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Export spillovers in local companies: How the presence of exporters in a sector contributes to export activities and productivity of other firms in Estonia

Master's Thesis

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Name and Signature of Supervisor …….

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I have written this master's thesis independently. All viewpoints of other authors, literary sources and data from elsewhere used for writing this paper have been referenced.

…….. (signature of author)

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ABSTRACT

Spillover effects though observable in different settings are difficult to quantify with accuracy. Export spillovers from exporter corporations are conjectured to have effects on exporting decision of local firms, however the direction and magnitude of such effects are still unclear. This paper aims at exploring the effects of export spillovers on local firms given their absorptive capacity. Using a panel of Estonian firms over the period 2005-2013 the dissertation tries to establish a relationship between export spillovers and exporting decision along with productivity levels of local manufacturing firms. The dissertation is also geared towards inquiring the dynamics of the above stated relationship when the ownership of firms changes from local to foreign. It was found out that export spillovers have positive effect on firms' export decision only when absorptive capacity is high. The other main finding is that domestic firms seem to benefit from the export spillover effect through high absorptive capacity. The other main finding is that in case of export spillovers effect, higher the absorptive capacity of the foreign-owned firm less likely for the firm to increase labor productivity.

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1. INTRODUCTION

This paper is motivated to study the impact of export spillovers in firms in Estonia given the likely heterogonous nature of absorptive capacity. The relationship between absorptive capacity and export spillovers effect is indeed important to notice. While spillovers may have a certain impact on firm's productivity or performance level (Aitken, 1997), this effect may vary across different degrees of absorptive capacity because for the spillover-effects to be absorbed by a given firm, a certain level of initial knowledge absorptive capacity may be needed.

Absorptive capacity is defined as the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends that is critical to its innovative capabilities (Cohen and Levinthal 1990). Absorptive capacity is generated in a variety of ways. Research shows that firms that conduct their own R&D are better able to use externally available information (Tilton, 1971; Mowery, 1983). In addition to the idea of absorptive capacity being created as a byproduct of a firm's R&D investment, some other authors evince that absorptive capacity also may emerge as a byproduct of a firm's manufacturing operations. Researchers found out that by being involved directly in manufacturing, a firm is better able to acknowledge and utilize new information (Abernathy, 1978; Rosenberg, 1982).

The knowledge spillovers and the role of absorptive capacity have been investigated a lot in the context of Foreign Direct Investment. There is significant competition among governments to attract FDI which would have effects on economy in both direct and indirect ways (Chaudhuri, et. al., 2014). It is speculated that the inflow of FDI helps the local firms to improve via the spillover effects (Aitken and Harrison 1999). However, also exports are one important channel of growth enhancement, via export related externalities such as the knowledge spillovers (Bernard and Jensen, 1999; Aitken et. al., 1997). When the decisions of a firm has positive or negative effects over the growth and productivity of other firms that are connected with them via industry or sector, it is referred to as spillover effect. Previously a large number of researchers have found out effects of FDI spillovers, R&D spillovers, various types of knowledge spillovers (Yang, 2014, Alvarez, 2007, Greenaway, et. al. 2004). However, this paper focuses specifically on export spillovers and their effects on exporting activity and productivity of the other companies. Previously, Greenaway, Sousa and Wakelin (2004) have researched about whether domestic firms learn to export from multinationals or not. Their research led to the conclusion that the exporting activities of Multinational Enterprises (MNE) from United Kingdom have positive spillover effects for local

Portuguese companies in terms of their attitude towards exports as well as its propensity (Greenaway et. al. 2004).

In addition to this, there is a detailed study by Masso, Rõigas and Vahter (2015) which concludes that the previous working experience of top-level management in an exporting organization in Estonia has a direct and positive affect to the export decision they make in new organizations, especially when the previous exporting experience was from a nearby product space.

In this thesis, I intend to find out relationship between Estonian firms' export entry decision, productivity and export spillovers and how these relationships depend on the absorptive capacity level and ownership (foreign, domestic) of firms. Specifically speaking, this thesis shall be revolving around the following three questions.

1. Do the export spillovers have an influence on firm's decision to export?
2. If there exists such spillover effect, does the impact of export spillovers on firm's productivity level changes for different degrees of absorptive capacity?
3. Do the export spillovers act as a catalyst for the productivity levels of domestic owned firms and foreign owned firms on different levels?

In order to ensure the robustness of results, I conduct a systematic study of the export decision of all manufacturing firms in Estonia and their productivity based on their absorptive capacity level as well as by their ownership. This approach of attacking the problem from two different dimensions i.e. with reference to ownership as well as the absorptive capacity, not only addresses the third research question, but also serve as a natural sensitivity analysis because of different treatment and control groups.

