high income markets by opening free access to their production and quality requirements. We do believe, that by further entering export markets, Ukrainian firms will become more productive, which will lead to increase in real per capita GDP, drive economic growth and take Ukraine out of the poverty during the next twenty years.

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APPENDIX A

Classification of high-income, not high-income, and offshore countries

Table 4. List of high income countries

Australia	Finland	Italy	Norway	Spain
Austria	France	Japan	Oman	St. Kitts and Nevis
Belgium	French Polynesia	Korea, Rep.	Poland	St. Martin (french part)
Canada	Germany	Kuwait	Portugal	Sweden
Channel islands	Greece	Latvia	Puerto Rico	United Kingdom
Chile	Greenland	Lithuania	Qatar	United States
Czech Republic	Guam	Netherlands	San Marino	Virgin Islands (U.S.)
Denmark	Hungary	New Caledonia	Saudi Arabia	
Estonia	Iceland	New Zealand	Slovak Republic	
Faroe islands	Israel	Northern Mariana Islands	Slovenia	

Note: the classification is based on 2018 World Bank Country and Lending groups (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups)

Table 5. List of offshore countries

Andorra	Ireland	United Arab Emirates
Antigua and Barbuda	Isle of Man	Uruguay
Aruba	Liechtenstein	
Bahamas, the	Luxembourg	
Bahrain	Macao Sar, China	
Barbados	Malta	
Bermuda	Monaco	
British Virgin Islands	Palau	
Brunei Darussalam	Seychelles	
Cayman Islands	Singapore	
Curacao	Sint Maarten (dutch part)	
Cyprus	Switzerland	
Gibraltar	Trinidad and Tobago	
Hong Kong Sar, China	Turks and Caicos Islands	

Note: the classification is based on IMF Offshore Financial Centers list (http://www.imf.org/external/NP/ofca/OFCA.aspx)

APPENDIX B

Ukrainian industry codes

Table 6. Description of 2-digit KZED of 2005 year

Code	Kind of economic activity
15	Food and beverages
16	Tobacco products
17	Textile
18	Fur and fur articles
19	Skin and skin articles
20	Wood and wood articles
21	Paper and paper mass
22	Publishing and printing activities
23	Refining and nuclear materials
24	Chemical industry

Appendix B Continued

Code	Kind of economic activity
25	Plastic and rubber products
26	Other non-metal mineral products
27	Metallurgical production
28	Completed iron articles
29	Machinery
30	Office equipment and computers
31	Electric machinery and equipment
32	Radio and telecommunications equipment
33	Medical and measuring equipment
34	Cars, trailers and semitrailers
35	Other transportation equipment
36	Furniture
37	Waste treatment

APPENDIX C

Sample composition by industry codes and year

Table 7. Number of firms in the dataset by 2-digit KZED and year

2-digit KVED	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
15	2,008	2,085	2,032	2,045	2,035	1,990	1,944	1,810	1,636	1,549	1,150	1,092	1,015
16	16	13	13	11	9	9	7	8	9	7	7	5	5
17	129	137	137	143	152	136	126	120	100	98	65	67	80
18	241	256	254	268	290	308	284	280	239	231	168	162	167
19	91	94	95	92	97	102	96	84	82	75	54	51	56
20	196	270	323	359	389	400	408	402	325	301	163	159	165
21	75	88	103	116	133	128	137	140	127	126	104	103	121
22	420	528	551	601	622	625	612	577	530	497	258	213	207
23	37	39	43	44	44	40	48	47	36	34	28	25	25
24	250	278	283	304	307	303	306	306	291	296	226	233	257

Appendix C Continued

2-digit KVED	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
25	194	255	274	321	354	387	440	449	407	366	256	246	267
26	496	536	572	605	665	695	783	813	706	669	457	407	382
27	77	87	84	96	107	109	124	138	125	130	101	101	139
28	280	297	319	380	431	461	498	510	444	419	280	274	389
29	713	701	724	759	769	780	770	749	696	703	481	465	548
30	27	34	33	31	31	30	34	38	26	30	11	10	8
31	198	212	238	261	268	305	320	304	262	256	180	196	233
32	62	63	68	70	70	66	63	54	44	43	26	31	40
33	105	113	120	134	140	154	142	150	138	139	85	84	109
34	69	77	68	72	67	66	60	65	56	56	45	39	64
35	93	105	123	119	125	126	134	132	116	107	90	103	113
36	281	297	324	355	377	408	401	382	323	305	182	182	185
37	113	120	116	131	138	140	112	117	118	121	83	67	60

