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Learning-by-Exporting across Export Destinations: Evidence from Lithuanian Manufacturing

Tobias D. Ketterer

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Tobias D. Ketterer

Abstract

This paper investigates micro-level effects of export market entry on firm-level productivity. In particular, we study the effects of single and multiple export market entry, and additionally differentiate between the effects of export market entry by destination country. To isolate the impact of participation in foreign markets we employ matching techniques. Using micro-level trade and balance sheet data for firms in Lithuania, we show that single export market entry is linked with larger post-entry productivity growth for new export market entrants, relative to similar non-exporting firms. Moreover, we find support for more learning-by-exporting when looking at firms exporting to more sophisticated markets with presumably higher productivity standards.

JEL Classification: F14, F18, Q56.

Keywords: Exporting, export destination, multi-market entry, Lithuania, propensity score matching

Contact: Tobias Ketterer (tobias.ketterer@ec.europa.eu), European Commission, Secretariat-General, unit SG.3 International Dimension (including G7/G20).

CONTENTS

1. INTRODUCTION

Climbing-up the value chain and moving towards knowledge and innovation-driven growth is crucial, not only for low-income countries, but also for many structurally encrusted or lagging regions in Europe. Early catching-up gains are often driven by low unit-labour costs. These benefits, however, are set to come to an end as income and prosperity rise. In light of declining population growth and sluggish investment, technical progress, and with it productivity growth, becomes a key factors in managing the transition towards a more value added economy. Given that only a handful of rich countries generate most of the world's new technologies (Keller 2004**)**, knowledge transfers and information spill-overs are of crucial importance for productivity improvements in many countries.[1] There are several important channels for external knowledge spill-overs including foreign direct investments, licensing and trade. The main objective of this paper is to investigate potential learning (i.e. productivity) effects from exporting in light of different export strategies.

As a key characteristic of the ongoing globalisation process, increasing exports feature prominently on global policymakers' agendas. Partially evidence-based through their positive correlation with aggregate economic growth (see for instance Edwards, 1993, 1998), but also reflecting fundamentally mercantilist trains of thought, exports are often seen as essential for prosperity and wealth creation. This export preoccupation has led to considerable export promotion activities world-wide including export subsidies, state trading monopolies and other government policies aiming to boost exports in one form or the other. This is quite striking given limited micro-level support for these policy decisions when analysing the causal linkages between international trade and firm-performance. While export activities and their interaction with firm performance have been subject to a sizeable empirical literature, which, by and large, finds a correlation between international trade and firm productivity, determining causality remains an open question. [2]

Building on this literature, this paper contributes to a better understanding of the causal relationship between firm performance and different strategies of export market entry. While most of the previous empirical evidence focuses on the decision to export in general, there is only very limited evidence on the causal effects between exporting and firm-level productivity gains which takes into account different types of export market entry. Evidence is scarce that exporting results in important learning-effects, and hence additional productivity premiums, with most existing studies suggesting that the most efficient firms self-select into exporting (Bernard and Jensen, 2004: Anderson et al., 2008; Castellani et al., 2010).[3] In the context of market-specific export decisions, it has been argued that simultaneous entry into several export markets may result in higher productivity gains relative to single market entry, largely based on a wider scope for learning and knowledge transfers (Masso and Vahter, 2015). It has also been suggested that learning-by-exporting opportunities may be greater for firms exporting to countries with higher living standards, given presumably higher productivity and technology levels in these export destinations, and hence a greater scope for learning effects (Blalock and Gertler, 2004).

Knowing about these linkages and obtaining reliable information on the causal relationship between different modes of export market entry and firm performance is important for effective policy design. For example, should firms be encouraged to enter several export markets simultaneously, or should they rather focus on a single foreign market? Should potential support be targeted to help firms enter highly competitive and developed markets, or does the choice of export destinations not matter at all?

[1] Eaton and Kortum (1999) and Keller (2002) find that for most countries foreign technology spill-overs account for at least 90% of their productivity growth.
[2] Wagner (2012) provides a recent overview of the literature.
[3] It is also worth noting that evidence for productivity gains from importing seem to be stronger than those from exporting (Keller, 2004).

We follow the approach set out in Masso and Vahter (2015), and investigate firm performance in the context of different types of export market entry, by using a rich panel dataset of Lithuanian manufacturing firms.[4] In light of Lithuania's rapid working-age population decline, analysing potential sources for productivity gains is particularly important to ensure future growth in a country where labour productivity currently stands 40% below the OECD average (OECD, 2015). As easy catching-up gains based on low unit-labour costs, are slowly coming to an end, climbing-up the value chain represents an important challenge for Lithuania's economy.

Our dataset includes data on various firm characteristics, and information on firm-level trade by destination. Covering the time period 2005 to 2012, we employ semi-parametric techniques to identify a causal relationship between different types of exporting and firm heterogeneity in productivity growth. We thereby distinguish between several modes of export market entry: First, we distinguish between the number of export markets entered during a firm's first year of exporting, with a particular focus on whether a firm sold to a single foreign market, or simultaneously supplied multiple export markets. Second, we also distinguish between different types of export destinations. Notably, we examine the learning effects when exporting to (i) the EU-28, (ii) the EU-15, (iii) the Eastern and Central European member states, and, in more general terms, (iv) developed and developing nations. While the group of firms selected into treatment (i.e. exporting) varies according to the respective modes of export market entry, the control (i.e. comparison) group is always based on a sample of non-exporting firms.

Our estimations yield the following results. First, we observe that firms that only entered a single export market benefit from higher productivity growth following the decision to export, compared to its non-exporting counterparts. Export-driven productivity gains seem, however, to be absent when accessing several foreign markets simultaneously pointing to significantly higher entry costs, and possibly rather modest additional learning-effects stemming from a wider scope for learning and knowledge transfer when supplying multiple foreign markets. Second, the heterogeneity in terms of different types of entered export markets seems to play a prominent role in shaping a firm's production efficiency growth. In particular, our results provide evidence for greater learning-by-exporting effects, when exporting to more developed countries, or markets with a presumably higher technological sophistication, lending support to the hypothesis of larger knowledge spill-overs when trading with countries which are technologically more advanced and closer to the technological frontier.

The remainder of the paper is organised as follows. Section 2 provides a brief overview of the relevant literature. Section 3 introduces the empirical methodology, and provides a description of the data. The empirical findings are presented and discussed in section 4. Section 5 concludes.

2. MULTI-MARKET EXPORT ENTRY, EXPORT DESTINATION AND FIRM PERFORMANCE

Sunk costs associated with market entry are the centrepiece in explaining why some firms start accessing international markets, and why other firms do not. Costs related to market research, contract formulation, search processes for potential distribution networks, product modifications and compliance issues are often referred to as additional cost items for firms selling abroad. Profit-maximising firms, hence, only enter export markets when their profits' net present value outweighs the fixed costs of entry. With marginal costs driving firm profits', numerous theoretical as well as empirical studies document significant productivity differentials between firms that export and firms

[4] Masso and Vather (2015) examine the effects of different modes of exporting on productivity growth. The authors find that multi-product export market entry results in higher post-entry productivity gains.

that do not trade at all. Most empirical studies show that it is only the most productive firms that start trading internationally and hence self-select into exporting (Melitz, 2003; Anderson et al., 2008; Castellani et al., 2010).