Export spillover is the effect of exporting firms on exporting decision and productivity of other firms (Aitken et. al., 1997, Hu and Tan, 2015). Currently, our world is experiencing rapid globalization and trade being one of its major drivers, the international linkages among businesses are also growing. So far, economists have often dedicated their efforts in studying the firm level decision making on exporting, i.e. by identifying factors that might influence the firms' exporting decisions (Aitken et. al., 1997, Roberts et. al., 1997). However, export spillovers are one of the likely key drivers of exporting activity. (Kneller and Pisu, 2007)

The aim of this thesis is to investigate the impact of export spillovers on exporting decisions and productivity of local firms and to further investigate the relationship in more detail by taking into account the absorptive capacity of an individual firm. An increase in absorptive capacity level for current low absorptive capacity level firms would help to the firms to would benefit from

existence of export spillovers (from higher share of exporters in a sector). If there is shortage of skill intensity and experience with more advanced technologies, this can substantially limit export spillovers.

In what follows, Section II reviews the academic literature. Section III discusses the data and describes the methodology. Section IV is dedicated to the presentation and discussion of results; and Section V will conclude my work for this thesis.

2. BACKGROUND AND REVIEW OF LITERATURE

This section aims to provide some background along with the review of literature relevant to my thesis. I will try to provide an elaborate overview of the relationship between export spillovers and export decision of the firms in order to understand the nature of my topic and my contribution to the literature.

Van Steel and Nieuwenhuijsen (2002) define the positive spillovers as the improvement or innovation realized by one enterprise benefitting the performance of another without the latter enterprise paying for this positive impact. One of the major types of spillover effects are the knowledge spillovers. On a firm level, the knowledge spillover is one firm benefitting from the knowledge generated by another firm without paying for this (Yang and Steensma, 2014). These firms usually combine the knowledge from the originating firm with their own knowledge to produce innovation (Yang and Steensma, 2014).

Marshall-Arrow-Romer (MAR) externalities associated with industrial specialization suggest that within a specific geographic region an increased concentration of an industry facilitates knowledge spillovers across firms. Marshall (1890) remarks that industries group geographically for three main reasons: (1) a thick market for specialized skills, (2) pecuniary externalities through forward and backward linkages and (3) technological or knowledge spillovers among firms. Arrow (1962) presents an early formulation of the economic implications of learning-by-doing which, in a more rigorous manner, is refined and extended in the contribution of Romer (1986).

According to the Marshall-Arrow-Romer (MAR) model, the knowledge spillover is stronger among the firms from the same industry if they are in a close proximity (Berchmans, Muchie, Zeleke, 2015). There have been some arguments that the knowledge spillovers decrease the incentive for the companies to embrace Research and Development (R&D) as they can integrate the innovation prepared by other companies in their proximity (Aghion and Jaravel, 2015).

Cohen and Levinthal's concept of absorptive capacity offers a counter-argument. The absorptive capacity refers to the *"ability to recognize the value of new information, assimilate it, and apply it to commercial ends"* (Cohen and Levinthal, 1990, pp. 128-152). Cohen and Levinthal argued that the R&D supports the absorptive capacity of the companies, thus, providing an incentive for them to engage in R&D and not count only on the knowledge spillovers (Aghion and Jaravel, 2015). There have been a lot of studies indicating that the positive impact of the FDI through the economic growth is higher particularly when the companies have a high absorptive capacity (Saleh and Khordagui, 2013) (Sallero, Martinez, Vazquez, 2013).

Export spillovers and its effects have been studied previously (Silvente and Giménez, 2006). Koenig et. al. (2010) showed that the probability of a manufacturing firm to export is increased by its geographic proximity to exporters. Aitken et. al. (1997) has examined the possibility of whether the spillovers work via decreasing the costs of firms or not. According to Melitz (2003), in order to be an exporter, the company needs to be able to cover some of its sunk expenses, and companies that have the ability to do it can become exporters.

Bernard and Jensen's (1999) paper "Why do firms export" argues that in order to increase the chance of being an exporter, companies need to exchange information. Doing this increases the probability of non-exporting companies to enter foreign markets. Koenig et. al. (2010) also conducted an empirical study to find out the relationship between the knowledge exchange between companies and export initiatives. The results are pretty much in line with the one found out by Bernard and Jensen (1999).

There have been carried through studies which have attempted to find the link between exporting and knowledge transferred between firms. They have also tested whether R&D influences exporting. Aw and Roberts have 3 different studies with Winston (Winston et. al., 2007) and with Xu in 2008 and 2010. They mostly focused on whether innovation has an effect on decision to export. In 2007, they found no direct statistical relationship between the R&D and exporting activity. Their results were proving the claim that R&D leads to future productivity improvements and it increases the possibility of exporting activity of the firm (Aw, 2007).

