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International Trade and Productivity: Firm-Level Evidence from Ukraine

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Yevgeniya Shevtsova [†]

Abstract

The paper empirically assesses microeconomic exporting-productivity nexus using the data for Ukrainian manufacturing firms for the years 2000-2005. The results of the estimation show that firms with higher total factor productivity (TFP) levels in the period prior to entry are much more likely to enter export markets. Also age, size and intangible assets of the firm have significant positive influence on the probability of exporting. In testing learning-by-exporting effect I employ propensity score matching to address issues of endogeneity and sample selection. When the estimation is done for the whole universe of firms in the dataset, the results go in line with common trends and suggest significant positive post-entry productivity effect for the firms that enter export markets for the first time (in the *t, t+1* and *t+2* periods). At the industry level the results confirm the presence of learning-by-exporting effect in some industries. However the effect is not universal and varies between different types of exporting firms.

JEL codes: D24; F14; L25

Keywords: exports; TFP; control function; matching; sample selection; endogeneity

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[*] I wish to thank Doctor David Brown for his continuous guidance and valuable comments. All remaining errors are the responsibility of the author.

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Introduction

In the last quarter-century there has been a considerable increase in the openness of the Ukrainian economy. The percentage of Ukrainian exporting firms has risen sharply after the collapse of the Soviet Union in 1991 and has been exhibiting strong positive dynamics since then. At the same time the structure of Ukrainian export has undergone through some significant changes. Row materials and semi-processed products that constituted the largest part of the Ukrainian export during 1990s have been partially replaced by the manufactured products of higher levels of processing.

In the current paper the research focus is made on exploring export-productivity linkages at the level of individual firms on the basis of the database covering main output sectors of the Ukrainian economy for the period 2000-2005. During the past decade increasing number of studies has emerged on the link between exporting activity and productivity at the micro-level. The literature suggested a number of ways by which engaging into international trade could be beneficial to the firm's as well as aggregate productivity growth.

Two alternative hypotheses of the casual link between exporting activity and productivity performance have been widely discussed. The first one is self-selection hypothesis that is based on the commonly known fact that companies engaging into exporting have to overcome barriers to export and make some prior investments in order to compete effectively in overseas markets. Costs associated with exporting are known as sunk-cost, and include costs of marketing, distribution, establishing foreign networks and others. Hence according to the self-selection hypothesis only more productive firms manage to enter and successfully operate in foreign markets while firms with lower productivity remain purely domestic. This hypothesis raises a question of whether there is a further learning effect from operating in international markets. Logically, firms that operate in the international markets have better access to the new knowledge and technical expertise through their international contacts, which should result in further advances in their productivity.

A number of recent studies have addressed the importance of these two hypotheses in the explaining productivity differences between exporting and non-exporting companies. Bernard and Jensen (1999) address these two questions using micro-data for the US; Clerides, Lach and Tybout (1998) - for Columbia, Mexico and Morocco; Aw and Hwang (1995) - for Taiwan; Aw, Chung and Roberts (2000) - for Taiwan and Korea; Delgado, Farinas and Ruano (2002) - for Spanish firms; Baldwin and Gu (2003) - for Canada; and Harris and Li (2005) - for the UK. All authors find strong empirical evidence supporting self-selection hypothesis. However, much less support has been found in favour of the learning-by-exporting hypothesis[‡].

I would like to mention that in a way this empirical exercise also allows to make some judgements regarding the importance of the IPR protection for the national economic growth. Let us recall that Ukraine is a country known for its under-protection of IPR and even in cases when the legislation corresponds to the international standards, its implementation and enforcement still remain questionable. However, empirical evidence suggests that Ukrainian exports have still been exhibiting positive dynamics during the period under study. Moreover, Ukraine's main export partners included countries of the Commonwealth of Independent States and members of the European Union, which provides an opportunity to explore trade flows between Ukraine and its more advanced trading partners. Thus, results of the current study should help to conclude if there is a real effect of technology spillovers on the productivity growth of exporting firms.

Thus in the scope of the current study I use firm-level data from Ukraine to assess the influence of exporting on productivity growth within firms across a set of manufacturing and service sectors. The main purpose of this chapter is to study differences in economic performance between exporters and non-exporters. First I estimate the unbalanced panel of Ukrainian firms for the years 2000-2005 to consider whether exporters are more productive prior to entry into overseas markets and/or whether there is also a post-entry learning-by-exporting effect. Further I study the differences in the effect of foreign market participation for 14 manufacturing and 5 service sectors separately.

The rest of the paper is organized as follows. Next section provides review of the relevant literature. Third section contains a brief overview of the main trends in Ukrainian export dynamics. Section 4 provides the descriptive statistics of the data used in the analysis. Section 5 describes the methodology used for the estimation of the TFP and presents econometric estimates of the production function for the whole sample and for separate industries. Section 6 describes the methodology used to estimate the differences in the TFP of exporting and non-exporting firms and presents results of the estimation for the matched sample of firms for the whole sample and for separate industries (for the list of industries refer to Appendix 1). Section 7 concludes.

[‡] The summary of evidence is given in Table 1 of Greenaway and Kneller (2005).

Literature Review: Exports and Productivity Links

In recent years the topic of the microeconomic evidence of international trade has become increasingly popular leading to a rapidly growing body of literature focusing on exporting and its impact on firm performance. Emerging interest in the firm-level evidence can be partially explained by the availability of high quality micro-level data, and partially by the development of new approaches in theoretical modeling and new econometric techniques, which allowed exploring usually more intricate datasets.

Due to the availability of more developed econometric methodologies recent research on the exporting-productivity links has been mostly empirically driven and proves the existence of the positive relations between productivity and exporting. However, there is still a lot of controversy about the direction of the relationship: whether causality runs from productivity to exporting, vice versa, or in both directions. Most of the authors examine these issues by testing two alternative hypotheses.

The first one is a '*self-selection* hypothesis' that presumes that on average firms that enter export markets have higher productivity prior to entry, relative to non-entrants. This hypothesis is supported by the substantial factual evidence of differences in characteristics between exporting and non-exporting firms. Stylized facts from a number of countries suggest that, on average, exporters are bigger, more productive, more capital intensive and pay higher wages. The reasons of a relatively better performance in case of export-oriented firms are easy to derive. First of all entrance and successful operation on the export market depends upon the ability of the firm to face and successfully overcome a significant competition from the side of foreign rivals. Another reason of a better exporter's performance is the existence of sunk entry costs, which means that exporters have to be initially more productive than their domestic rivals to afford such fixed costs of entering a foreign market.

An alternative but not excluding is a '*learning-by-exporting'* hypothesis, which means that firms that manage to enter the export market continue to experience acceleration in their productivity growth following entry; the reasons for this include access to the new, better technologies and product designs, knowledge, technical expertise, which contributes to the overall improvement of the manufacturing process. Another important reason for improvement in productivity is that firms participating in foreign market may acquire information from foreign customers and foreign contacts about new managerial practices. This proposition however has received less support in the empirical as well as theoretical literature.

Recent empirical research on the basis of firm-level data provides strong empirical evidence in favor of the 'self-selection' hypothesis, confirming existence of significant productivity differences between exporting and non-exporting establishments. Several empirical studies, such as Bernard and Jensen, 1999, Girma et. al., 2004, Baldwin and Gu, 2004, Greenaway and Kneller 2004; Aw, Chang and Roberts, 2000 (for Taiwan), and Clerides, Lack and Tybout, 1998 (for Colombia, Mexico, and Morocco) have addressed this issue of 'self-selection'.

Theoretical models developed by Crelides (1998), Melitz (2003), Bernard et. al. (2003) also provide theoretical proof that firms have to be more productive to overcome fixed (sunk) costs and enter the export markets.

For example the paper by Melitz (2003) develops a dynamic industry model with heterogeneous firms to analyze intra-industry effects from international trade. The author incorporates firm heterogeneity into Krugman's model of trade under monopolistic competition and increasing returns. The model developed in the paper relies on the Hopenhayn's (1992a, 1992b) work to explain endogenous selection of heterogeneous firms in the industry. Hopenhayn derives the equilibrium distribution of the firm productivity based on the profit maximizing decisions of initially identical firms uncertain of their current and future productivity. Melitz adapts Hopenhayn's model to a monopolistically competitive industry in a general equilibrium setting (Hopenhayn considers the case of perfect competition). The main contribution of the Melitz paper is that it provides a general equilibrium model with geterogeneous firms that yet remains easily tractable. In order to achieve it the author integrates firm heterogeneity in such a way that for the aggregate outcome the relevance of the distribution of firm's productivity is summarized by an average firm productivity level. After the average productivity level is determined the aggregate outcomes of the model become identical to the ones of the model with identical firms that all share the same productivity level. The analysis is based on the Dixit and Sitglitz (1977) model of monopolistic competition, and focuses of the long run effects of trade on the behavior and performance of firms that differ in productivity levels. The paper also allows the number of product varieties to vary depending upon the country openness to trade, and the number of varieties consumed in a given country is endogenously determined in the model. On of the important innovations of the Melitz paper is the introduction of the dynamic forward-looking entry decision of firms facing sunk costs of entering foreign market. The main finding of the paper states that only more productive firms will enter export markets, while less-productive will remain domestically oriented and the least productive will be forced to exit. Also analysis shows that further increase in the industry's exposure to trade leads to additional inter-firm reallocations towards more productive firms, which in its turn increases aggregate industry productivity growth and leads to welfare gains.

Another paper by Bernard, Eaton, Jenson and Kortum (2000) adapts Ricardian trade model to firm specific comparative advantage, also introducing firm heterogeneity. However in this paper firms compete to produce the same product variety and the competition includes foreign as well as domestic firms. To account for the heterogeneity of plants the authors introduce the Ricardian differences in technological efficiency across plants and countries. In order to explain the coexistence of domestic and export-oriented firms within the same industry the costs of exporting are being introduced in terms of a standard 'iceberg' assumption, which means that exporting costs to a given destination are proportional to production costs. Further in order to avoid for the technological differences to be fully reflected in output and prices the authors introduce imperfect competition with variable mark-ups, thus the authors introduce Bertrand competition into the Ricardian frameworks with a given set of goods. Thus the paper operates on the assumption that the total number of product varieties consumed and produced in the world is exogenously fixed and is based on a specific parameterization of the distribution of the productivity levels. The authors further calibrate their model to fit a combination of micro and macro US data and then they obtain comparative static results by simulating the model. The paper also operates on the assumption that the total number of product varieties consumed and produced in the world is exogenously fixed and is based on a specific parameterization of the distribution of the productivity levels.