At the theoretical level, recent firm-level trade models allow for extensive and intensive trade margins to vary across different markets, assuming that trade is affected by bilateral trade costs (Chaney, 2008; Lawless, 2009 Helpman et al., 2008). Based on these bilateral market-specific entry costs, firms hence face different fixed costs which, together with firm heterogeneity in productivity, determine a firm's potential to enter foreign export markets. This suggests that more productive firms are able to export to more countries simultaneously, and to access markets which may be associated with higher entry costs. Recent empirical findings tend to confirm these conjectures suggesting that plants selling their goods to a larger number of foreign markets are more productive relative to firms supplying only a smaller number of export markets (see for instance, Muuls and Pisu, 2009; Lawless, 2009). Likewise, exporting to developed countries or simultaneously selling to several foreign markets has been found to require higher ex-ante productivity levels, compared to less developed destinations, highlighting the importance of country-specific sunk costs for export market entry (Pisu, 2008; Serti and Tomasi, 2014; Albbornoz et al., 2012; Bernard et al., 2011).

Fixed costs and market entry decisions also offer a framework to analyse potential learning-by-trading effects, and hence additional productivity gains caused by the decision to enter foreign export markets. It has been suggested that exporters may benefit from international clients' expertise or technology transfers by having to upgrade their product quality to satisfy clients' demands and product quality standards (Bernard and Jansen, 2004; De Locker, 2007). Moreover, benefits may also come from greater scale effects based on larger sales markets (Falvey and Yu, 2005), or the exposure to tougher international competition, which may create higher incentives to reduce managerial slack (Vickers, 1995), or to increase innovation outcomes (Aghion and Griffith, 2005). Empirical evidence on a causal relationship between exporting on additional post-entry productivity gains is however quite limited. As regards the decision to enter export markets in general, most empirical studies do not find statistically significant evidence for the learning-by-exporting hypothesis.[5]

In the context of the few existing studies which do find a significant impact on firm productivity,[6] it has been hypothesised that there may be a wider scope for learning effects for exporters from countries with lower living standards, given higher productivity and technology standards in their respective export destinations (Blalock and Gertler, 2004). Systematic empirical evidence on additional productivity gains by export destinations, however, remains very limited and inconclusive. De Loecker (2007), for instance, finds for Slovenian manufacturing firms some support for higher export-driven productivity gains when selling goods to high income countries, which may point to more learning when exporters compete with firms producing closer to the technological frontier. Analysing a sample of Japanese firms, Yashiro and Hirano (2009) find that only firms selling world-wide enjoy additional productivity gains from exporting. Similarly, Silva et al., (2013) find significant learning-by-exporting effects only for Portuguese firms supplying the European market, and not for those exporting to less developed countries.[7] Pisu (2008), on the contrary, finds, for Belgian manufacturing firms, that productivity differences associated with exporting to developed economies are largely explained by self-selection. More recently, it has been argued that simultaneous entry into several export markets may lead to higher productivity gains relative to single export market entry, thanks to a greater scope for learning and technology transfer from a wider range of foreign partners, but also that multi-market entry may be associated with a higher risk given higher market entry costs (Rauch and Watson, 2003). Examining single vs. multiple-product and single vs. multiple export market entry with export data from a full population of Estonian firms, Masson and Vather (2015) indeed find that

[5] For recent surveys of this literature see Silva et al., (2013), and Wagner (2012).

[6] See for instance, Blalock and Gertler (2004) for Indonesia, van Biesebroeck (2005) for sub-Saharan Africa and De Loecker (2007) for Slovenia, Albotnoz and Ercolani (2007) for Argentina.

[7] Further analysis is provided by Wilhelmsson and Kozlov (2007), who report inconclusive evidence on the causal relationship between exporting and productivity for Russian manufacturing firms.

multi-product exporters, that sell goods to a larger number of markets, benefit from additional productivity growth. They however, do not find any clear-cut regularity in support for productivity growth following single-product or single-market entrants. The important role of the breadth of foreign knowledge linkages has also been highlighted by the management literature (Chesbrough, 2006; Laursen and Salter, 2006), with simultaneous multiple foreign market entry likely to generate more knowledge connections than entry into one single export market. Wider external knowledge sourcing has also been linked to higher production efficiency and firm performance by increasing firm-level knowledge absorption and innovation potentials (Laursen and Salter, 2006).[8] Details set aside, it seems fair to say that, while there seems to be some evidence for productive firms self-selecting into more sophisticated markets, the verdict is still out on the causality issue, and hence possible learning-by-exporting effects by different export destinations.

3. EMPIRICAL STRATEGY

3.1. DATABASE AND SAMPLE CHARACTERISTICS

The sample of firms used in this study was drawn from the annual enterprise survey conducted by the Lithuanian Statistics Office.[9] The dataset contains information on 5,441 different manufacturing firms (sectors 15-36 in *Nomenclature générale des activités économique dans les Communauté européenne*, NACE), and constitutes an unbalanced panel covering the period 2005 to 2012. The dataset contains information on sales, inventories, employment, tangible fixed assets, ownership, input costs, and exports by destination. Deleting missing values, zero employment, zero sales, observations failing to pass other basic error checks, and calculating lagged values, results in a final sample size that varies between 1,594 and 757 companies in a given year.[10] We use the dataset to calculate firm performance variables – i.e. labour productivity and total factor productivity. To estimate total factor productivity we employ the semi-parametric methodology suggested by Levinsohn and Petrin (2003),[11] which uses information on material input spending as a proxy for productivity shocks to address potential endogeneity concerns regarding the use of inputs in the production function.[12] We use value added as the dependent variable in the production function, and an average manufacturing production price index as a value-added deflator. Material inputs equal the value of purchased materials and are deflated by using an intermediate input price deflator. The factor capital is defined as the value of fixed assets at the beginning of the year, deflated by the simple average of the following five 2-digit NACE industry deflators: computer, electronic and optical products; electrical equipment; machinery and equipment (n.e.c.); motor vehicles, trailers and semi-trailers; other transport equipment.[13]

[8] There is a related literature on the effects of single and multi-product export market entry, which, by and large, argues that tougher international competition motivates firms to focus on their core products, where unit costs are lowest (Bernard et al., 2001; Mayer et al., 2014).

[9] The Lithuanian enterprise data are known for its high quality and reliability. Belkindas et al., (1999), rank the quality of the Lithuanian enterprise data second out of 20 transition countries.

[10] Annex Table A.1 introduces some basic summary statistics for the most important variables used in this study. Please also note that based on the data available our results do not explitily distinguish between return-to scale effects and technology upgrading.