In 2008, study with the Xu suggested that R&D and exports are two independent variables, and thus they studied whether the larger export markets lead to larger future returns for R&D (Aw et. al., 2008). However, in 2010, they found out that there exists a weak relationship between exporting activity and return on R&D. Similarly, in 2007, they found out that R&D leads to productivity improvements which later on lead to self-selection into exporting activity. Additionally, I will be

contributing through this dissertation to the existing literature by addressing to the research question that whether exporting spillovers affect the productivity of the other firms.

Some studies argue that previously non-exporters did not attach importance to the exporting behavior of other firms. So, it fails to play significant role in decision to start exporting as no one starts exporting only because others succeeded in exporting (Roberts and Tybout, 1997; Bernard and Jensen, 1999; Clerides et. al., 1998; Clerides and Kassinis, 2001). According to Greenaway et. al. (2004), exporting firms are more productive than non-exporters. Therefore, if presence of exporting firm results in more indigenous firms exporting, so an indirect productivity spillover will result.

Another study done by Alvarez (2007), shows that labor skills and technology have positive effect on becoming an exporter. Also, it was found out that previous exporting experience, MNE's (Multinational Enterprises) spillovers and an increase in productivity levels positively effect to the probability of becoming a permanent exporter (Alvarez, 2007). Furthermore, there were other studies which found the opposite of what was mentioned above. This will also be discussed in the results section of this thesis for the case of Estonian firms.

There is some research about the channels of knowledge transfers that leads to export spillovers. Many researchers have mentioned different channels of spillovers on firms' productivity levels. For example, if the firm hires employee with prior experience in the specific market, for the firm it is more likely for export entry to that specific region. (Masso et. al., 2015) Thus labor mobility is one of the key channels of export spillovers. Aitken and Harrison's (1999) study this issue: after an employee of the foreign-owned firm starts new position in the domestically owned firm, his/her knowledge can be of great influence on domestic owned firms' productivity levels. Moreover, they discuss also about the negative effect of competition caused by foreign owned firms to the domestically owned firms. Foreign owned firms with higher productivity have a chance to draw local market share away from domestic firms. This draw can lead domestic firms to cut their productivity levels (Aitken and Harrison, 1999). Similar competition effect might occur in the case of export spillovers as well. When exporter firms increase their productivity due to participation in the foreign markets, it may lead non-exporter firms to decrease their productivity levels. The reason behind it is non-exporters start losing their market shares in home country to more capable exporters.

3. METHODOLOGICAL FRAMEWORK

3.1 Data and Variables

This paper uses a panel data from 2005 till 2015 obtained from the Estonian Business registry. The data is reported at the annual frequency. This dataset has been merged by Jaan Masso with the Statistics Estonia firm-product-market level exports data for the period of 1995-2014. The information includes firms' export activity, size, age, wage expenses, labor productivity based on sales, equity and turnover. In order to cover all the necessary variables for modelling the spillover effects, missing variables have been dropped, hence year 2014 and 2015's data has been removed from the analyses because of the year differences of the two datasets. The top 1% and bottom 1% of the variables used in the research have been recognized as outliers and dropped. Moreover, the database includes EMTAK 5-digit level industry code which is the Estonian national version of the international harmonized NACE classification. To calculate the export spillover variables the EMTAK 3-digit codes are used. A complete set of industry dummies have been included into regression equations to identify other EMTAK 2-digit industry level effects.

A quick descriptive statistics calculation for the share of observations exporters and non-exporters on firm-year observation level revealed that exporters have 23.91% (11,996) of total firms-year observations. As this dissertation focuses on the manufacturing firms only, we need to see the share of such firms and then estimate the impact that these firms create for their non-exporting counterparts. For this purpose, a simple dummy variable was created with 1 being coded for exporter and 0 otherwise. The following contingency table shows the quick stats for manufacturing firms' year-firm combination for the period of 2005-2013.

Table 1: Contingency table for Manufacturing firms based on Exporting

(firm-year observations level)

	Frequency	Percent	Cumulative
Non- Exporter	38,179	76.09	76.09
Exporter	11,996	23.91	100.00
Total	50,175	100.00	

Appendix 1 shows total amount manufacturers who are involved in the exports of several different products and classify them according to their ownership i.e. domestic or foreign. A cursory overview of the table reveals that the domestically owned manufacturing firms dominate over foreign owned firms in exports.

For the purpose of this dissertation, firms will further be classified into two groups i.e. High and Low, based on their absorptive capacity for benefiting from spillovers.