A simple model by Lopez (2004) shows that one of the possible explanations of the self-selection pattern is that a company consciously attempts to increase its productivity via investment in R&D activities and new technologies with an explicit purpose to become an exporter. The explanation/motivation for such models comes from the fact that goods made for export in developing countries are usually of the better quality than the analogous goods produced for the local market (e.g. Keesing, 1983; and Keesing and Lall, 1992). Hence, the company lured by the prospects of higher returns in the international market has to improve the quality of its products by introducing new technologies to become an exporter. The adoption of the new technology in its turn requires the firm to become more productive and increase its absorptive capacity in order to be able to absorb the technology and internalize the new knowledge. A similar idea was also developed in a paper by Hallward-Driemeier, Iarossi and Sokoloff (2002), however they do not limit the discussion to more productive firms, but instead try to show that firms target export markets from the initial date of operation, and design their investment decisions and technology activities in a way that will allow them to increase their productivity. This is also supported by several anecdotal evidences and case studies. Surely there are many other factors that influence a firm's productivity (i. e. the quality of the personnel, managerial practices, and other external factors). However, the benefits of exporting might still play an important part in the increase of the productivity of the firms in developing countries.

Another important contribution is the model by Yeaple (2004) who introduces a framework in which firms invest in two technologies that differ in terms of the unit costs of production. He shows that a reduction in trade costs induces some firms to switch from the high-cost technology to the low-cost technology which is reflected as an increase in measured productivity.

Two recent papers by Wagner (2005) and Greenaway and Kneller (2005) provide a review of the majority of the empirical literature on 'self-selection hypothesis'. Numerous papers find an empirical support of the hypothesis in different countries, for example Aw and Hwang (1995) develop an empirical model to study the impact of resource-level differences and productivity differences on the output levels of exporting and non-exporting firms of Taiwanese electronic industry. The results of the model show that the bulk of the output differences between exporters and non-exporters can be explained by the larger size of exporting firms. However the authors also find significant differences in productivity levels between exporters and non-exporters.

Another study by Bernard and Wagner (1997) examines the differences in characteristics and performance between exporters and non-exporters in German manufacturing. Their findings show that exporting plants have decidedly better performance attributes when compared to non-exporters, even within the same industry; moreover while the wage differences are quite modest, productivity is much higher at exporters. However explanations of these findings shows that the causality runs from performance to exporting, because several years before entering overseas markets exporters already possess majority of superior characteristics, i. e. they are larger, more productive and pay higher wages. In the years prior to entering export markets these future exporters show faster levels of growth in employment, shipments and productivity.

Clerides, Lach and Tybout (1998) also analyze the causal links between exporting and productivity using firm-level panel data from Morocco, Mexico and Colombia. They study the shift in the firms' stochastic cost processes after they break into foreign markets. They find that relatively efficient firms become exporters, but firms' unit costs are not affected by previous export market participation. So the well-known efficiency gap between exporters and non-exporters is due to self-selection of the more efficient firms into the export market, rather than learning-by-exporting. The authors also find some evidence that exporters reduce the costs of breaking into foreign markets for domestically oriented producers, but they do not appear to help these producers become more efficient.

Bernard and Jensen (1999) use the US panel data to address the issue of export benefits to individual exporters and a contribution of exporting activity towards economic growth as a whole. The results of the analysis do indicate that better performing firms become exporters at the first place, however the benefits of exporting are much harder to locate. The main benefit of exporters is increased probability of survival. However, the paper concludes that current exporting status is a poor prediction of future performance especially over medium and log term horizons: only employment growth is significantly higher for today's exporters over the long term, while shipment volumes, productivity and wages show a much slower growth dynamics instead.

Among studies addressing the linkages between exporting and productivity in developing countries Kraay (1999) finds significant positive productivity gains from exporting for a panel of 2105 Chinese industrial enterprises between 1988 and 1992. Controlling for past performance and unobserved firm characteristics, he finds that exporting activity record leads to significant improvements in enterprise performance. Moreover he finds that, these learning effects are most pronounced among established exporters, while for new entrants to export markets, learning effects are insignificant and occasionally negative.

Also Alvarez (2001) in his work on Chilean manufacturing industry studies the impact of the outward orientation variables on technological innovation as on one of the most important sources of productivity growth. Using firm-level data he identifies three main channels of new technology absorption: exports, direct foreign investment and purchases of technical licenses. The results of the study suggest that export is the most effective in increasing technological innovation, while FDI and technical licenses purchases improve only limited number of technological indicators.

Castellani (2002) uses the data on Italian manufacturing firms in order to estimate the impact of export behaviour on productivity growth rate. It is found that when export behaviour is measured as a share of foreign sales in total sales (export intensity) it has a positive and significant effect on TFP growth. Conversely, when export behaviour is measured as a dummy indicating a firm's participation in the export market it has no impact on TFP growth. In other words, empirical findings suggest that entering the export market do not produce any learning per se. A significant involvement in international activities, specific investments and knowledge accumulated through time and experience of foreign contexts are needed in order to capture the benefits from internationalization.

Delgado, Farinas and Ruano (2002) measure total factor productivity differences between exporting and non-exporting firms in Spanish manufacturing. The authors document these productivity differences on the basis of a panel sample of Spanish manufacturing firms over the period 1991–1996. Further paper compares the cumulative distribution functions of total factor productivity for different groups of firms: exporters, non-exporters, entering exporters and exiting exporters. These distributions are ranked using the concept of stochastic dominance, and their differences are formally tested using Kolmogorov–Smirnov one and two-sided tests, which are consistent in the direction of general non-parametric alternatives. Third, the paper makes an attempt at sorting out the 'self-selection' versus the 'learning-by-exporting' explanations for the superior productivity of exporting firms. The paper explores and tests for these two different, but non-mutually exclusive explanations by comparing productivity levels as well as productivity growth for groups of firms with different trajectories between the export and domestic markets. Empirical findings confirm higher levels of productivity for exporting firms versus non-exporting firms. With respect to the relative merits of the 'self-selection' and the 'learning-by-exporting' hypotheses proposed to explain the greater productivity of exporters, the authors find evidence supporting the self-selection of more productive firms into the export market. The evidence in favour of the learning-by-exporting hypothesis is rather weak, and limited to younger exporters. These results are very much in line with those by Clerides et al. (1998), and Bernard and Jensen (1999).

Although the methodology used differs throughout their research, all three studies mentioned above come to a similar conclusion: 'self-selection' rather than 'learning-by-exporting' is the factor that leads to higher productivity of exporting firms with respect to non-exporting firms.

Another study, by Farinas and Martin-Marcos (2003), measures economic performance differences between exporters and non-exporters on the basis of an unbalanced panel of Spanish manufacturing firms over the period 1990-1999. The authors study differences in several performance measures, such as labor productivity, investment, wages, the composition of labor force, R&D activities, etc. Further the paper studies ex-ante differences in performance between exporting and non-exporting firms and ex-post differences in their evolution. The paper also measures the differences in total factor productivity between exporters and non-exporters by the estimation production functions. The authors apply estimators developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The paper provides support in favor of both 'self-selection' and 'learning-by-exporting' hypotheses.

However, some studies still find that there is not much difference in productivity between exporters and non-exporters. Mostly this conclusion appears in the papers that study micro-level data from the advanced, developed countries with stable, non-increasing, export shares.

One of the examples is the study by Bleaney and Wakelin (2002), in which they find that non-innovating firms are more likely to export having lower unit labor costs, while innovating firms have higher probability of exporting in case they have accumulated higher number of innovations. Thus the probability that a firm is an exporter is higher if the firm operates in a sector with high R&D. And for non-innovating firms the probability of becoming exporter is higher if the firm operates in a sector with low capital intensity.

Also Greenaway et al (2005) do not find much difference in the efficiency between exporters and non-exporters for Swedish manufacturers that have relatively high average level of international exposure. Damijan et al (2005) finds that in Slovenia higher productivity levels affect the probability of exporting only in case the exporting firm is oriented at advanced countries' markets, and, in case the export is aimed mostly at other developing nations, productivity differences have no significant impact on the probability of exporting.

As has been discussed *learning-by-exporting* hypothesis - states that firms that participate in the export market have better access to new knowledge and technical expertise from their international contacts which allows them to experience much higher levels of productivity growth following entry into the export markets. This proposition however has received considerably less support in empirical literature.

Many early empirical studies raised considerable doubts about the direction of causality running from exporting to productivity as they failed to find any significant impact of exporting on productivity levels in the post-entry period, with majority of findings being that firms on average have significantly higher growth levels in terms of employment and wages after entering export markets. Again the study by Aw and Hwang (1995); Bernard and Wagner (1997); Bernard and Jensen (1999); Delgado, Farinas and Ruano (2002), Baldwin and Gu (2003).

However, majority of the literature on the international entrepreneurship highlights the importance of the exporting activity as a learning process and an access to new technologies (Barney, 1990; Teece et. al., 1997; Cohen and Levinthal, 1989, 1990). This set of literature views the process of becoming an exporter as a sequence of stages in a firm's growth trajectory, which involves learning through external and internal channels, in order to improve the competence and the performance of the participant. Moreover some positive effects on learning-by-exporting have been identified especially after new econometric techniques have been developed (Castellani, 2002; Kraay, 1999; Hallward-Driemier et al., 2002).

Also a number of studies find evidence in favor of co-existence of the 'self-selection' and 'learning-by-exporting' hypotheses. (Baldwin and Gu, 2003; Girma et al, 2004; Greaway and Yu, 2004). And yet a lot of controversy remains with respect to causal mechanisms of empirical linkages between exporting and productivity growth. And no universal conclusion has been made so far as to whether learning-by-exporting hypothesis holds.

There are several reasons for such discrepancies in this area: one of them is structural differences in different databases. For example Baldwin and Gu (2004) state that for Canadian manufacturing with smaller market size and less intense competition main factors of exporting that lead to productivity improvements are benefits from greater product specialization, longer production runs when expanding into foreign markets of a much larger size, and learning from international best practices. However in the case of US manufacturing the main source of productivity growth would be technology developed domestically. Thus testing learning-by-exporting hypothesis using the US data would not probably provide researchers with robust positive results.