[11] As shown by DeLocker (2013), assuming a exogenous Markov process for productivity, as it is the case when employing the Levinsohn and Petrin (2003) methodology, may bias results against learning by exporting effects. DeLocker (2013) points out that a non-parametric approach which uses an endogenous productivity function leads to much better findings in support for the learning by exporting hypothesis.

[12] Unfortunately, we were unable to obtain from Lithuania's National Statistics Office the respective industry identifiers for each firm, which would have allowed calculating total factor productivity by allowing NACE 2-digit specific coefficients for capital and labour.

[13] To allow for inter-temporal analysis all values were transformed from current into constant price values using disaggregated price deflators.

Table 3.1 provides some basic statistics on the distribution of exporting and non-exporting firms in our dataset. It shows that the number of exporting firms, in our final dataset, amounts to 949 in 2005 and to 490 in 2012, representing about 65.3% and 77.9% of all active firms in the sample, respectively. This reflects an increased participation in export activities by Lithuanian firms, in relative terms, over the consider time horizon. The average number of export destination countries that a firm exports to has risen from 6.5 in 2005 to 10.5 in 2012. During the same period the average productivity of Lithuanian firms has also increased when measured by total factor or labour productivity, with exporting firms being, on average, more efficient than their non-exporting counterparts.

Table 3.1. **Descriptive statistics - Manufacturing firms, exporting and productivity**

Year	No. of exporting firms	Exporter share in all active firms	TFP (log) - exporters	TFP (log) - non-exporters	Labour productivity (log) - exporters	Labour productivity (log) - non-exporters	Average no. of export markets
2005	949	65.3	5.7	5.3	5.6	5.3	6.5
2012	490	77.9	5.9	5.7	5.9	5.7	10.5

Source: Author's own calculations based on data from Lithuania National Statistics. Note that the above statistics refer to a sample of non-matched firms.

The key export markets for Lithuanian manufacturing firms, in terms of trade value, are Germany, Great Britain, France, Russia and Sweden.[14] New exporters (i.e. firms that start to enter export markets for the first time) represent between 58% and 19% of all exporting firms in a given year. Moreover, new exporters which initially supply only one foreign market represent by far the largest group of new export market entrants; 69% of first time exporters, export to only 1 country; 19% to 2; 5% to 3; and 7% to 4 markets or more. Of the companies exporting to just one country, 48% are newcomers.

Table 3.2. **Descriptive statistics – New exporters and market entry modes**

No. of export markets entered in firms 1st exporting year	No. of new exporters	Share of new exporters in all exporting firms	Relative distribution of new exporters	Average export volume in thousand Litas
1	144	0.48	0.69	1007.9
2	39	0.09	0.19	954.1
3	11	0.22	0.05	411.8
4	8	0.18	0.04	615.2
5	2	0.12	0.01	573.0
6 or more	5	0.07	0.02	6434.3

Source: Author's own calculations based on data from Lithuania National Statistics. 1 Euro equals 3.4528 Litas. Average export volumes refer to new export starters.

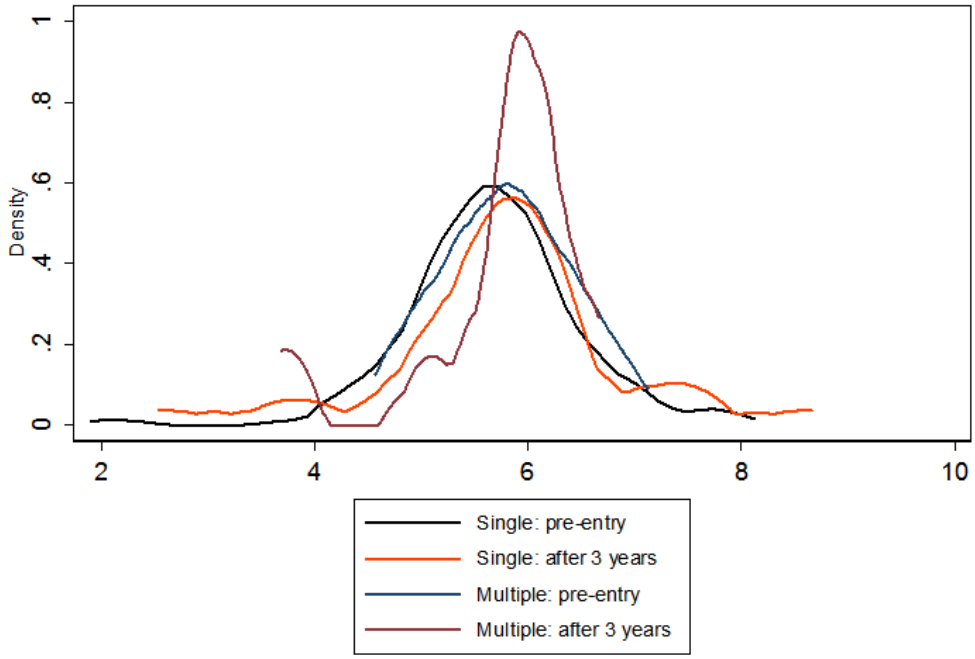
Exporters are usually found to show remarkably different characteristics compared to other firms; most notably in terms of productivity (see for instance Bernard, 2004; Wagner, 2012). Manufacturing data from Lithuania corroborates these findings and additionally highlights that there are differences between single and multi-market entrants, in particular in the years following market entry. Figure 3.1 illustrates these differences showing the kernel densities of total factor productivity for single and multi-market entrants in the period before market entry and three years thereafter.[15] The graphs points

[14] For a graphical illustration see Annex Figure A.1.

[15] Kernel densities, in our analysis are used to estimate the probability density function of the TFP variable, whereby the kernel density estimations ensures the smoothing of data based on a finite sample. The chosen underlying density function is

to a higher productivity for both single and multi-market entrants after three years following market entry, with the distribution of multi-market exporters showing a notably higher density three years after market entry (i.e. there are fewer firms, which are, however, highly productive).

Figure 3.1. **TFP (log) distribution for single & multi market entrants**



Notes: The figure shows the kernel densities of total factor productivity (logs), which are based on the two samples of Lithuanian single-, and multiple export market entrants, respectively. The pre-entry curves depict the TFP distribution in the pre-entry period, while the post-entry curves illustrate the TFP distributions three years following the decision to export.

Source: Author's own calculations based on data from Lithuania National Statistics.

3.2. THE MICRO-ECONOMETRIC IDENTIFICATION PROBLEM

We aim to evaluate the causal effect of export market entry by destination on firm performance (Δy). In our investigation, Δy denotes total factor productivity growth, or alternatively labour productivity growth. To identify the causal direction between first-time export market entry and firm-level production efficiency, we employ an econometric approach which is grounded in matching and difference-in-differences techniques. Matching has been described as a strategy to re-create the conditions of a natural experiment, where the latter is realistically not at hand (see Blundell and Dias, 2000). Matching employs non-experimental data by hypothesising that selection into treatment (i.e. exporting) is conditional on a series of observable variables – i.e. the decision to export depends on certain firm characteristics which first need to be identified.[16] Once these factors determining foreign market entry have been taken into account, the assignment into treatment is assumed to be random. Using matching techniques, represents a suitable strategy to isolate economic performance indicators of export starters, and may result in more reliable findings compared with more standard approaches, which use all non-trading firms as the control-group (Girma et al., 2004; Greenaway and Kneller, 2008).