There are two dimensions of interest in this paper, firstly whether the firm decides to export or not (export propensity) and secondly whether existence export spillovers influence on the productivity of firms with the role of absorptive capacity. In case of the export model where the dependent variable is the dummy variable (exporting), the main explanatory variable is spillovers and various control variables that have been used by the similar studies (Masso et. al., 2015) are used to control for the effects other than spillovers that are the following: age, age squared, size, size squared, capital to labor ratio, foreign owned firms and productivity. The squared of some variables are included in order to control for the non-linear relation between these variables and the productivity. In case of productivity model where the dependent variable is the productivity, the main explanatory variable is the export spillovers. However, in order to see whether the impact of the export spillovers on firm's productivity level varies across different degrees of absorptive capacity, an interaction variable is created by interacting the export spillover variable and the absorptive capacity variable. Similarly, there are various control variables such as profitability, exporters, capital to labor ratio, size, size squared, age, age squared, year dummies and sector dummies to control for the time fixed effects and the sectors.

As the literature indicates, the above-mentioned control variables have a direct and significant impact on the exporting decisions of the firm, hence to isolate the affect the variables of interest, the other variables need to be controlled (Majocchi & et. al., 2005; Bernard and Wager, 2001)

Since absorptive capacity of an individual firm is not an observable characteristic, therefore, I shall be resorting to a proxy for absorptive capacity. In order to have a valid proxy, the proxy variable must be directly related to the unobserved characteristic and should only have an indirect effect over dependent variable via unobserved characteristic channel. A valid proxy in case to me is to be skills, calculated as wage cost to the employment of the firm (see equation 1 below). Skills does not affect the exporting decision only directly but also indirectly through absorptive capacity channel.

$$Skills_{i,j,t} = \frac{(Wage\ cost_{i,j,t}t)}{(number\ of\ employees_{i,j,t})} \quad (1)$$

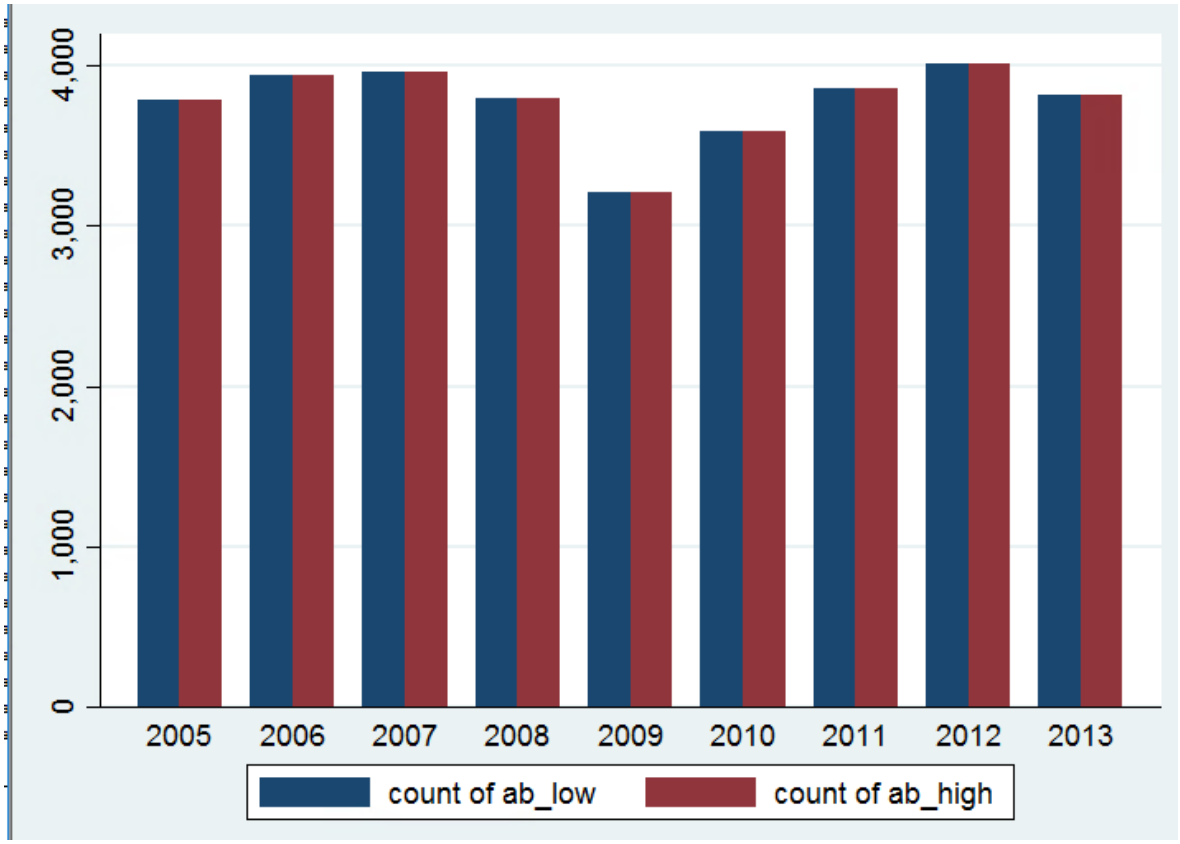
i = Firm

j= sector

t= time

To understand the influence of absorptive capacity proxy, the companies in the sample space were divided into 2 groups according to their skills level. In order to define the groups, I took the average of skill intensity for each year and the first group is having less than average of skills for each year, being the group with low level of absorptive capacity and the second group has more than average level of skills for the each years between 2005 and 2013, hence being defined as the group with high level absorptive capacity. The following histogram depicts the number of companies at the groups of low and high absorptive capacity levels.