Also, heterogeneity of export markets may play a considerable role in determining the extent to which participants will gain higher productivity form exporting. The paper by Damijan et. Al. (2005) mentioned earlier suggests that exporting activity does not automatically imply productivity gains, only the firms that supply to the advanced, high-waged export markets experience considerable improvements in their productivity levels.

Lastly, it should be emphasized that numerous methodological issues arise when testing the effect of exporting on the productivity. One of the most common problems is 'sample-selection bias' that arises when making comparison between the treatment group (group of exporting firms) and the whole population. Usually, the firms in the treatment group are not randomly drawn from the whole population but have managed to become exporters due to some unobservable characteristics that gave them priority over the rest of the population. Thus estimating 'learning-by-exporting' effect using conventional econometric routines would lead to biased and spurious results. This issue is of great importance when using the results obtained from comparing exporters and non-exporters for policy implications.[4]

[4] See Blundell et. al. (2005) for recent overview.

Moreover the empirical literature survey by Harris and Li (2005) outlines the fact that majority of empirical studies that find evidence in favor of the 'learning-by-exporting' hypothesis are based on the data from developing countries, i. e. the countries with increasing export shares, changes in the export structure, and low technological frontiers; much less support has been found in the case of developed countries characterized by stable export shares and considerable technological advances.

Ukrainian Export Dynamics: Brief Overview

Ukraine has a well-developed industrial base inherited from the USSR and rich farmlands. The country also has quite a lot of mineral resources are used for exports as well as for domestic consumption. Although Ukrainian export structure has undergone significant changes over the past decade the main part of it still consists of fabricated ferrous and nonferrous metals, chemicals, machinery, fuel and petroleum products, transport equipment and food products. In 2008 the country's gross domestic product had an estimate of 950 billion UAH (which equals to 85.45 billion £)[5], of which some 40 billion £ (that is 4.7%) came from exports.

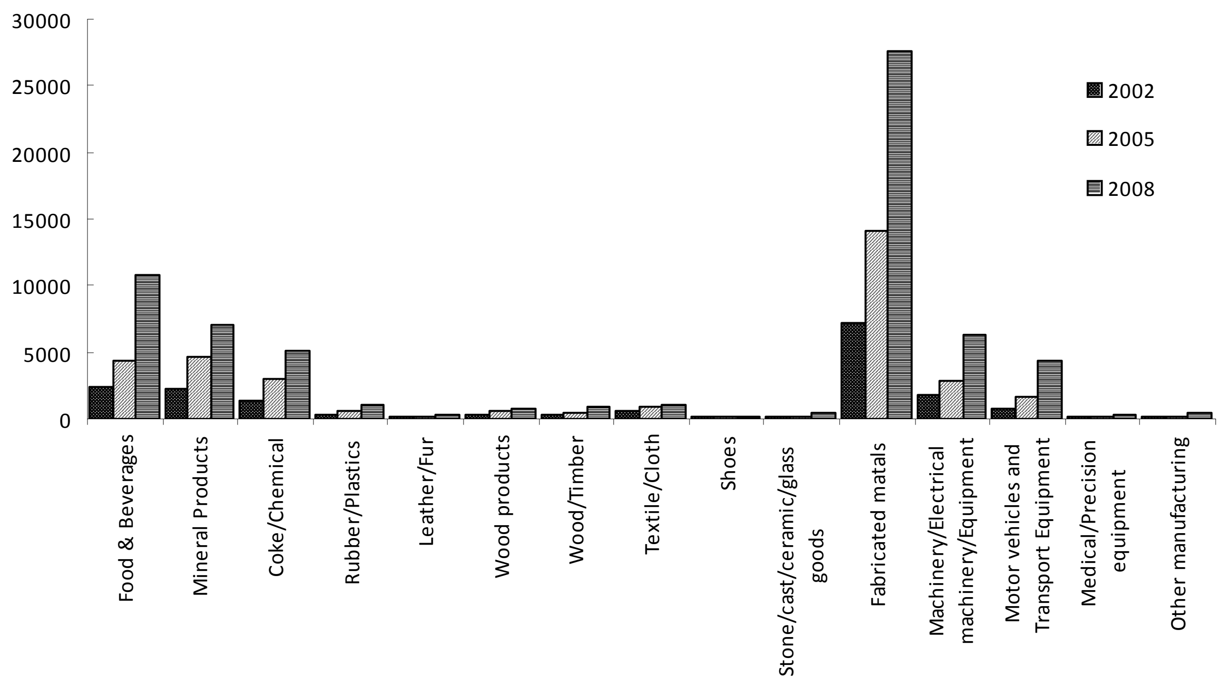
Geographical structure of Ukrainian exports (Figure 1) shows the dominance of exports to the CIS countries with the main trading partners being Russia, Kazakhstan and Belarus. However, export share to the EU countries has been exhibiting strong positive dynamics. The main export partners among the EU countries are Germany, Spain, Italy, Poland, Latvia, Lithuania, Czech Republic. Significant amount of export also goes to the USA, China and Turkey.

Ukraine sees a lot of financial gain from exports. The country has immense agricultural, mineral and industrial resources; and despite suffering almost a decade of economic decline during 1990s, it has emerged as a country of high economical importance. Since the turn of the century the country's economic growth averaged 7.4% a year, but this dropped to about 2.1% in 2008.

During last eight years Ukraine has been increasing the amount of international trade generating more trading partners worldwide (Figure 2). The dynamics of Ukrainian geographical export structure thourgh 2002-2008 clearly shows increase in the amount of international trade with EU countries, as well as Asia and USA. Product structure of Ukrainian export also reflects positive dynamics with significant increase of exports of such manufacturing sectors as Food and Beveraes, Coke, Chemical and Nuclear producs, Fabricated metals, Machinery electrical machinery and equipment, Motor vechicles and transport equipment. This tendency means that Ukrainian exports structure that has mostly consisted of raw materials exports has been gradually changing with more and more manufacturing products being sold overseas.

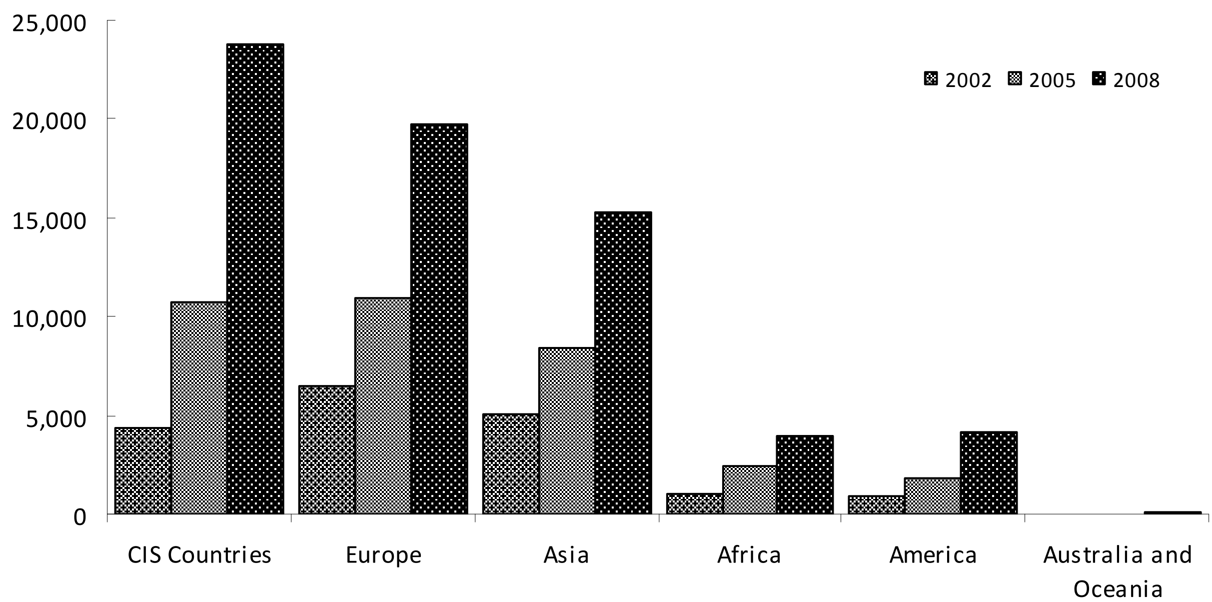
[5] Data source: Ukrainian State Statistic Committee and National Bank of Ukraine.

Figure 1. Ukrainian Exports Structure, selected industries, 2002-2005-2008, '000 000 USD



Note: Source - Ukrainian State Statistic Committee website; million USD

Figure 2. Ukrainian Geographical Exports Structure, 2002-2005-2008, '000 000 USD



Note: Source - Ukrainian State Statistic Committee website; million USD

Data and Descriptive Statistics

This section describes the sources and construction of the database in use and provides basic descriptive statistics of the sample characteristics.

The dataset is constructed on the basis of the database that groups annual accounts data of the population of firms operating in Ukraine. All firms are uniquely defined by their VAT (OKPO) number and divided into sectors according to the Ukrainian Office of National Statistics (Derjkomstat) nomenclature, which is comparable to the NACE[6] classification commonly used for European Statistics. Further the sectors grouped in a way to correspond to the NACE classification.

The data contains basic information on firm-specific characteristics, such as employment, output, sales, overseas sales, assets, 2-digit industry code, different types of intermediate expenditures (including R&D and innovation expenditure) and investment. The age of the firm is calculated by adding the number of times (years) the firm enters the dataset. The data has been compiled from the National Institute of Statistics, checked and cleaned for consistency[7].

The final dataset used for statistical analysis comprises an unbalanced panel with 337,057 firms and 1,077,292 observations covering 2000-2005, with information showing entry and exit from export markets.

The set contains information on firms in 51 industries based on the 2-digit NACE industry code. Appendix 1 contains summary statistics on the number and the percent of exporting firms by industry. Average annual number of firms in the sample is 179, 432, while average annual percent of exporting firms in the sample is 5.6% (Table 1).