The essential problem when determining a causal relationship between exporting and potential productivity gains is that it is not observed what a firm's productivity growth would have been *had the*

the Epanechnikov kernel. The kernel densities for EU-28, EU-15, and NMS market entrant are shown in Annex Figures A.2 to A.4.

[16] This assumption is known as the conditional independence assumption (CIA) (Blundell and Dias, 2000).

firm not started to export. To address this issue we construct a counterfactual for our productivity outcome variables by identifying non-exporting firms with similar observable characteristics to those of firms that eventually started exporting, in the pre-entry period. Thus, the basic principle of matching is to choose from the pool of all non-exporting firms those with most similar characteristics for the factors which determine entry into foreign export markets. To select a suitable control group Rosenbaum and Rubin (1983) suggested using propensity scores which determine the probability to be selected into treatment (i.e. exporting) based on a series of observable variables. Propensity scores allow for matching control group and treated firms on a single score rather than on a wide range of individual variables.[17] To establish the probability of accessing international markets we calculate an export propensity score (i.e. a measurement for a firm's likelihood to start exporting) for each firm in our dataset, by using the following probit model:

$$\Pr(EX_{i,t} = 1) = F(TFP_{i,t-1}, size_{i,t-1}, capital\_intensity_{i,t-1}, foreign_{i,t-1}) \quad (1)$$

with the normal cumulative distribution function denoted by F, and annual time dummies included. Pr denotes the predicted probability of accessing international markets at time t for firm i, which finally starts selling to foreign sales markets. For each eventually exporting firm i another non-trading firm j is identified and selected as a suitable match based on a similar propensity score. The matching of firms is conducted using the nearest neighbour caliper matching method, where the minimum distance in terms of the calculated propensity scores is smaller than a pre-specified value (i.e. caliper).[18] Moreover, we restrict the possibilities of matching to the space of common support. That is, we limit the selection of similar treated and untreated firms to the area between the lowest and highest propensity scores, that fall in the propensity score distribution for both of the respective groups.[19] We implement the matching on a cross-section by cross-section basis, and hence require the matching algorithm to select matches that occur in the same time period, which removes the risk of comparing firms that had to deal with remarkably different macroeconomic conditions. Upon selecting matched pairs of treated and untreated firms we pool these observations to construct a panel, which we use for our analysis. Following Blundell and Costa Dias (2000) we employ a difference-in-difference strategy comparing productivity growth rates of both treated and control group firms. The benefit of this is that it allows us to account for additional unobserved, time-constant factors, which may affect firm performance. We compare firm performance across the entry and first two post entry periods. The performance indicators are measured in growth relative to the pre-entry period (i.e. the period before switching the exporting status).

To formally illustrate the employed empirical identification strategy, we define an indicator variable, $D_{i,t} \in \{0,1\}$, taking the value one if firm $i$entered a foreign market in year t for the first time, or zero if it remained outside. The variable $D_{i,t}$ thus identifies firms that change their international trading status from non-exporting in $t-1$ to exporting in t. We employ different specifications for $D_{i,t} \in \{0,1\}$ and distinguish between:

(i) single export market entry – i.e. $D_{i,t}$ takes the value one if firm i switches to become an exporter by serving only one foreign market at time t;

(ii) multi-export market entry – i.e. $D_{i,t}$ takes the value one if firm i switches to become an exporter by simultaneously selling to multiple (i.e. more than two) export markets;

(iii) developed vs. developing country destinations – i.e. for each of the latter two groups of countries separately, $D_{i,t}$ takes the value one if firm i switches to become an exporter to a pre-defined set of destination countries.

[17] By creating a single probability index we match firms across several dimensions.
[18] In case there is no control-group match for a treated firm for which the propensity score distance is smaller than the specified caliper, the respective treated firm is excluded from the sample.
[19] We allow non-trading firms to be selected more than once as an appropriate match for exporting firms.

Note, that for all modes of export market entry, the respective treatment group is always contrasted to a control group of non-exporting firms.[20] To conceptually illustrate the matching strategy, let $\Delta\Delta y^{1}_{i,t+s}$ be the treated firm's economic performance at time $t+s$, $s \geq 0$, following export market entry; and $\Delta\Delta y^{0}_{i,t+s}$ firm *i*'s performance *had it not* entered foreign markets. We define the average expected treatment effect as:

$$E\{\Delta y^{1}_{i,t+s} - \Delta y^{0}_{i,t+s} | D_{i,t} = 1\} = E\{\Delta y^{1}_{i,t+s} | D_{i,t} = 1\} - E\{\Delta y^{0}_{i,t+s} | D_{i,t} = 1\} \quad (2)$$

To address the problem of causal inference – i.e. the fact that the variable $\Delta\Delta y^{0}_{i,t+s}$ is never observed, we construct a counterfactual for the productivity outcome variable, $\Delta\Delta y^{0}_{i,t+s}$, by selecting firms with similar observable characteristics in before market entry, but which did not start exporting. Based on the constructed control group, equation (2) becomes

$$E\{y^{1}_{i,t+s} | EX_{i,t} = 1, X\} - E\{y^{0}_{i,t+s} | EX_{i,t} = 0, X\}$$

with *X* denoting a control vector of observable firm characteristics.

Finally, the chosen matching algorithm has been instructed to only assign *one* neighbour to each of the treated firms regarding their proximity in terms of propensity scores. Once the pairs have been identified, the pre-entry firm characteristics of the treated and control group need to be sufficiently similar to ensure the validity of the matching exercise (Caliendo and Kopeinig, 2008). To account for this we test these differences' statistical significance (balancing property test). The findings of the balancing property test are reported in Annex Table A.2, and by and large, confirm that for each of the constructed treatment groups a control group has been identified with similar pre-treatment firm characteristics (i.e. the differences are statistically not significant).[21]

4. EMPIRICAL RESULTS

4.1. SINGLE AND SIMULTANEOUS MULTI-EXPORT MARKET ENTRY

Table 4.1 shows the estimated average treatment effect (ATTs) of exporting on total factor and labour productivity growth, when examining potential learning-by-exporting effects stemming from the extensive margin of trade at market-level. The main finding from table 3 seems to be that there is a clear difference between potential learning-by-exporting effects when breaking up firm-level export strategies into the number of foreign markets accessed in the first year of exporting. While there are statistically significant post-entry productivity gains for single export market entrants compared to similar non-exporters (at least in the entry and second post entry period).[22] This tends to differ from the findings of Masso and Vather (2015), who do not find consistent evidence for significant productivity gains following single-market entrance when examining exports of Estonian firms.[23] Our finding also suggest that Lithuanian multi-market entrants do hence not experience a rise in labour-, or total factor productivity growth upon the start of exporting, as shown by the insignificant estimated ATT effects of multi-market entry (columns 3 and 4). To sum up, our findings point to positive and

[20] The group of treated firms varies according to the above specifications, for which each time a separate likelihood estimation has been run.
[21] Annex Table A.2 reports the results for the various treatment groups when analysing TFP differences. When analysing labour productivity the results (not reported in Annex Table A.2, but available upon request) are qualitatively similar.
[22] The benefits of single export-market entry also appear to be economically significant, since single market exporters show a 10 to 16 per cent higher productivity growth after the start of exporting.
[23] Masso and Vather (2015) however find post-entry efficiency gains following multi-product-multi-market entry of Estonian exporters.

significant benefits for single market entry; for multi-market entry we find positive signs (and a larger coefficient than for single entry), but we do not get statistically significant results.[24] Based on the here analysed sample of Lithuanian firms, it remains inconclusive whether simultaneous entry into several export markets consistently leads to additional productivity gains based on a wider scope for learning and knowledge transfers.