Figure 1: Number of Companies at Low and High Absorptive Capacity groups



In order to study the effects of spillovers, I have created the variable spillover, the mathematical formulation of which is provided below in equation (2). Exporter spillovers are calculated as sum of exporters' sales without the shares of their own turnover divided by the sales of all firms. By doing

this, we see the share of the exporters in a sector. Export spillovers has been calculated on 3-digit level of EMTAK aggregation.

$$Spillovers_{i,j,t} = \frac{\sum(Turnover_{i,j,t} * Export\_dummy_{i,j,t}) - Turnover_{i,j,t}}{\sum(Turnover_{i,j,t})} \quad (2)$$

i = Firm

j= sector

t= time

Table 2: Correlation table of Spillovers, Productivity and Exporting

(2005-2013)

	Spillovers	Productivity (log)	Exporters
Spillovers	1.000 63,763		
Productivity (log)	0.0451* 0.0000 35,835	1.0000 35,837	
Exporters	0.2173* 0.0000 48,851	0.3238* 0.0000 35,256	1.0000 49,991

Table 2 shows correlation matrix between Spillovers, productivity and exporters for the years 2005-2013 for the manufacturing firms whilst outliers have been dropped.

Summary statistics of the above variables can be found in Appendix 2.

3.2 Methodology

In this paper the analysis for a large number of firms is conducted and each firm is different from the other in terms of management style, business practices and so on. Therefore, to account for the individual differences between the firms fixed effects model is preferred to OLS. Because it may be the case that one firm due to its better management practices, able to reap more benefits of spillovers, therefore, it is not needed such things to affect with the causality that we are looking for.

Earlier studies, such as Aitken et. al (1997), focused on spillovers effects and foreign investment, whereas here the research focuses on how spillovers and foreign investment affect firm's decision to export alongside with its productivity. For the purpose of addressing the first two research questions elicited in the Section 1 of this dissertation a latent variable approach with dichotomous output variable is used. The most appropriate way is Heteroskedastic Probit Model with Robust Standard Errors in instances similar to this paper. The mathematical formulation of the aforementioned latent variable is elicited below using equation (3) & (4)

$$f_{it}^{*} = \beta x_{it} + u_{it} \tag{3}$$

and,

$$f_{it} = 1 \; if \; f_{it}^{*} > 0 \tag{4}$$

$$f_{it} = 0 \; if \; f_{it}^{*} \leq 0$$

Equations (3) and (4) describe the measurement of the probability of local firms' decision to export with a latent dependent variable f_{it}^{*}. As such it creates a dichotomous variable that takes the value of 1 when firm *i* is exporting at time *t*, and 0 otherwise. The final model can be written with the following mathematical representation.

$$Exporters_{i,t} = \beta_1(Spillovers_{i,t}) + \beta_2(Productivity_{i,t}) + \beta_3(X_{i,t}) + \varepsilon_{i,t} \tag{5}$$

In equation (5), $Exporters_{i,t}$ is the exporting dummy for the firm *i* at period *t* where the value of 1 indicates that the firm is exporting and 0 indicates the firm is not exporting, $Spillovers_{i,t}$ represents the export spillovers for firm *i* at period *t*, $Productivity_{i,t}$ represents the productivity level of the firm *i* at period *t* that is the second main explanatory variable. $X_{i,t}$ represents the control variables such as firm *i*'s age and size for firms *i* at period *t* and $\varepsilon_{i,t}$ is a gaussian white noise error term.

As for the last research questions that pertains to the establishment of linkages between spillovers and productivity level, I used a mixed effects modelling approach as well as OLS, fixed effects

model and as well as random effects model. The reason is the general superiority of mixed models over its other counterparts i.e. fixed, random and OLS models, especially for firm level data with different sectoral and industrial characteristics (McCulloch and Neuhaus, 2005). Two different approaches will be adopted to establish relationship between productivity levels and export spillovers. The first one will be a mixed model with random intercept, which will allow flexibility for individual firm specific differences. The second model will be a mixed model with both random intercept as well as random slope. The random slope component will help us identify how the interaction of effects of control variables vary from firm to firm. This would in turn be identifying the industrial and sectoral differences between the firms. Mathematical formulation both of the mixed models are provided below in equation (6) and (7)

$$\log(Productivity)_{i,t} = \beta_i + \beta_1 Spillovers_{i,t} + \beta_2 Skills_{i,t} + \beta_3(X_{i,t}) + \varepsilon_{i,t} \quad (6)$$

$$\log(Productivity)_{i,t} = \beta_i + \beta_{1i} Spillovers_{i,t} + \beta_{2i} Skills_{i,t} + \beta_{3i}(X_{i,t}) + \varepsilon_{i,t} \quad (7)$$