Table 1. Number of firms, share of exporter (%) by year, 2000-2005

Year	2000	2001	2002	2003	2004	2005	Average
Number of firms	138,171	172,840	186,578	191,760	202,412	184,829	179,432
Number of exporters	8,694	10,402	10,307	10,848	11,199	8,005	9,909
Share of exporters, %	6.3%	6.0%	5.5%	5.7%	5.5%	4.3%	5.6%

Note: Database used in the analysis

[6] The Nace Rev. 1 classification can be downloaded from the Eurostat Ramon server: http://ec.europa.eu/eurostat/ramon/nomenclatures/
[7] Describe the outliers

Table 2 contains summary statistics for the basic variables —output, capital, employment and material costs—for selected years. Statistics reflects declining average employment size, increasing output and material expenditure. The capital on the other hand shows a mild negative trend.

Table 2. Means (Standard Deviation) of Production Function Variables (2000, 2003, 2005)

	2000	2003	2005
Output	1692.248 (43923.67)	2061.05 (51019.31)	5303.714 (124614.1)
Employment	54.51899 (762.04)	37.77886 (646.03)	24.62973 (429.79)
Materials	3648.21 (49598.52)	6348.605 (79180.38)	5974.771 (107172.1)
Capital	3097.747 (60613.25)	2467.321 (53056.17)	1858.925 (33621.67)

Note: Capital, materials and output are expressed in constant 2000 prices, thousands of Hryvnias.

Next I calculate annual percentage of the exporting firms in each industry to identify most/least export intensive industries (Table 3)[8].

This simple analysis reveals persisting prevalence of raw materials and semi-processed goods in Ukrinain export tructure. Most export oriented industries are Agriculture/Forestry/Fishing; Mining/quarrying; Coke/Nuclear/Chemical; Transport Equipment – share of exporting firms in these industries exceeds 20%.

For further analysis I use firms of the 14 manufacturing industries[9] I also leave Transport/Transport Services/Post (I), Real estate/renting/business (K), Wholesale/retail trade/repair of motor vehicles (G) sections due to the large number of exporting firms. Producer price indices used to deflate firm-level sales as well as material inputs and investment is available from Ukraine State Statistic Committee[10] website.

Next I follow the exercise used by Girma *et. al.* (2005) later replicated by Wagner (2006) and by Harris and Li (2008) and test the rank ordering of the total factor productivity (TFP) distribution of exporting versus non-exporting firms[11].

[8] The industry is counted as export intentive if share of exporting firms in the industry exceeds 10%.
[9] For the complete list of industries refer to the Appendix 1.
[10] http://www.ukrstat.gov.ua/
[11] See section 5 for details of the TFP estimation.

Table 3. Export intensive industries

NACE code	Industry	All firms	Exporters	Exporters, %	% of total
(A/B)	Agriculture/Forestry/Fishing	4,863	1,287	26.5%	0.5%
(CA)	Mining/quarrying of energy producing materials	1,478	263	17.8%	0.1%
(CB)	Mining/quarrying, except of energy producing materials	2,213	584	26.4%	0.2%
(DA)	Food/Beverages/Tobacco	33,640	3,620	10.8%	3.1%
(DB/DC)	Textile/Clothing/Leather/Fur	17,739	2,156	12.2%	1.6%
(DD)	Wood/Wooden products (+36)	13,342	2282	17.1%	1.2%
(DF/DG)	Coke/Nuclear/Chemical	7214	1676	23.2%	0.7%
(DH)	Rubber/Plastic	7,392	986	13.3%	0.7%
(DI)	Non-metallic minerals	13,316	1603	12.0%	1.2%
(DJ)	Basic/Fabricated Metals	14,907	2,210	14.8%	1.4%
(DK)	Machinery and equipment	23,807	3953	16.6%	2.2%
(DL)	Electrical and optical equipment	22,008	2,676	12.2%	2.0%
(DM)	Transport equipment	5,008	1,215	24.3%	0.5%
(DN)	Manufacturing n.e.c.	13,963	1,518	10.9%	1.3%
(G)	Wholesale/retail trade/repair of motor vehicles	492,989	29,750	6.0%	45.8%
(I)	Transport/Transport Sevices/Post	60,705	1,759	2.9%	5.6%
(K)	Real estate/renting/business activities	212,976	3,597	1.7%	19.8%
	Totals	**947,569**	**61,135**	**6.0%**	**100.0%**

Using a two-sided Kolmogorov-Smirnov statistics I test whether the productivity distribution of one sub-group of firms (exporters, permanent exporters, entrants into international markets) lies to the right of another sub-group of firms. The null hypothesis states that distributions of both subgroups are the same, however rejection of the null hypothesis confirms first-order stochastic dominance of the second group.

Table 4 shows that in most of the examined industries TFP distribution of exporting firms (first two columns) lies significantly to the right of that of non-exporters. However in some industries (Agriculture/Forestry/Fishing; Coke/Nuclear/Chemical; Non-metallic minerals; Machinery and equipment and Transport equipment) it is also possible to reject the null hypothesis that distribution of exporters lies significantly to the right of that of that of their non-exporting rivals. This phenomenon however is observed for the industries that mainly specialize in the exports of resources and products of low levels of processing. We can speculate that trade advantage for the firms in these industries depend on the access to natural resources but not on the TFP per se.

Table 4. Two-sample Kolmogorov-Smirnov tests on the distribution of TFP by various subgroups and industries, Ukraine, 2000-2005

NACE code	Industry	All exporters	All non-exporters	All entrants	All non exporters
(A/B)	Agriculture/Forestry/Fishing	-0.275***	0.101***	-0.067	0.219***
(CA)	Mining/quarrying of energy producing materials	-0.003	0.279***	-0.038	0.192**
(CB)	Mining/quarrying, except of energy producing materials	-0.002	0.388***	-0.105	0.101
(DA)	Food/Beverages/Tobacco	-0.003	0.085***	-0.062**	0.043
(DB/DC)	Textile/Clothing/Leather/Fur	-0.005	0.086***	-0.092	0.014
(DD)	Wood/Wooden products (+36)	-0.018	0.126***	-0.083	0.065
(DE)	Paper/Printing/Publishing	-0.012	0.234***	-0.070	0.206***
(DF/DG)	Coke/Nuclear/Chemical	-0.091***	0.101***	-0.080	0.130
(DH)	Rubber/Plastic	-0.025	0.117***	-0.051	0.148**
(DI)	Non-metallic minerals	-0.068***	0.091***	-0.126**	0.018
(DJ)	Basic/Fabricated Metals	-0.009	0.181***	-0.026	0.101
(DK)	Mashinery and equipment	-0.053***	0.057***	-0.039	0.057
(DL)	Electrical and optical equipment	-0.032	0.126***	-0.020	0.104 *
(DM)	Transport equipment	-0.101 ***	0.024	-0.062	0.089
(DN)	Manufacturing n.e.c.	-0.006	0.428***	-0.087	0.153 **
(E)	Electricity, gas and water supply	-0.000	0.620***	0.000	0.608***
(G pt)	Wholesale	-0.001	0.266***	-0.141*	0.196***
(G pt)	Retail trade	-0.004	0.208***	-0.142***	0.066***
(G pt)	Repair of motor vehicles	-0.023	0.103***	-0.048	0.127**
(H)	Hotels/Restaurants	-0.003	0.319***	-0.080	0.290
(I)	Transport/Transport Sevices/Post	-0.001	0.374***	-0.001	0.261***
(K)	Real estate/Renting/Business activities	-0.001	0.248***	-0.005	0.178***
(L)	Public administration and defence	-0.212	0.516***	-0.145	0.827**
(O)	Community/social service activities	-0.002	0.535***	-0.017	0.595***

Total Factor Productivity (TFP) Estimation

This section will review some of the common issues emerging when estimating TFP, provide a short description of the available TFP estimation techniques, and conclude with an estimation of the TFP productivity of the data set used in the analysis.

Usually studies on productivity on the firm level assume the production function (measured as deflated sales or value added) to be a function of inputs and productivity of the firm.

First, we estimate an augmented production function to obtain the estimates of the total factor productivity (TFP),

$$y_{it} = \alpha_0 + \alpha_E e_{it} + \alpha_M m_{it} + \alpha_K k_{it} + \alpha_T t + \gamma X_{it} + \varepsilon_t \quad (1)$$

Where *y, e, m* and *k* stand for the logarithms of the gross output, employment, intermediate inputs and tangible assets in firm *i* at time *t.* Vector of variables *X* determines TFP, hence TFP growth in defined as (dropping subscripts):

$$\ln T\dot{F}P = \hat{\alpha}_T + \hat{\gamma}\dot{X} \equiv \dot{y} - \alpha_E \dot{e} - \alpha_M \dot{m} - \alpha_K \dot{k} \quad (2)$$

The measure of the TFP is obtained as a residual of this functional relationship and is further used to evaluate the impact of different policy measures, such as trade liberalization, the extent of foreign ownership (Javorcik, 2004) or antidumping protection (Konings and Vandebussche, 2004).

Several methodological issues emerge when TFP is estimated with the help of traditional methods such as Ordinary Least Squares (OLS) applied to a panel of (continuing) firms. Since there is a likely correlation between productivity and input choices, estimation of the firm-level production function brings up a *simultaneity* or *endogeneity* problem. In case of a balanced panel, where no allowance is made for entry and exit into the export markets, using OLS results in a selection bias. Some other methodological issues include proxying for firm-level prices using industry level deflators (Katayama, Lu and Tybout, 2005), and correlation of the firm's product choices to their productivity.

The recent literature has proposed several estimators to overcome these problems. However traditional estimators used to overcome endogeneity issues such as fixed effects (henceforth FE), instrumental variables and GMM haven't provided satisfactory solution in case of production function.

Further several semiparametric estimators have been proposed. Olley and Pakes (1996, henceforth OP) and Levinsohn and Petrin (2003, henceforth LP) have developed a semiparametric estimators that address the simultaneity bias and the selection bias (in case of the OP estimator). The extensions to this model were later introduces by De Loecker (2007).

We implement various estimation techniques (OLS, Fixed effects, Olley-Pakes and Levinson-Petrin) to obtain production function coefficients and estimates of the firm-level TFP. Table 3 reports production function coefficients obtained using three methodologies discussed above. The results of the FE, OP and LP estimation for the 18 industry groups are reported in Appendices 4, 5 and 6. All reported estimates are obtained for the unbalanced panel of firms (allowing for implicit entry and exit).