Table 4.1. **Post entry effects: Single-, and multi-export market entry**

	Lithuania			
	Single-Market Entry		Multi-Market entry	
	(1)	(2)	(3)	(4)
Dependent variable (growth)	Total factor productivity	Labour productivity	Total factor productivity	Labour productivity
Entry effect	0.105***	0.134***	0.186	0.117
	(0.036)	(0.035)	(0.124)	(0.132)
1 Year later	0.027	0.011	0.175	0.131
	(0.066)	(0.067)	(0.139)	(0.137)
2 Year later	0.164***	0.162***	0.231	0.197
	(0.061)	(0.060)	(0.190)	(0.194)
Observations	208	208	64	64

Notes: Standard errors are in parentheses below all coefficients. All regressions are OLS. *, **, *** respectively denote the 10%, 5%, 1% significance levels. The reported coefficients have to be read as the increase in productivity growth (in percent).

4.2. EXPORT-MARKET ENTRY BY DESTINATION COUNTRIES

We now turn to the assessment of a firm's possible productivity growth when exporting to a pre-defined set of countries.[25] In the context of potential market-specific learning-by-exporting effects, it has been argued that the scope for learning effects may be wider when exporting to developed countries, or destinations which operate closer to the technological frontier, and hence show higher productivity and technology standards (Blalock and Gertler, 2004; De Loecker, 2007). Table 4.2 and 4.3 below report the estimated average treatment effects (ATT) on labour and total factor productivity for Lithuanian export market entrants subdivided into different groups by export destinations. Table 4.2 examines potential post entry gains for new export market entrants when accessing European markets, which we break down in the EU-28 as a whole, the EU-15, and the Eastern European new member states (NMS). Table 4.2 (columns 1 and 2) shows the estimates of the ATT, using total factor, and labour productivity growth and as outcome variables. The estimated productivity premiums for Lithuanian EU-28 export market entrants are statistically highly significant and amount to roughly 14 to 15 per cent for the entry period, and to about 20 per cent for the period following market entry. Breaking up European export markets into destination sub-groups, by analysing the efficiency gains for new export market entrants supplying EU-15 markets also provides interesting insights. The estimated ATT effects for EU-15 market entrants are positive, statistically significant and show slightly larger coefficients for the entry and the first post-entry period (compared to the EU-28). The benefits of exporting to the EU-15, and hence to markets with presumably higher living or technological standards, also appear to be economically significant as new EU-15 exporters are likely to benefit, on average, from a rise of up to 37 per cent in total factor productivity, and roughly 42 per

[24] Some of these findings also have to be treated with some caution given the, at times, low number of matched pairs.
[25] It is worthwhile to note that Masso and Vather (2015) did not examine possible export learning effects based on different destination countries.

cent in labour productivity in the period following market entry. Examining productivity premiums for firms starting to access Eastern European export markets delivers further interesting insights. The estimated ATT effects for the entry, and first post-entry period are statistically highly significant and, in magnitude, substantially larger than the ATTs for the EU-15 exporters. NMS exporters are shown to have 35 to 38 per cent higher labour and total factor productivity in the entry period, respectively, compared to non-exporters with similar characteristics in the pre-entry period. The estimated ATTs for the first period following export market entry are even higher showing an increase in firm efficiency by almost 60 per cent for total factor productivity, and around 57 per cent for labour productivity.

The significant results for the ATT estimates in the entry period may indicate the presence of additional scale effects from accessing a larger market, or effects driven by higher product prices in the destination country, while the productivity premiums in the post-entry period, in magnitude even larger, may also indicate certain learning effects when supplying Eastern European export markets.[26] Moreover, when contrasting the magnitude of the estimated ATTs for the EU-15 and NMS market entrants, it could be argued that it may, under certain circumstances, be easier for Lithuanian exporters to absorb foreign knowledge more effectively from geographically closer and technologically slightly more advanced but rather similar countries, than countries with which the gap in technological standards is too distant to the Lithuanian firms' own production efficiency standards. Those exporters would then capture both economies of scale (clients are just a short truck drive away) and technology effects.

Table 4.2. **Post entry effects: Export market entry by destination country**

	Lithuania					
	EU-28		EU-15		NMS	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable (growth)	Total factor productivity	Labour productivity	Total factor productivity	Labour productivity	Total factor productivity	Labour productivity
Entry effect	0.157***	0.142***	0.151*	0.165*	0.375***	0.349***
	(0.048)	(0.050)	(0.081)	(0.087)	(0.067)	(0.067)
1 Year later	0.198***	0.201***	0.370***	0.419***	0.596***	0.572***
	(0.062)	(0.062)	(0.103)	(0.103)	(0.096)	(0.094)
2 Year later	-0.048	-0.082	0.203	0.210	0.133	0.107
	(0.073)	(0.072)	(0.129)	(0.129)	(0.103)	(0.102)
Observations	224	224	80	80	160	160

Notes: Standard errors are in parentheses below all coefficients. All regressions are OLS. *, **, *** respectively denote the 10%, 5%, 1% significance levels.

The finding of significant productivity premiums when exporting to developed countries and destinations with presumably higher productivity standards tends to be corroborated when sub-dividing Lithuania's firm-level export markets into the two broad categories of developed and developing countries.[27] Table 4.3 presents the ATT estimates for the respective sub-groups and shows statistically significant export market premiums in the first two periods following market entry amounting to roughly 12 and 15 per cent, for the respective periods. The absence of statistically significant efficiency gains in the entry period coupled with a slight increase in productivity gains between the first and second post-entry period, may perhaps once more suggest that the significant

[26] These results do not distinguish between local or foreign owned companies in the destination country (e.g. we cannot distinguish between Lithuanian exports going to a local or a German factory in Slovakia, for instance).

[27] It is worth noting that the group of countries classified as developing does not include the so-called BRIC counties. When looking at exports to the emerging BRIC countries, we find a statistically highly significant TFP growth premium of around 43% one year upon entry, while all the other ATTs report statistically insignificant parameter estimates.