Table 2 below provides a correlation matrix for some of the variables that will be used as inputs in the abovementioned models. It is revealed from the table that except productivity, every other control variable is positively and strongly statistically significantly correlated with export spillovers. Besides that, there is no negative correlated variables in the data. Labor productivity of the firm and its size have positive correlation however it is not statistically significant. Even if there is no statistically significant correlation between some variables, these results are in line with previous researches (Islam et. al., 2015; Wagner, 2002).

Table 2: Correlation matrix of the explanatory variables for manufacturing firms in 2005-2013

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Exporter (1)	1.0000						
Age (2)	0.2301* (0.0000)	1.0000					
Size (3)	0.6023* (0.0000)	0.3015* (0.0000)	1.0000				
Capital to labor ratio (4)	0.2212* (0.0000)	0.1419* (0.0000)	0.1395* (0.0000)	1.0000			
Productivity (5)	0.1385* (0.0000)	0.0031 (0.5482)	0.0059 (0.2570)	0.1324* (0.0000)	1.0000		
Spillovers (6)	0.2102* (0.0001)	0.0017* (0.0000)	0.1865* (0.2928)	0.0438* (0.0000)	-0.0105* (0.0000)	1.0000	
Absorptive Capacity (7)	0.3357* (0.0000)	0.2011* (0.0000)	0.4020* (0.0000)	0.2295* (0.0000)	0.1341* (0.0000)	0.0173* (0.0026)	1.0000

The methodological limitations of this study are worth noticing. One major limitation is the potential endogeneity issue. Endogeneity of spillovers means that those variables that are not included in the models that have been used in this paper, which are not controlled for, may be having effect in the results. For example, supposing that export spillovers are only happening when government have favorable export policies for firms (assuming favorable export policies encourage exporting). Since these two variables are related and it is not controlled in this research paper for favorable export policies, it may be the case that export spillovers affect is partly due to true spillovers and partly due to favorable policies. Hence, coefficients for spillovers is magnified due to not controlling the other related omitted variables from the data. Since this paper does not use an instrumental variable to tackle the reverse causality, further studies addressing the endogeneity problem might be useful. The reason why this paper does not use an instrumental variable is due to the challenge of finding a valid instrumental variable for spillover. For this reason simple OLS, Fixed Effect and Random Effect models are given the focus. Moreover, the endogeneity issue is likely to occur due to reverse causality between productivity of firms and export spillovers since the relation between productivity of firms and export spillovers may run both ways. Reverse causality means that not only export spillovers have affect over the labor productivity of firms, but the relationship may be other way

round i.e labor productivity of firms affect the export spillovers in the industry. Generally, it is used Two-Stage Least Squares to take of both endogeneity and reverse causality. However, because of previous mentioned choice of OLS, Fixed Effects and Random effects model, it is suggested for the future studies to use Two-Stage Least Squares, Instrumental Variable or GMM model in order not to face endogeneity and reverse causality issues.

4 RESULTS AND DISCUSSION

The first thing to be kept in mind while going through this section is that each model has been run twice on separate dataset, in order to have separate results for High and Low absorptive capacity firms. The idea of having separate results for different absorptive capacity firms is for the sake of addressing the second research question posed in the very beginning of this thesis.

4.1 Heteroskedastic Probit Model

Starting with the first question, following are the results of the Heteroskedastic Probit Model with Robust Standard Errors for both Low and High type firms.

Table 3: Results of Probit model for Low and High Absorptive Capacity Firms

Dependent variable: Exporting *(dummy)*	Low Absorptive Capacity Firms	High Absorptive Capacity Firms
VARIABLES	(1)	(2)
Spillovers	-0.227	0.227*
	(0.245)	(0.119)
Age	-0.135	0.315***
	(0.133)	(0.099)
Age Squared	0.070*	-0.057**
	(0.037)	(0.025)
Size	0.430***	0.612***
	(0.067)	(0.047)
Size Squared	0.053***	0.020**
	(0.016)	(0.009)
Capital to labor ratio	0.033*	0.037***
	(0.018)	(0.010)
Foreign owned firms	0.921***	0.866***
	(0.119)	(0.044)
Productivity (log)	0.407***	0.469***
	(0.033)	(0.022)
Constant	-10.003	-8.035***
	(238.434)	(0.407)
Observations	9381	15788
R-squared	-1767.945	-6251.474
Year Dummies	YES	YES
Sector Dummies	YES	YES

Heteroskedastic	-0.042	-0.052
	(0.057)	(0.048)
ll	-1767.945	-6251.474

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The above results of the heteroskedastic Probit model show the parameter estimates and can indeed not be interpreted the same way as we do with ordinary least squares results. The reason being the formulation of the coefficients, which makes it difficult to interpret; however, conclusions can be made about the direction of effects and their statistical significance.