The main different between OP and LP semi-parametric estimators is that, while OP uses investment decision to proxy for unobserved productivity; LP relies on intermediate inputs as a proxy. Further, the monotonicity condition for OP technique requires investment to be strictly increasing in productivity, which implies that only observations with positive investment can be retained in the first stage. This requirement leads to a significant data loss and subsequent reduction in the overall estimation efficiency. Moreover zero investment in a significant number of cases casts doubts on the validity of the monotonicity condition. LP technique in its turn uses intermediate inputs rather than investment as a proxy for unobserved productivity. This in turn requires good quality data on intermediate inputs. However, since firms typically report positive use of materials and energy in each period, the technique makes it possible to retain most of the observations. This also implies that the monotonicity condition is more likely to hold. The second difference between these two techniques is the selection bias correction. OP technique allows for both an unbalanced panel and an incorporation of the survival probability in the second stage of the estimation. LP technique however does not incorporate the survival probability in the second stage, because the efficiency gains of this in the final results proved to be very small provided an unbalanced panel is used. Hence, two main differences of the LP techniques from the OP technique are the use of intermediate inputs instead of investment to proxy for productivity and omitting the survival correction in the second stage.

Share of firms with positive investments in the current dataset equals 5.2%, which leads to significant data loss in case the OP estimator to be used. Thus we use LP estimation technique for our further analysis. However, it is worth noting that both techniques produce similar results when the sample is restricted to satisfy the conditions for the OP estimation procedure. FE estimates produce significant results when used on a whole sample. However, when we apply FE to estimate

TFP for each of the industries separately, the results become insignificant and of the wrong sign in most of the cases (See Appendix 4).

Table 5. Production function coefficients: Different estimation methods

18 Sub-sectors	OLS	Fixed Effects	Levinsohn-Petrin	Olley-Pakes
β_l	.721*** (.00230)	.677*** (.00386)	.564*** (.00594)	0.568*** (0.00712)
β_m	.292*** (.00146)	.304*** (.00216)	.326*** (.00347)	0.326*** (0.00420)
β_k	-.101*** (.00124)	.105*** (.00250)	.0109** (0.0052)	0.0737*** (0.0281)

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Exporting-Productivity Relationship Estimation

When estimating the linkages between exporting and productivity using micro level data, the most topical issues are *endogeneity* and *sample selection bias*. Selection bias occurs because exporting firms may have certain characteristics compared to non-exporting firms that would allow them to achieve better performance even if they did not enter the global markets. This in turn means that all standard estimation techniques will lead to biased results[12]. Thus the essential problem with estimation of the effect of exporting is to obtain an estimate of an unobserved counterfactual that is unbiased of any simultaneous relationship between the decision to export and gains from exporting.

There are several standard techniques that account for the self-selection bias.

First approach that deals with self-selection bias is *instrumental variables (IV)* estimation. For this purpose the variable should be found that affects the probability that a firm engages in exporting but does not affect outcomes directly. We can then use such a variable as an instrument for the treatment and overcome the problem of self-selection. The main issue in practice is finding an appropriate instrument. The following variables can be used as instruments: age of the firm that is usually not included in the production function or dummy of intangible assets (R&D investment and advertising). However, R&D investment and advertising is one of the variables that significantly increases chances of the firm to overcome international market entry barriers and hence can have a direct impact on the probability of exporting. Some theoretical models also argue that age is directly linked to firm's productivity and a number of empirical studies have provided evidence in favour of this hypothesis. In general theoretical underpinnings of the instruments are quite weak. Moreover GMM estimation procedure requires several lags, which is a significant drawback in the current case due to the comparatively short time period of the data set in use (2000-2005).

Second approach used to deal with self-selection bias is a standard Heckman two-stage (or control function) procedure. This is closely linked to the IV approach. This approach begins with a first-stage use of a probit (or logit) estimator to generate first-stage predicted values of the probability of exporting, followed by the estimation of equation that includes the sample selectivity correction terms from the first-stage model. That is, if $\hat{P}_{it}$ is the predicted propensity score of exporting of the firm *i* at time *t* (from equation (4) discussed further), then the inverse Mills ratios (or selectivity terms) are given by:

[12] Heckman (2000), Heckman and Navarro-Lozano (2004) discuss standard evaluation problems.

$$\lambda_{0it} = \frac{-\phi(\hat{P}_{it})}{1-\Phi(\hat{P}_{it})} \text{ if Export=0; } \lambda_{1it} = \frac{\phi(\hat{P}_{it})}{1-\Phi(\hat{P}_{it})} \text{ if Export=1} \quad (3)$$

Selectivity terms (λ_0 and λ_1) enter equation to control directly for the correlation of the error term in the model determining TFP with the error term in the model determining whether the firm exports or not.

The last approach used to tackle self-selection is *matching*. This technique implies matching every exporting firm with another firm that has very similar characteristics but does not export. Under the matching assumptions exporters and non-exporters possess the same (observable) attributes that impact on the productivity, hence the probability of exporting. In this way we obtain the non-exporting matched subgroup that constitutes the correct counterfactual for the missing information on the outcomes that, on average, exporters would have experienced if they had not exported. The matching process requires the rich dataset that includes all relevant variables (that impact productivity) and all variables that impact on whether the firm exports or not.

This paper implements *propensity score matching approach* to estimate the impact of engagement into international markets on the productivity using the representative dataset of Ukrainian firms.

In the first stage I estimate the following (random effects) probit model to identify the probability of exporting (i. e. the propensity score):

$$P(Export_{it}=1) = \phi(\ln TFP_{it-1}, \ln Age_{it-1}, Intang_{it-1}, \ln Employment_{it-1}, Industry_{it}, \mathrm{Re}\,gion_{it}) \quad (4)$$

Where *Export* is coded 1 if the firm enters the export market in the year *t*; *TFP* is the estimate of the Total Factor Productivity obtained in the first stage; *Age* is the age of the firm (number of times/years in operation); *Intang* is coded 1 if the firm has nonzero intangible assets[13] (the average annual percent of firms possessing positive intangible assets equals 14.8%, we assume that the rest of the sample does not posses any intangible assets by setting the rest of the observations to zero), *Employment* represents the number of employees; and *Industry* and *Region* are dummy variables indicating each industry subgroup and regional attribute. To increase the quality of the estimation we estimate the model separately for each of the 19 sub-sectors, which also allow us to exclude industry specific dummies from the regression.

[13] The non-monetary assets in this context usually refer to corporate intellectual property (e. g. patents, copyrights, trademarks etc), innovative activities, advertising, goodwill, brand recognition and similar intangible assets. There are considerable amount of controversies about what should be included and how to measure intangible assets (Webster and Jensen, 2006).

Further we use the propensity scores (probability of becoming exporter) obtained in the first stage to construct the matched sample (Girma *et. al.*, 2004). In order to increase the quality of the matching we require that potential matches to be in the same 2-digit NACE industry as their exporting counterparts[14]. We construct the matched comparison group using the "nearest-neighbor" approach, i. e. we choose those non-exporters that have predicted probability of entering international markets closest to that of the exporting firms. Matching is done with replacement, which means that if a non-exporting firm appears to be the closest match for more than one exporting firm, this firm can be used as control as many times as needed (the size of the dataset allows to implement this type of matching technique, however the results do not differ much if matching is done without replacement).

Figure 3. Difference in probability of exporting treated and matched firms, 18 sub-sectors

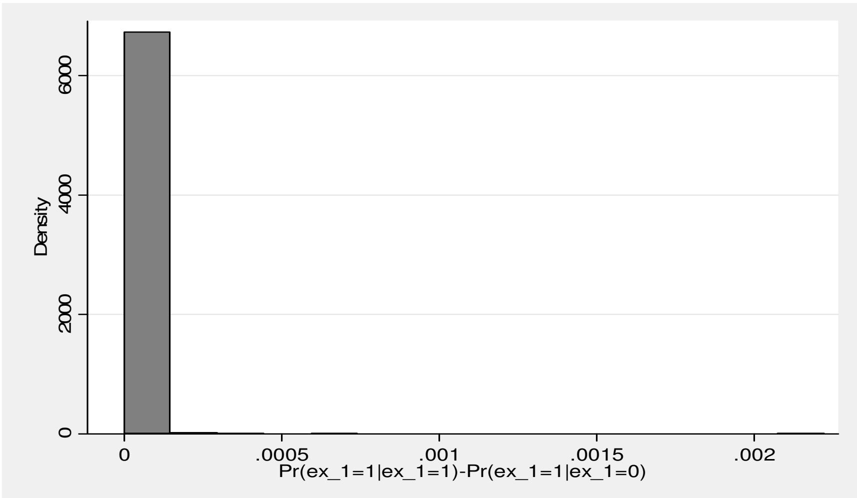


Figure 3 shows the differences in the predicted probability of exporting between exporters and matched non-exporters. Most of the differences in the probability of exporting do not exceed 0.0003, which means that there are enough close matches for all treated (entrants into exporting) firms. However, the level (0.0003) is set as a caliper which defines the interval of common support and any matched pairs with a difference in the exporting probabilities grater than this threshold are eliminated. A relatively small size of the caliper increases matching quality, decreasing the size of the sample. However, this procedure excludes the possibility of obtaining spurious results drawn by the outliers, that don't have good matches. (Brown, Earle, 2008).

[14] My attempts to impose the requirement on the potential estimates to be in the same region as their exporting counterpart have led to significant data loss.

Having obtained the matched sample we test the learning-by-exporting hypothesis by estimating the following fixed effect panel model:

$$(\ln TFP_{it} - \ln TFP_{jt}) = \phi(Export_{it}) \quad (5)$$

Where the dependent variable is the difference between the TFP estimates of the treated and control firm. *Export* is a set of dummy variables indicating export status. The set includes: $Year\_before_{it}$ coded 1 in the year prior to the start of exporting; $entry\_year_{it}$, $year\_after_{it}$, $two\_years\_after_{it}$ – dummies reflecting correspondingly the entry-into-exporting year, one year after the entry, and two and more years (omitted category) after engaging into exporting activity.

Empirical Modeling and Results

We start with estimating equation (4) using random effects probit model to get the propensity score, i. e. the probability of exporting that will be used in the matching procedure at a later stage. The results of the 19 industry groups are reported in the table 6. Overall the results of the estimation show that size of the firm matters for exporting, i. e. larger firm are more likely to engage into exporting activity. Also firms with higher TFP in period *t-1* are more likely to enter export markets in period *t*. Firms with positive intangible assets are more likely to enter export markets. However, this variable appears to be insignificant for a large number of industries.