ATT estimates are not only driven by potential scale or higher export price effects, but may, to some extent, also stem from additional learning effects that may eventually take some time to fully materialise. On the contrary, Lithuanian export market entrants supplying developing countries cannot be shown to benefit. Overall, these results tend to support previous empirical findings in favour of the learning-by-exporting hypothesis when selling goods to higher income countries (De Loecker, 2007; Silva et al., 2013), and tend to highlight the importance of export market heterogeneity, when investigating productivity gains.

Table 4.3. **Post entry effects: Export market entry by country group: Developed vs developing export destinations**

	Lithuania			
	Developed		Developing	
	(1)	(2)	(3)	(4)
Dependent variable (growth)	Total factor productivity	Labour productivity	Total factor productivity	Labour productivity
Entry effect	0.036	0.035	-0.112	-0.066
	(0.040)	(0.039)	(0.095)	(0.099)
1 Year later	0.118**	0.118**	-0.210*	-0.171
	(0.055)	(0.056)	(0.115)	(0.114)
2 Year later	0.148**	0.151**	-0.080	-0.013
	(0.065)	(0.065)	(0.112)	(0.118)
Observations	320	320	80	80

Notes: Standard errors are in parentheses below all coefficients. All regressions are OLS. *, **, *** respectively denote the 10%, 5%, 1% significance levels. The reported coefficients have to be read as the increase in productivity growth (in percent).

5. CONCLUSIONS

This paper provides a better understanding of the dynamics that drive external knowledge diffusion by looking at different types of export strategies as possible channels for information spill-overs. Our analysis looks at Lithuania, a low to middle income country, which embarked on a notable catching-up process since its EU accession in 2004. The country now faces the challenge of moving towards a more value-added and knowledge-driven economy. In light of sluggish investment and coupled with a shrinking working age population, Lithuania's economic growth prospects crucially depend on future productivity growth.

Trade and in particular exports may represent an important source for learning effects and productivity growth. Analysing different strategies to enter export markets, and distinguishing between different types of export destinations, we find that different export market entry modes may crucially influence potential learning-by-exporting effects. Our analysis shows that firms that start exporting to a single market experience higher growth in total factor -, and labour productivity, on average, than similar firms that did not enter foreign export markets. We find no positive effect for newly exporting firms that simultaneously supply multiple markets. In addition, we also investigate the learning-by-exporting hypothesis with respect to foreign sales markets' heterogeneity in living standards. Our findings show that exporting to more developed markets may, indeed, result in higher productivity growth, while the learning effects from markets in developing countries do, on average, not generate any additional efficiency gains. In particular, we show that accessing the EU's common market brings about significant efficiency gains, relative to non-exporters, with even greater productivity gains for Lithuanian firms supplying sales markets in the Eastern European new member states. These findings

may suggest that, together with possible scale and price effects, higher productivity and technology standards in foreign markets may indeed represent an important source for more knowledge transfers.

Finally, our analysis may also be interpreted as a call for further research on potential productivity premiums following sequential exporting (i.e. expanding initial single market entry to multiple destinations), on how market-specific learning effects may depend on the firm's own absorptive capacity (Cohen and Levinthal, 1989), or on how the identified productivity premiums may be broken down into possible, export price or technology adoption effects.

REFERENCES

Aghion, P., Griffith, R., 2005, Competition and Growth: Reconciling Theory and Evidence, Cambridge, MA: MIT Press, 2005.

Albornoz, F., Calvo Pardo, H., Corcos, G., Ornelas, E., 2012, Sequential exporting, *Journal of International Economics*, 88(1), 17-31.

Andersson, M., Lööf, H., Johansson, S., 2008, Productivity and international trade: Firm level evidence from a small open economy, *Review of World Economics*, 144(4), 774–801.

Bernard, A. B., Jensen, J. B., 2004, Exporting and Productivity in the USA, *Oxford Review of Economic Policy*, 20(3), 343-357.

Bernard, A. B., Redding, S. J., Schott, P. K., 2011, Multi-product Firms and Trade Liberalisation, *Quarterly Journal of Economic*s, 126(3), 1271-1318.

Belkindas, M., Dinc, M., Ivanova, O., 1999, Statistical Systems Need Overhaul in Transition Economies, *Transition*, 10(4), 22-24.

Blalock, G., Gertler, P. J., 2004, Learning from exporting revisited in a less developed setting, *Journal of Development Economics*, 75(2), 397-416.

Blundell, R., Dias, M. C., 2000, Evaluation methods for non-experimental data, *Fiscal Studies*, 21(4), 427–468.

Castellani, D., Serti, F., Tommasi, C., 2010, Firms in International Trade: Importers and Exporters Heterogeneity in the Italian Manufacturing Industry, *The World Economy*, 33(3), 424-457.

Caliendo, M., Kopeinig, S., 2008, Some Practical Guidance for the Implementation of Propensity Score Matching, *Journal of Economic Surveys*, 22(1), 31-72.

Chaney, T., 2008, Distorted gravity: The intensive and extensive margins of international trade, *American Economic Review*, 98(4), 1707–1721.

Chesbrough, H., 2006, Open Business Models: How to Thrive in the New Innovation Landscape, Harvard Business School Press, Boston, MA.

Cohen, W.M., Levinthal, D.A., 1989, Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico and Morocco, *The Quarterly Journal of Economics*, 113, 903-947.

De Loecker, J., 2007, Do exports generate higher productivity? Evidence from Slovenia, *Journal of International Economics*, 73(1), 69–98.

Eaton, J., Kortum, S., 1999, International Patenting and Technology Diffusion: Theory and Measurement, *International Economic Review*, 40: 537-570

Falvey, R., Yu, Z., 2005, Exporting and Productivity Growth: Theory. In H. Görg, D. Greenaway, R. Kneller (eds.) Globalisation and Productivity Growth. London: Palgrave Macmillan, pp. 117-135.

Girma, S., Greenaway, D., Kneller, R., 2004, Does Exporting increase productivity? A Micro-econometric Analysis of Matched Firms, *Review of International Economics*, 12(5), 855-866.

Greenaway, D., Kneller, R., 2008, Exporting, productivity and agglomeration, *European Economic Review*, 52, 919-939.

Keller, W., 2002, Geographical localisation of international technology diffusion, *American Economic Review*, 92: 120-142.

Keller, W., 2004, International Technology Diffusion, *Journal of Economic Literature*, 42(3): 752-782.

Laursen, K., Salter, A., 2006, Open for Innovation: The role of openness in explaining innovation performance among UK manufacturing firms, *Strategic Management Journal*, 27(2), 131-150.

Lawless, M., 2009, Firm export dynamics and the geography of trade, *Journal of International Economics*, 77(2), 245–254.

Levinsohn, J., Petrin, A., 2003, Estimating production functions using inputs to control for unobservables, *Review of Economic Studies*, 70, 317-341.

Masso, J., Vather, P., 2015, Exporting and productivity: The effects of mulit-product and multi-market export entry, Scottish Journal of Political Economy, 62(4), 325-350.

Mayer, T., Melitz, M. J., Ottaviano, G.I.P, 2014, Market Size, Competition, and the Product Mix of Exporters, *American Economic Review*, 104(2), 495-536.