For the firms with low absorptive capacity, spillovers do not seem to have a statistically significant impact on the firms' decision to export while on the other hand for the firms with high absorptive capacity, spillovers have positive and statistically significant impact on firm's decision to export. This result indicates that firms with high absorptive capacity are more likely to benefit from this export spillover effect and thus more likely to export compared to the firms with low absorptive capacity This is in line with the results of the earlier studies(see Barrios, Görg and Strobl, 2003; Kneller and Pisu, 2007; Kokko, Zejan and Tansini, 2001). As the low absorptive capacity firms, have lesser skill intensity indicator than High absorptive capacity firms, this outcome is not surprising. For the both of the low and high absorptive capacity firms, all of the explanatory variables (except age for the Low absorptive capacity firms) have positive relation with the dependent variable that is exporting dummy. *Size* effects are positive and statistically significant for the both types of the firms, meaning of the size of the firm is increasing, it is more likely for the firm to enter the exporting activities. Independently from the owner of the firm, if size and/or age of the firm increases, the chance of being an exporter is increases. Moreover, if the firms are owned by foreigners in both cases, the firm is more likely to decide to export. It could be directly and indirectly linked to the foreign direct investment and its effects on decision to export (Aitken and Harrison 1999).

This answers the very first research question that was whether the export spillovers have an effect on other firm's decision to export. Now that it is established that export spillovers have positive and statistically significant impact on the exporting activities firms. Therefore, the question of our interest is the volume of this export spillovers effect on other firms now.? In order to answer this question, we need to quantify the effect of spillovers on exporting activities. However, the magnitude of *Spillover* coefficient in the above results cannot be taken as it is. Therefore, the calculation of Average Marginal Effects for *Spillover* needed. The results are provided in the table 4 below:

Table 4: Average Marginal Effects for Low and High Type firms

Low Abs. cap. firms	dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]
n=9,381					
Spillovers	**-0.024**	**0.026**	**-0.93**	**0.36**	-0.073 0.026
Productivity (log)	**0.042**	**0.003**	**13.07**	**0.00**	0.035 0.048
High Abs. cap. firms	dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]
n=15,788					
Spillovers	**0.051**	**0.027**	**1.91**	**0.06**	-0.001 0.105
Productivity (log)	**0.107**	**0.004**	**26.22**	**0.00**	0.099 0.115

The calculated average marginal effect (AME) shows that on average values how would the change in one unit of the investigated explanatory variable (here: spillovers, from 0 to 1) impact the dependent variable. In our case, the AME are found to be statistically significant and there is a difference between the AME of the spillover variable in the case of Low and High types of firms. The results above show that the magnitude of the coefficients of productivity is not the same for firms with high absorptive capacity and low absorptive capacity. While the magnitude of the coefficient of the productivity is 0.042 for firms with low absorptive capacity, the magnitude of the coefficient of the productivity is higher for firms with high absorptive capacity being 0.107. This result indicates that if a firm has already existing certain level of knowledge referred as high absorptive capacity, then these firms with high absorptive capacity can benefit from other firm's productivity and it will increase their chance to export. Also, for firms with high absorptive capacity, the magnitude of the coefficient of the spillover is modest being 0.051 while on the other hand export spillover does not seem to affect the firm's decision to export for firms with low absorptive capacity. The more a firm is capable to learn given the practices of a successful exporting firm, the greater it will be engaged in exporting activities. The results for the low absorptive capacity firms indicate that

if spillovers and productivity levels go up by one unit, the probability of a low absorptive capacity firms to become an exporter decrease by approximately 2% and increases by 4% respectively. On the other hand, if the firm has high level of absorptive capacity, the probability of being an exporter will go up by around 5.1% and 10.7% respectively.

For second group, export spillovers and firms' productivity level have positive effect on firm's decision to export while for the first group export spillovers is not statistically significant. The results state that this effect is much stronger for the high-level absorptive capacity level firms than low absorptive capacity level firms (if it was significant). Moreover, for both of the groups being owned by foreigner has positive relation to the firm *i's* decision to export. One difference though is that the coefficients obtained with margins command vary in terms of their magnitude. Nevertheless, the positive and robust relation is obtained between export spillovers and firms' decision to export. Due to the heterogeneity issue, the robust standard errors are used.