The analysis in line with the majority of previous studies shows that there was a strong self-selection into export markets among Ukrainian firms during 2000-2005, in all 19 industry sub-groups examined.

Next I estimate equation (5) to test for a "learning-by-exporting" effect associated with a further increase in TFP due to the post-entry sales to the overseas markets. First I employ propensity score matching procedure to obtain a matched sample of exporters and non-exporters concentrating on export market entrants and then use this matched sample to estimate equation (5).

The complete set of results referring to the impact of "learning-by-exporting" performed on the matched sample is presented in tables 7 and 8 for the OLS and fixed effects specifications. The estimates show whether firms that enter export markets for the first time experience significant positive post-entry impact of the overseas sales on productivity, in the entry year, post entry year and two and more years after entry.

One of the drawbacks of the matching approach is the need for a sufficient number of observations in the sample, especially for those industries where the majority of firms do not export. Another extreme would be the loss of the exporting firm due to the lack of "common support" in sectors with the majority of export-oriented firms, which does not pose a significant problem in this particular case.

Table 8 shows that learning-by-exporting effect is present in some of the industries - such as Real estate/renting/business activities; Manufacturing n.e.c.; Coke/Nuclear/Chemical; Mining/Quarrying of energy producing

Table 6. Probit Model Estimation Results

Industry classification	lnTFP_{t-1}	(lnTFP_{t-})^2	Age_{t-1}	(Age_{t-1})^2	$lnEmp_{t-1}$	(lnEmp_{t-1})^2	$Intange_{t-1}$
19 sub sectors	0.201***	-0.00551*	0.356***	-0.0819***	0.359***	-0.0219***	0.174***
	(0.0164)	(0.00316)	(0.0264)	(0.00431)	(0.0280)	(0.00278)	(0.0169)
1. Agriculture/Forestry/Fishing	0.460	-0.0895	0.241	-0.0878*	2.730***	-0.258***	-0.327*
	(0.281)	(0.0948)	(0.270)	(0.0523)	(0.906)	(0.0893)	(0.188)
2. Mining/quarrying of energy producing materials	0.489***	-0.0848*	0.403	-0.117*	0.0810	0.0114	-0.0230
	(0.154)	(0.0491)	(0.328)	(0.0658)	(0.380)	(0.0287)	(0.166)
3. Mining/quarrying, except of energy producing materials	-0.0189	0.0598*	0.180	-0.0740	0.719	-0.0770*	0.0220
	(0.140)	(0.0348)	(0.281)	(0.0512)	(0.451)	(0.0429)	(0.181)
4. Food/Beverages/Tobacco	0.138**	0.00652	0.314***	-0.0957***	0.782***	-0.0586***	0.162***
	(0.0571)	(0.0157)	(0.0916)	(0.0168)	(0.183)	(0.0179)	(0.0514)
5. Textile/Clothing/Leather/Fur	0.0379	-0.00458	0.135	-0.0534*	1.148***	-0.106***	0.0243
	(0.115)	(0.042)	(0.165)	(0.0303)	(0.317)	(0.0317)	(0.101)
6. Wood/Wooden products (+36)	-0.0597	0.0674	-0.0774	-0.0312	2.267**	-0.217**	0.00880
	(0.148)	(0.0578)	(0.290)	(0.0522)	(0.948)	(0.0980)	(0.190)
7. Coke/Nuclear/Chemical	0.722	-0.308	0.234	-0.0596*	1.011**	-0.126**	0.0925
	(0.515)	(0.207)	(0.214)	(0.0329)	(0.514)	(0.0556)	(0.151)
8. Rubber/Plastic	0.921**	-0.303*	0.130	-0.0574	0.239	-0.0267	0.0910
	(0.426)	(0.176)	(0.236)	(0.0366)	(0.431)	(0.0461)	(0.158)
9. Non-metallic minerals	0.0175	0.0138	0.491***	-0.0965***	0.573**	-0.0435*	0.199**
	(0.0813)	(0.0332)	(0.141)	(0.022)	(0.263)	(0.0248)	(0.0926)
10. Basic/Fabricated Metals (DJ)	0.397**	-0.0630	0.356**	-0.0809***	0.951***	-0.0934***	-0.0332
	(0.167)	(0.0559)	(0.154)	(0.0240)	(0.288)	(0.0287)	(0.101)
11. Machinery and equipment	0.0260	0.0385***	0.453***	-0.0968***	0.476**	-0.0444**	0.0233
	(0.0599)	(0.0146)	(0.123)	(0.0205)	(0.191)	(0.0182)	(0.0790)

Industry classification	lnTFP_{t-1}	(lnTFP_{t-})^2	Age_{t-1}	(Age_{t-1})^2	$lnEmp_{t-1}$	(lnEmp_{t-1})^2	$Intange_{t-1}$
12. Electrical and optical equipment	0.167*	-0.0138	0.117	-0.0383*	0.290	-0.0300	0.0233
	(0.101)	(0.0257)	(0.133)	(0.0202)	(0.186)	(0.0183)	(0.0945)
13. Transport equipment	-0.00142	0.0353	0.371*	-0.0756**	0.812**	-0.0716**	0.0454
	(0.122)	(0.0432)	(0.193)	(0.0297)	(0.322)	(0.0285)	(0.137)
14. Manufacturing n.e.c.	0.472**	-0.150**	0.154	-0.0466*	0.356	-0.0304	0.0569
	(0.194)	(0.0733)	(0.165)	(0.0261)	(0.346)	(0.0371)	(0.115)
15. Wholesale trade	0.396**	-0.0242		-0.315	0.624*	0.0535	0.368***
	(0.174)	(0.0335)		(477.9)	(0.329)	(0.0389)	(0.123)
16. Retail trade	0.155***	-0.00875		-0.150	0.114*	-0.00217	0.110***
	(0.0331)	(0.00550)		(32.55)	(0.0630)	(0.00841)	(0.0370)
17. Repair of motor vehicles	0.203	0.0183		-0.00594	0.625***	-0.0335	0.302***
	(0.140)	(0.0204)		(0.0183)	(0.242)	(0.0250)	(0.0824)
18. Transport/Transport Sevices/Post	0.489***	-0.0488***	0.231**	-0.0588***	0.284***	-0.0120	0.118*
	(0.0775)	(0.0156)	(0.0914)	(0.0143)	(0.0869)	(0.00743)	(0.0649)
19. Real estate/renting/business activities	0.326***	-0.0282	0.118	-0.0473***	0.255**	-0.0174	0.143**
	(0.0748)	(0.0175)	(0.0879)	(0.0140)	(0.119)	(0.0127)	(0.0625)

Note: Dependent variable: difference between treated and control TFP estimates; base category is observations two and more years before engaging into exporting. Standard errors in parentheses; ***- significant at 1% level; **- significant at 5% level; *- significant at 10% level

Table 7. Impact of Exporting Activity on TFP, entrants versus non-exporters, matched sample

Industry classification	Export Dummies	
	OLS	FE
	Post Entry	Post Entry
19 sub sectors	0.0141 (0.0246)	-0.0189 (0.0226)
1. Agriculture/Forestry/Fishing	0.240** (0.118)	.157* (0.0890)
2. Mining/quarrying of energy producing materials	0.167 (0.282)	-0.103 (0.167)
3. Mining/quarrying, except of energy producing materials	-0.214 (0.137)	0.135 (0.136)
4. Food/Beverages/Tobacco	0.0740** (0.0375)	0.0149 (0.0352)
5. Textile/Clothing/Leather/Fur	-0.0891 (0.0815)	-0.0458 (0.0686)
6. Wood/Wooden products (+36)	0.0894 (0.197)	0.0800 (0.153)
7. Coke/Nuclear/Chemical	0.134 (0.0953)	0.0567 (0.133)
8. Rubber/Plastic	0.0947 (0.0935)	0.108* (0.0592)
9. Non-metallic minerals	0.153** (0.0620)	0.230*** (0.0780)
10. Basic/Fabricated Metals	-0.0670 (0.0677)	0.00248 (0.0527)
11. Machinery and equipment	0.219*** (0.0744)	0.0464 (0.0538)
12. Electrical and optical equipment	0.00246 (0.0740)	0.0555 (0.0769)
13. Transport equipment	0.110 (0.126)	0.0315 (0.155)
14. Manufacturing n.e.c.	-0.0765 (0.124)	-0.0980 (0.0859)
15. Wholesale trade	0.115 (0.251)	0.255 (0.242)
16. Retail trade	-0.265** (0.111)	-0.0427 (0.129)
17. Repair of motor vehicles	0.815 (0.512)	-0.328 (0.597)
18. Transport/Transport Services/Post	0.192 (0.157)	-0.230 (0.143)
19. Real estate/renting/business activities	-0.341** (161)	-0.0851 (0.112)

Note: Dependent variable: difference between treated and control TFP estimates; base category is observations two and more years before engaging into exporting. Standard errors in parentheses; ***- significant at 1% level; **- significant at 5% level; *- significant at 10% level

Table 8. Impact of Exporting Activity of TFP, matched sample, entrants versus non-exporters: Fixed Effects Specification