Melitz, M. J., 2003, The impact of trade on intra-industry reallocations and aggregate industry productivity, *Econometrica*, 71(6), 1695-1725.

Muuls, M., Pisu, M., 2009, Imports and exports at the level of the firm: Evidence from Belgium, *The World Economy*, 32(5), 692–734.

Organisation for Economic Co-operation and Development, 2015, Economic assessment of Lithuania, Eco/Edr(2015)24, Paris.

Pisu, M., 2008, Export destination and learning-by-exporting: Evidence from Belgium, Working Paper 140, National Bank of Belgium.

Rauch, J., Watson J., 2003, Starting Small in an Unfamiliar Environment, *International Journal of Industrial Organisation*, 21(7), 1021-1042.

Rosenbaum, P., Rubin, D., 1983, The Central Role of the Propensity Score in Observational Studies for Causal Effects, *Biometrika*, 70(1), 41-50.

Serti, F., Tomasi, C., 2014, Export and import market-specific characteristics. How they drive the decision to trade and how much, *Empirical Economics*, 2014, 47, 1467-1496.

Silva, A., Afonso, O., Africano, A. P., 2013, Do Portugese manufacturing firms self-select to exports?, *International Economics and Economic Policy*, 10(4), 521-547

Van Biesebroeck J., 2005, Exporting raises productivity in sub-Saharan African manufacturing firms," *Journal of International Economics*, 67(2), 373-391.

Wagner J., 2012, International trade and firm performance: a survey of empirical studies since 2006, *Review of World Economics*, 48:235–267

Wilhelmsson, F., Kozlov, K., 2007, Exports and productivity of Russian firms: In search of causality, *Economic Change and Restructuring*, 40(4), 361–385.

Yashiro, N., Hirano, D., 2009, Do all exporters benefit from export boom? Evidence from Japan, KIER Working Paper 689, Kyoto University: Institute of Economic Research.

ANNEX

Table A.1. **Summary statistics**

Variable	Mean	Std. dev.	Min	Max
Export share	0.06	0.39	0	1
Total output (in logs)	9.31	1.31	4.58	14.14
Total employed (in logs)	3.75	0.93	0	6.70
Total factor productivity (in logs)	5.58	0.83	1.74	10.58
Capital-Labour ratio (in logs)	5.11	1.49	0.07	11.17
Foreign ownership	0.09	0.29	0	1

Note: The summary statistics are based on the final estimating sample.

Table A.2. **Quality of propensity score matching: t-tests comparing sample means of the treated and control groups - total factor productivity**

Lithuanian manufacturing

	Single-market exporting				*Multi-market exporting*			
	Treated	Control	T-test (stat.)	T-test (p-val.)	Treated	Control	T-test (stat.)	T-test (p-val.)
Total factor product.$_{t-1}$	6.10	6.25	-0.51	0.61	5.93	6.22	-1.03	0.32
Employment$_{t-1}$	4.51	4.61	-0.33	0.74	4.34	4.81	-1.28	0.21
Capital intensity$_{t-1}$	5.26	5.63	-0.89	0.38	5.36	5.33	0.04	0.97
Value-added$_{t-1}$	10.48	10.74	-0.71	0.49	10.17	10.85	-1.54	0.14
Foreign ownership$_{t-1}$	0.12	0.18	-0.47	0.64	0.08	0.08	0.00	1.00

Lithuanian manufacturing

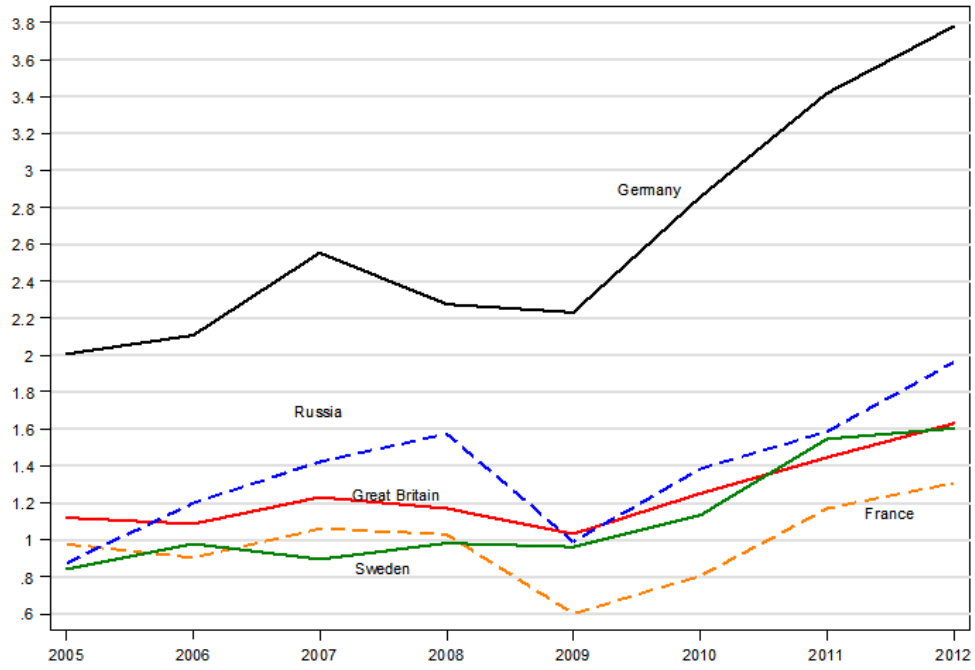
	Exporting to EU-15				*Exporting to EU-28*				*Exporting to NMS*			
	Treated	Control	T-test (stat.)	T-test (p-val.)	Treated	Control	T-test (stat.)	T-test (p-val.)	Treated	Control	T-test (stat.)	T-test (p-val.)
Total factor product.$_{t-1}$	5.75	6.80	-2.26	0.04	5.82	6.36	-1.64	0.12	5.98	6.07	-0.26	0.80
Employment$_{t-1}$	4.45	4.52	-0.21	0.84	4.45	4.98	-1.32	0.20	4.65	4.63	0.05	0.96
Capital intensity$_{t-1}$	4.96	6.34	-1.94	0.08	5.55	5.43	0.26	0.80	5.22	5.13	0.18	0.86
Value-added$_{t-1}$	10.04	11.31	-2.05	0.06	10.17	11.14	-2.33	0.03	10.47	10.53	-0.11	0.91
Foreign ownership$_{t-1}$	0.00	0.00	-	-	0.10	0.10	0.00	1.00	0.07	0.07	0.00	1.00

Lithuanian manufacturing

	Exporting to developed countries				*Exporting to developing countries*			
	Treated	Control	T-test (stat.)	T-test (p-val.)	Treated	Control	T-test (stat.)	T-test (p-val.)
Total factor product.$_{t-1}$	6.08	6.00	0.39	0.70	5.93	6.53	-0.93	0.38
Employment$_{t-1}$	4.57	4.60	-0.13	0.89	4.06	4.68	-1.24	0.25
Capital intensity$_{t-1}$	5.41	5.68	-0.79	0.43	4.72	5.48	-0.66	0.53
Value-added$_{t-1}$	10.52	10.50	0.07	0.94	9.86	11.07	-1.13	0.29
Foreign ownership$_{t-1}$	0.08	0.13	-0.46	0.65	0.20	0.00	1.00	0.35