APPENDIX D

Average effects of treatment on treated using nearest-neighbor matching

Table 8. Results of ATT estimation using Nearest Neighbor matching

Period	Start		1 year after start		2 years after start	
Measure	ATT	s.e	ATT	s.e	ATT	s.e
Exporters	0.1568**	0.0357	0.1013**	0.0385	0.1232**	0.0422
Exporters (De Loecker model)	0.1060**	0.0360	0.1244**	0.0384	0.0871**	0.0421
Exporters to high income countries	0.1093**	0.0399	0.1059**	0.0421	0.1079**	0.0444
Exporters to not high income countries	0.1525**	0.0357	0.1137**	0.0375	0.1176**	0.0410
Exporters to offshores	0.2082**	0.0785	0.1205	0.0847	0.1662*	0.0927
Exporters to Russia	0.1839**	0.0423	0.1806**	0.0455	0.1843**	0.0483

Note: ** -significant at 95% level, * - significant at 90% level

Appendix D Continued

Period	3 years after start		4 years after start		5 years after start		6 years after start	
Measure	ATT	s.e	ATT	s.e	ATT	s.e	Measure	ATT
Exporters	0.1366**	0.0459	0.0918*	0.0495	0.0994*	0.0572	0.0305	0.0664
Exporters (De Loecker model)	0.1049**	0.0447	0.0785	0.0501	0.0752	0.0577	0.0555	0.0665
Exporters to high income countries	0.1493**	0.0494	0.0915*	0.0539	0.0893	0.0593	0.1572**	0.0675
Exporters to not high income countries	0.1076**	0.0445	0.1507**	0.0508	0.1782**	0.0579	0.1142*	0.0646
Exporters to offshores	0.1099	0.0996	0.1495	0.1117	0.2135	0.1702	0.0855	0.1672
Exporters to Russia	0.1398**	0.0528	0.1447**	0.0612	0.1310*	0.0681	0.1332	0.0812

APPENDIX E

Average effects of treatment on treated using caliper matching

Table 9. Results of ATT estimation using Caliper matching(** -significant at 95% level, * - significant at 90% level)

Period	Start		1 year after start		2 years after start	
Measure	ATT	s.e	ATT	s.e	ATT	s.e
Exporters	0.1568**	0.0357	0.0977**	0.0384	0.1245**	0.0422
Exporters (De Loecker model)	0.1060**	0.0360	0.1252**	0.0384	0.0864**	0.0422
Exporters to high income countries	0.1093**	0.0399	0.1046**	0.0422	0.1084**	0.0444
Exporters to not high income countries	0.1533**	0.0357	0.1133**	0.0374	0.1163**	0.0410
Exporters to offshores	0.1897**	0.0786	0.1155**	0.0843	0.1684*	0.0926
Exporters to Russia	0.1839**	0.0423	0.1794**	0.0455	0.1831**	0.0483

Note: ** -significant at 95% level, * - significant at 90% level

Appendix E continued

Period	3 years after start		4 years after start		5 years after start		6 years after start	
Measure	ATT	s.e	ATT	s.e	ATT	s.e	Measure	ATT
Exporters	0.1377**	0.0459	0.0934*	0.0495	0.0995*	0.0573	0.0316	0.0666
Exporters (De Loecker model)	0.1057**	0.0447	0.0785	0.0501	0.0692	0.0577	0.0511	0.0666
Exporters to high income countries	0.1493**	0.0494	0.0944*	0.0538	0.0887	0.0593	0.1531**	0.0676
Exporters to not high income countries	0.1071**	0.0445	0.1475**	0.0509	0.1767**	0.0581	0.1132*	0.0648
Exporters to offshores	0.0874	0.0987	0.1666	0.1123	0.1930	0.1687	0.1114	0.1650
Exporters to Russia	0.1423**	0.0528	0.1486**	0.0610	0.1299*	0.0681	0.1289	0.0813