	Export dummies			
Industry classification	Year before	Entry year	Year after	2 and more Years after
19 sub sectors	.022***	.083***	.076***	.089***
	(.00347)	(.00376)	(.00507)	(.00661)
1. Agriculture/Forestry/Fishing	0.0530	0.420**	0.925**	0.323***
	(0.241)	(0.202)	(0.368)	(0.102)
2. Mining/quarrying of energy producing materials	1.040**	1.402**	1.266**	-0.647**
	(0.496)	(0.660)	(0.569)	(0.326)
3. Mining/quarrying, except of energy producing materials	0.268*	0.242	0.0999	0.204
	(0.150)	(0.257)	(0.418)	(0.140)
4. Food/Beverages/Tobacco	-0.0494	-0.0401	-0.0589	-0.0308
	(0.0801)	(0.0697)	(00844)	(0.0435)
5. Textile/Clothing/Leather/Fur	-0.0106	0.0329	0.224	-0.178*
	(0.414)	(0.185)	(0.298)	(0.0954)
6. Wood/Wooden products (+36)	-0.603*	0	0	-0.0710
	(0.314)	(0)	(0)	(0.191)
7. Coke/Nuclear/Chemical	-0.166	0.393**	-0.269	0.0245
	(0.243)	(0.170)	(0.173)	(0.117)
8. Rubber/Plastic	0.181	0.115	-0.174	0.151*
	(0.185)	(0.169)	(0.220)	(0.0874)
9. Non-metallic minerals	-0.144	0.00941	-0.100	-0.109
	(0.113)	(0.0958)	(0.174	(0.0878)
10. Basic/Fabricated Metals	0.0364	0.0646	0.127	0.0141
	(0.160)	(0.231)	(0.159)	(0.0792)
11. Machinery and equipment	-0.0532	0.124	0.0726	0.0807
	(0.227)	(0.260)	(0.164)	(0.0667)
12. Electrical and optical equipment	0.178	0.163	0.270	0.0332
	(0.268)	(0.165)	(0.206)	(0.0666)
13. Transport equipment	-0.483**	-0.475	-0.790**	0.0509
	(0.214)	(0.299)	(0.380)	(0.147)
14. Manufacturing n.e.c.	0.290	0.521**	0.586*	-0.258*
	(0.177)	(0.216)	(0.350)	(0.134)
15. Wholesale trade	0.545**	0.169	1.343**	0.175
	(0.227)	(0.787)	(0.644)	0.604)
16. Retail trade	0.0126	0.0554	0.104	-0.0958
	(0.161)	(0.191)	(0.216)	(0.124)
17. Repair of motor vehicles	-0.395**	0.538	1.716*	0.488*
	(0.198)	(0.915)	(0.994)	(0.271)
18. Transport/Transport Services/Post	-0.505*	-0.475	-0.0903	-0.267*
	(0.299)	(0.304)	(0.289)	(0.162)
19. Real estate/renting/business activities	-0.121	0.217*	0.258	0.0403
	(0.224)	(0.128)	(0.194)	(0.125)

Note: Dependent variable: difference between treated and control TFP estimates; base category is observations two and more years before engaging into exporting. Standard errors in parentheses; ***- significant at 1% level; **- significant at 5% level; *- significant at 10% level

materials; Transport equipment; Agriculture/Forestry/Fishing. However, in many industries – such as Electrical and optical equipment; Non-metallic minerals; Food/Beverages/Tobacco; Textile/Clothing/Leather/Fur – no significant productivity gains in the period following entry into international markets have been observed.

A closer look at the results may help us to reveal some common trends lying behind the results. For example, such capital-intensive sectors as transport equipment and other manufacturing might show significant productivity gains from exporting due to economies of scale and access to better technologies, which might result in the improvements in production process. In case of food/beverages/tobacco and textile/clothing/leather/fur industries - majority of the improvements should have been made before entering global markets to ensue that firm would be able to resist international rivalry. The overall estimate for the 16 Ukraine manufacturing industries reveals the presence of a substantial post-entry productivity effect for the firms new to exporting.

Thus, the results presented in the current study provide mixed support in favour of learning-by-exporting hypothesis. In general our findings correspond to the previous findings in the area. For example, Bernard and Jensen (2004) followed by Harris and Li (2005) found a positive boost in TFP for the first time entrants into export markets during the first and the second post-entry years for the whole sample of the US and UK manufacturing firms. However, their results for separate manufacturing sectors show that post-entry productivity effect is present only in some industries, while others do not experience any significant productivity gains.

Conclusion

This chapter presents an attempt to estimate the ways in which exporting might influence firm's performance and productivity at the micro-level on the basis of the dataset covering main Ukrainian output sectors during the period 2000-2005. In doing so current study measures productivity effect that occurs before entering export markets (self-selection effect) as well as the effect that occurs in the post-entry period (learning-by-exporting effect).

The estimation of self-selection hypothesis is done on a basis of a random effects probit model. The results of the estimation studying the firms that started exporting at any time during the reported period for the 14 Ukraine manufacturing and 5 trade and service sectors go in line with previous findings in the literature on self-selectivity. Mainly the results show that firms with higher TFP levels in the period *t-1* are much more likely to enter export markets in the period *t.* Also age, size and in some cases intangible assets of the firm have significant positive influence of the probability of exporting.

Next part of the analysis studies the productivity effects that occur after the entry into overseas markets (learning by exporting effect). In order to account for the issues of endogeneity and sample selection I use propensity score matching technique, based on the propensity scores obtained from the random effects probit model that estimates the probability of exporting. The results of the analysis confirm the presence of learning-by-exporting effect in some industries; while other industries show no presence of any statistically significant productivity gains in the post-entry period.

In order to reveal common trends (if any) behind the mixed results, obtained in favor of the learning-by-exporting hypothesis it might be useful to compare the results of the currents study with previous findings. Paper by Harris and Li (2008) is one of the most recent examples and is one of the best to use for comparison. The authors provide estimates for the 16 separate industries in the UK for the period 1996-2004. Despite the fact that format of the aggregation across different output sectors is slightly different from the current study, the structure of the analysis still allows us to compare our results to their findings. Table 9 compares the results for the long-term learning-by-exporting effect obtained in the current study to those of Harris and Li (2008). The comparison shows that such service sectors as Wholesale Trade and Repair of Motor Vehicles enjoy productivity gains from exporting in both Ukraine and UK. In the former case the gains in productivity probably arise due to the economies of scale and better managerial practices learned from foreign partners; while in the latter case the productivity increase might also be caused by the access to the new foreign technologies.

As to the industries that do not experience any learning-by-exporting effect the common ones for the UK and Ukraine are: Food/Beverages/Tobacco; Non-metallic Minerals; Basic/Fabricated Metals; Machinery and equipment; Electrical and optical equipment; Real estate/renting/business activities.

Table 9. Presence of learning-by-exporting effect in separate industries

NACE code	Industry	Harris and Li	Current Study
(A/B)	Agriculture/Forestry/Fishing	-	+
(CA)	Mining/quarrying of energy producing materials	N/A	+
(CB)	Mining/quarrying, except of energy producing materials	N/A	-
(DA)	Food/Beverages/Tobacco	-	-
(DB/DC)	Textile/Clothing/Leather/Fur	-	+
(DD)	Wood/Wooden products (+36)	+	-
(DE)	Paper/Printing/Publishing	+	-
(DF/DG)	Coke/Nuclear/Chemical	+	-
(DH)	Rubber/Plastic	+	+
(DI)	Non-metallic minerals	-	-
(DJ)	Basic/Fabricated Metals	-	-
(DK)	Machinery and equipment	-	-
(DL)	Electrical and optical equipment	-	-
(DM)	Transport equipment	-	+
(DN)	Manufacturing n.e.c.	-	+
(G1)	Wholesale trade	+	+
(G2)	Retail trade	+	-
(G3)	Repair of motor vehicles	+	+
(I)	Transport/Transport Services/Post	-	+
(K)	Real estate/renting/business activities	-	-
	Totals	**+**	**+**

Note: See Harris and Li (2008) for the complete list of the results

When the estimation is done for the whole universe of firms in the dataset, the results go in line with common trends and suggest a substantial positive post-entry productivity effect for the firms that enter export markets for the first time in one and two years after entry.

Our approach has been widely applied in the literature on the exports-productivity linkages. Main results of the analysis confirm that differences in productivity between exporting and non-exporting firms can be partially attributed to higher productivity levels of exporters prior to entering export markets (which allows them to overcome entry barriers more easily). However, the results of the estimation provide us with mixed evidence in favour of learning-by-exporting hypothesis showing no positive productivity gains in the period following international market entry in a significant number of Ukrainian manufacturing industries.

There several possibilities for further research in the area. First, it would be interesting to study different subsets of exporting firms, for example foreign ownership versus domestic ownership. Also with the availability of the better data covering longer periods of time it would be interesting to distinguish between groups of older and younger firms. The last suggestion for further research is to study the impact of export destination on the magnitude of learning-by-exporting effect.

Appendix 1. Ukrainian Export – Import Structure, selected industries, 2002-2005-2008

Category	Export 2002	Import 2002	Export 2005	Import 2005	Export 2008	Import 2008
Food & Beverages	2388933.75	1113761.33	4307004.9	2684081.89	10830635.3	6456568.1
Mineral Products	2244887.94	7047279.28	4707983.04	11567831.37	7046089.7	25441471
Coke/Chemical	1397046.43	1375005.12	2990247.4	3097918.28	5045387.7	6959125.1
Rubber/Plastics	262735.1	736233.91	575238.83	1938136.24	997666.2	4476816.6
Leather/Fur	159063.06	58560.96	211085.31	111179.36	359518.9	232455.4
Wood products	289678.9	84998.2	533924.35	199883.28	801168.1	545722.5
Wood/Timber	278633.17	682004.26	454335.89	1004118.63	874402.5	1835249.1
Textile/Cloth	654650.68	673007.43	914034.36	1406190.76	984587	2099247.4
Shoes	75961.07	53646.21	107759.95	279287.31	178099.1	531113
Textile/Clothing	730611.75	726653.64	1021794.31	1685478.07	1162686.1	2630360.4
Stone/cast/ceramic /glass goods	147298.89	202359.21	218679.66	516192.6	454820.3	1276483.6
Fabricated matals	7125620.2	810919.76	14047248.78	2468818.31	27633085.3	6390049.9
Machinery/Electrical machinery/Equipment	1758609.21	2502043.63	2841800.99	6342271.65	6341164.6	13378597.5
Motor vehicles and Transport Equipment	689335.43	1021519.26	1655874.59	3219711.33	4324092.3	12091355.8
Medical/Precision equipment	182892.48	267213.09	141934.28	507425.38	242906.4	1222606.7
Other manufacturing	96626.67	135920.04	218408.4	323120.61	438909.6	1011012.8
Art works	79.01	500.63	186.93	732.27	723.4	4105.9
Other	198566.63	118697.51	244770.52	36554.18	242914	35444.9

Appendix 2. Ukrainian Geographical Export-Import Structure, years 2002, 2005, 2008

	Export 2002	Import 2002	Export 2005	Import 2005	Export 2008	Import 2008
CIS Countries	4377441.64	8968209.78	10739718.76	17030312.34	23819222.70	33569461.80
Europe	6515796.73	5751138.12	10892674.05	12670066.96	19736731.80	30475821.20
Asia	5067695.84	1171641.09	8403473.69	4644492.57	15263929.20	15306353.60
Africa	1055209.04	177295.12	2405679.38	426207.12	3903658.90	1559056.20
America	936849.94	856679.39	1831216.93	1265611.83	4144124.70	4190567.20
Australia and Oceania	4101.66	51485.17	13720.97	103951.32	63960.10	431680.50
Total, '000 USD	17957094.85	16976448.67	34286748.26	36141094.96	67002502.80	85534441.30