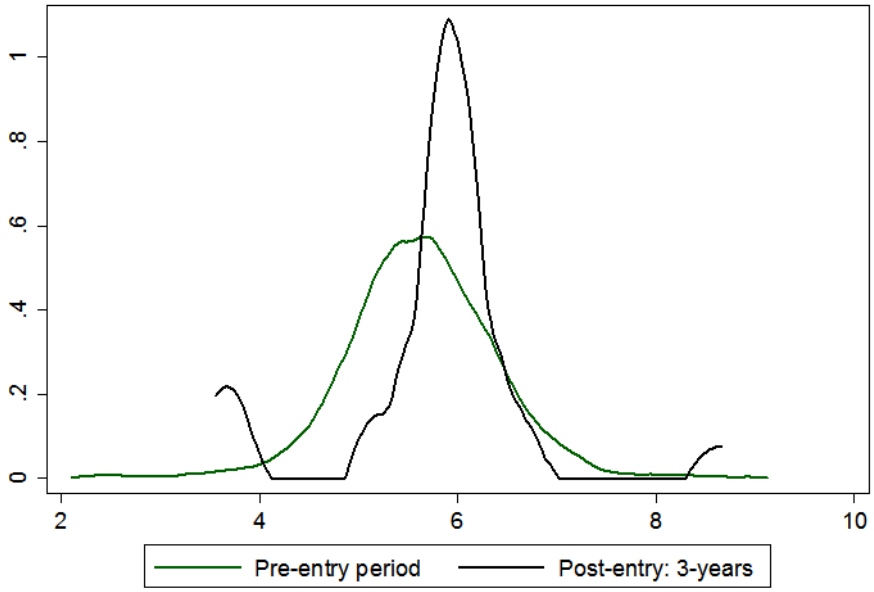
Note: *, **, *** respectively denote the 10%, 5%, 1% significance levels.

Figure A.1. **Exports by main trading partners**



Source: Author's own calculations based on data from Lithuania National Statistics.

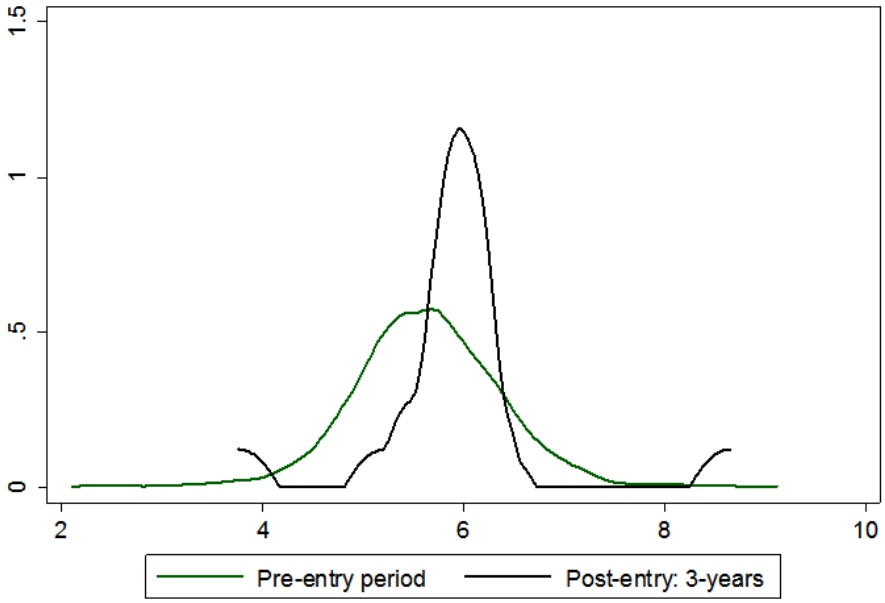
Figure A.2. **TFP (logs) distribution for EU-28 market entrants**



Notes: Kernel density of total factor productivity (logs) based on a sample of Lithuanian EU-28 export market entrants. The pre-entry curve depicts the TFP distribution in the pre-entry period, while the post-entry curve illustrates the former three years following the decision to export.

Source: Author's own calculations based on data from Lithuania National Statistics.

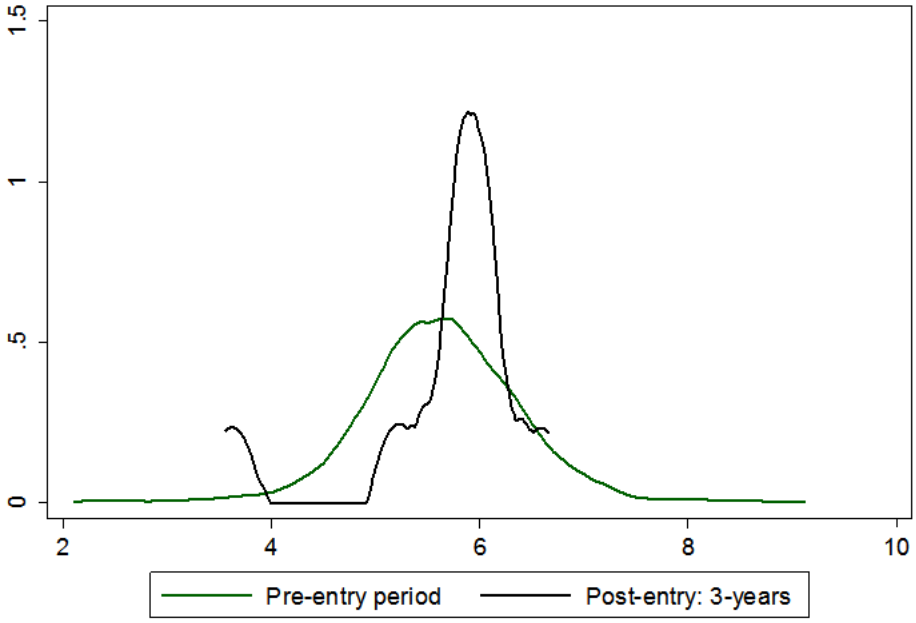
Figure A.3. **TFP (logs) distribution for EU-15 market entrants**



Notes: Kernel density of total factor productivity (logs) based on a sample of Lithuanian EU-15 export market entrants. The pre-entry curve depicts the TFP distribution in the pre-entry period, while the post-entry curve illustrates the former three years following the decision to export.

Source: Author's own calculations based on data from Lithuania National Statistics.

Figure A.4. **TFP (logs) distribution for NMS market entrants**



Notes: Kernel density of total factor productivity (logs) based on a sample of Lithuanian new member states (NMS) export market entrants. The pre-entry curve depicts the TFP distribution in the pre-entry period, while the post-entry curve illustrates the former three years following the decision to export.

Source: Author's own calculations based on data from Lithuania National Statistics.

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