Appendix 3. Exports statistics by industry

NACE code	Industry	All firms	Exporters	% of Exporters	% of total
(A/B)	Agriculture/Forestry/Fishing	4,863	1,287	26.5%	0.5%
(CA)	Mining/quarrying of energy producing materials	1,478	263	17.8%	0.1%
(CB)	Mining/quarrying, except of energy producing materials	2,213	584	26.4%	0.2%
(DA)	Food/Beverages/Tobacco	33,640	3,620	10.8%	3.1%
(DB/DC)	Textile/Clothing/Leather/Fur	17,739	2,156	12.2%	1.6%
(DD)	Wood/Wooden products (+36)	13,342	2282	17.1%	1.2%
(DE)	Paper/Printing/Publishing	28,286	778	2.8%	2.6%
(DF/DG)	Coke/Nuclear/Chemical	7214	1676	23.2%	0.7%
(DH)	Rubber/Plastic	7,392	986	13.3%	0.7%
(DI)	Non-metallic minerals	13,316	1603	12.0%	1.2%
(DJ)	Basic/Fabricated Metals	14,907	2,210	14.8%	1.4%
(DK)	Machinery and equipment	23,807	3953	16.6%	2.2%
(DL)	Electrical and optical equipment	22,008	2,676	12.2%	2.0%
(DM)	Transport equipment	5,008	1,215	24.3%	0.5%
(DN)	Manufacturing n.e.c.	13,963	1,518	10.9%	1.3%
(E)	Electricity, gas and water supply	10,792	310	2.9%	1.0%
(G1;G2;G3)	Wholesale/retail trade/repair of motor vehicles	492,989	29,750	6.0%	45.8%
(H)	Hotels/Restaurants	42,753	162	0.4%	4.0%
(I)	Transport/Transport Services/Post	60,705	1,759	2.9%	5.6%
(K)	Real estate/renting/business activities	212,976	3,597	1.7%	19.8%
(L)	Public administration and defence	1,180	23	1.9%	0.1%
(O)	Community/social/personal service activities	46,721	193	0.4%	4.3%
	Totals	**1,077,292**	**62,601**	**5.8%**	**100.0%**

Appendix 4. Production function coefficients: Fixed Effects

		Production function coefficients	
Industry classification	β_l	β_m	β_k
19 sub-sectors	0.616***	0.271***	0.111***
	(0.00472)	(0.00269)	(0.00327)
1. Agriculture/Forestry/Fishing	0.538***	0.379***	0.0878***
	(0.0270)	(0.0177)	(0.0193)
2. Mining/quarrying of energy producing materials	0.700***	0.521***	0.0455
	(0.0544)	(0.0375)	(0.0458)
3. Mining/quarrying, except of energy producing materials	0.640***	0.461***	-0.0612
	(0.0441)	(0.0302)	(0.0436)
4. Food/Beverages/Tobacco	0.361***	0.605***	0.00866
	(0.0129)	(0.00794)	(0.0101)
5. Textile/Clothing/Leather/Fur	0.589***	0.401***	0.00639
	(0.0164)	(0.0113)	(0.0141)
6. Wood/Wooden products (+36)	0.431***	0.481***	0.0446
	(0.0383)	(0.0259)	(0.0289)
7. Coke/Nuclear/Chemical	0.473***	0.515***	-0.0254
	(0.0359)	(0.0193)	(0.0264)
8. Rubber/Plastic	0.359***	0.534***	0.0118
	(0.0314)	(0.0238)	(0.0211)
9. Non-metallic minerals	0.445***	0.642***	-0.0227
	(0.0215)	(0.0149)	(0.0158)
10. Basic/Fabricated Metals	0.411***	0.511***	-0.00968
	(0.0205)	(0.0130)	(0.0151)
11. Machinery and equipment	0.548***	0.438***	0.000404
	(0.0171)	(0.0100)	(0.0137)
12. Electrical and optical equipment	0.610***	-0.0145	0.384***
	(0.0234)	(0.0185)	(0.0128)
13. Transport equipment	0.417***	0.492***	0.0284
	(0.0348)	(0.0203)	(0.0293)
14. Manufacturing n.e.c.	0.666***	0.384***	-0.0132
	(0.0322)	(0.0189)	(0.0213)
15. Wholesale trade	0.623***	0.203***	0.125***
	(0.0292)	(0.0165)	(0.0204)
16. Retail trade	0.676***	0.171***	0.0675***
	(0.0127)	(0.00618)	(0.00834)
17. Repair of motor vehicles	0.791***	0.137***	0.0893***
	(0.00973)	(0.00520)	(0.00662)
18. Transport/Transport Sevices/Post	0.571***	0.336***	0.0553***
	(0.0123)	(0.00745)	(0.00873)
19. Real estate/renting/business activities	0.619***	0.232***	0.0491***
	(0.0101)	(0.00574)	(0.00633)

Appendix 5. Production function coefficients: Olley-Pakes Technique

	Production function coefficients		
Industry classification	β_l	β_m	β_k
19 sub-sectors	0.568***	0.326***	0.0737***
	(0.00712)	(0.00420)	(0.0281)
20. Agriculture/Forestry/Fishing	0.572***	0.495***	−0.0925***
	(0.0347)	(0.0248)	(0.0343)
21. Mining/quarrying of energy producing materials	0.415***	0.387***	0.0631
	(0.0806)	(0.0574)	(0.151)
22. Mining/quarrying, except of energy producing materials	0.478***	0.574***	0.00934
	(0.0930)	(0.0547)	(0.0221)
23. Food/Beverages/Tobacco	0.220***	0.768***	0.0329
	(0.0183)	(0.0122)	(0.0218)
24. Textile/Clothing/Leather/Fur	0.596***	0.446***	0.0143
	(0.0282)	(0.0174)	(0.0164)
25. Wood/Wooden products (+36)	0.422***	0.607***	0.0426
	(0.0844)	(0.0559)	(0.0415)
26. Coke/Nuclear/Chemical	0.410***	0.596***	0.211**
	(0.0658)	(0.0389)	(0.102)
27. Rubber/Plastic	0.397***	0.478***	0.0323
	(0.0787)	(0.0553)	(0.0591)
28. Non-metallic minerals	0.359***	0.719***	0.0103
	(0.0382)	(0.0301)	(0.0367)
29. Basic/Fabricated Metals	0.391***	0.634***	0.0146
	(0.0456)	(0.0311)	(0.0159)
30. Machinery and equipment	0.529***	0.453***	−0.0475*
	(0.0310)	(0.0211)	(0.0278)
31. Electrical and optical equipment	0.465***	0.542***	0.564*
	(0.0466)	(0.0259)	(0.329)
32. Transport equipment	0.532***	0.527***	0.00596
	(0.0559)	(0.0365)	(0.0272)
33. Manufacturing n.e.c.	0.361***	0.497***	0.107
	(0.0428)	(0.0275)	(0.0961)
34. Wholesale trade	0.621***	0.168***	0.171**
	(0.0517)	(0.0285)	(0.0820)
35. Retail trade	0.544***	0.210***	−0.0264
	(0.0241)	(0.0127)	(0.0506)
36. Repair of motor vehicles	0.648***	0.232***	0.00985
	(0.0161)	(0.0105)	(0.0145)
37. Transport/Transport Sevices/Post	0.549***	0.285***	0.143
	(0.0261)	(0.0180)	(0.0972)
38. Real estate/renting/business activities	0.582***	0.285***	0.0173
	(0.0172)	(0.0117)	(0.0160)

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Appendix 6. Production function coefficients: Levinson-Petrin Technique

Industry classification	Production function coefficients		
	β_l	β_m	β_k
19 sub-sectors	0.564***	0.326***	0.0109**
	(.00594)	(.00347)	(0.0052)
1. Agriculture/Forestry/Fishing	0.468***	0.548***	0.341
	(0.0399)	(0.0584)	(0.294)
2. Mining/quarrying of energy producing materials	0.647***	0.346***	0.421
	(0.125)	(0.125)	(0.379)
3. Mining/quarrying, except of energy producing materials	0.752***	0.390***	-0.320
	(0.156)	(0.117)	(0.350)
4. Food/Beverages/Tobacco	0.313***	0.628***	0.140***
	(0.0240)	(0.0226)	(0.0282)
5. Textile/Clothing/Leather/Fur	0.592***	0.501***	0.00454
	(0.0234)	(0.0209)	(0.0315)
6. Wood/Wooden products (+36)	0.318***	0.579***	0.211**
	(0.0638)	(0.0556)	(0.0920)
7. Coke/Nuclear/Chemical	0.332***	0.622***	0.0881
	(0.0434)	(0.0417)	(0.0575)
8. Rubber/Plastic	0.185***	0.580***	0.231***
	(0.0296)	(0.0805)	(0.0558)
9. Non-metallic minerals	0.395***	0.662***	0.0630*
	(0.0573)	(0.0499)	(0.0325)
10. Basic/Fabricated Metals	0.309***	0.587***	0.0785
	(0.0305)	(0.0411)	(0.0491)
11. Machinery and equipment	0.506***	0.468***	0.114*
	(0.0315)	(0.0288)	(0.0667)
12. Electrical and optical equipment	0.381***	0.527***	0.0859
	(0.0364)	(0.0288)	(0.107)
13. Transport equipment	0.447***	0.518***	0.242***
	(0.0648)	(0.0529)	(0.0780)
14. Manufacturing n.e.c.	0.336***	0.430***	-0.173
	(0.0445)	(0.0403)	(0.178)
15. Wholesale trade	0.731***	0.175***	0.0128
	(0.0378)	(0.0261)	(0.114)
16. Retail trade	0.680***	0.152***	0.0575
	(0.0182)	(0.00888)	(0.0815)
17. Repair of motor vehicles	0.810***	0.211***	0.243***
	(0.0166)	(0.0117)	(0.0296)
18. Transport/Transport Sevices/Post	0.420***	0.284***	0.294***
	(0.0276)	(0.0185)	(0.0445)
19. Real estate/renting/business activities	0.508***	0.284***	0.128***
	(0.0119)	(0.00901)	(0.0349)

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

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