4.2 Mixed Model with Random Intercepts

As we have already discussed the reasoning behind using a mixed model with random intercepts, the results of this approach are discussed in this section. The results of this model will help us answer the third research question posed in the beginning which is related to the effects of spillovers on the productivity of the firm. Significant amount of research has already been done on this topic and I will contribute to the existing literature as follows. Here we shall be looking at both the cases when the firms are domestically owned or foreign owned. The table 5 below exhibit the results of mixed model with random intercepts for both domestic and foreign owned manufacturing firms, as well as all manufacturing firms.

Table 5: Results of Random Intercept model

Dependent variable: Productivity*(log)*	All Manufacturing firms	Domestic owned Manufacturing firms	Foreign owned Manufacturing firms
VARIABLES	(1)	(2)	(3)
Spillovers	-0.756***	-0.778***	1.608**
	(0.147)	(0.154)	(0.724)
Absorptive capacity	0.445***	0.429***	0.846***
	(0.012)	(0.012)	(0.058)
The interaction term	**0.091*** **	**0.429*** **	**-0.174** **
Spillovers * Absorptive capacity	**(0.017)**	**(0.012)**	**(0.078)**
Profitability	0.013***	0.011***	0.079***
	(0.001)	(0.001)	(0.006)
Exporters	0.216***	0.202***	0.220***
	(0.012)	(0.013)	(0.031)
Capital to labor ratio	0.119***	0.119***	0.124***
	(0.004)	(0.004)	(0.010)
Size	-0.240***	-0.236***	-0.291***
	(0.013)	(0.013)	(0.044)
Size Squared	0.036***	0.034***	0.040***
	(0.003)	(0.004)	(0.044)
Age	0.102***	0.098***	0.154**
	(0.025)	(0.027)	(0.073)
Age squared	-0.044***	-0.045***	-0.059***
	(0.005)	(0.006)	(0.017)
Constant	6.230***	6.354***	2.617***
	(0.785)	(0.785)	(0.569)
lns1_1_1			
Constant	-0.409***	-0.416***	-0.421***
	(0.011)	(0.012)	(0.034)
lnsig_e			
Constant	-0.900***	-0.887***	-1.194***
	(0.005)	(0.004)	(0.019)
R-squared	0.519	0.556	0.543
Observations	25,802	23,278	2,169
Year Dummies	YES	YES	YES
Sector Dummies	YES	YES	YES
ll	-20,656.626	-18,874,417	-1,288.070

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Positive and statistically significant coefficient of the interaction term for local manufacturing firms and all manufacturing firms show that for greater degrees of absorptive capacity, there is positive relation between spillovers and firm's productivity. While on the other hand for foreign-owned firms, the coefficient of the interaction term is negative meaning that for greater degrees of absorptive capacity, there is negative relation between spillovers and firm's productivity. For all manufacturing firms, the coefficient of the interaction term is positive with lower magnitude than local manufacturing firms as the foreign-owned manufacturing firms have negative coefficient of the interaction term. Absorptive capacity proxy (skills) separately has positive relationship with the productivity of firms and the coefficient is statistically significant. When absorptive capacity and spillovers effect interact, domestic owned firms get beneficial positive impact on their productivity. Thus, if the spillovers variable for foreign owned manufacturing firms increase by 1 unit (from 0 to 1), it leads productivity increase for the firm by 1.60 log points. For domestic owned manufacturing firms, if the spillovers variable increase by 1 unit, its productivity level decreases by 0.778 log points. However, when the absorptive capacity interacts with the spillovers, the firm's productivity level increase by 0.095 log points. This result confirms that the negative effects of the presence of exporters on domestic firms are limited to the low absorptive capacity firms among the domestic owned firms, whereas highly skill intensive domestic owned firms reap positive effects of the presence of exporters. Interestingly, this relationship is not confirmed in the case of foreign owned firms: there the higher absorptive capacity is not increasing the export spillovers.

A simple line of reasoning suggests that the export spillover effects help the domestic firms with high enough absorptive capacity to become more productive by adopting better management practices and technological changes, however, the foreign owned firms operating at transnational or international level with high skill intensity level already have best practices and top-notch technology, hence there is rather little for them to learn from these spillovers.

4.3 Mixed Model with Random Intercept and Random Slope

In order to increase the robustness of the results that we just discovered in the previous section, it was of major importance to let the coefficients of the control variables be different for each firm. For this purpose, this random slope model was also investigated in order to have relatively more unbiased results and reiteration of the previous findings. Table 6 below shows the results of mixed model with random intercept and random slope for both domestic and foreign owned manufacturing firms.

Table 6: Results of Random Intercept and Random Slope model

Dependent variable: Productivity*(log)*	All Manufacturing firms	Domestic owned Manufacturing firms	Foreign owned Manufacturing firms
VARIABLES	(1)	(2)	(3)
Spillovers	-0.570***	-0.562***	0.350
	(0.129)	(0.135)	(0.669)
Absorptive capacity	0.434***	0.420***	0.698***
	(0.010)	(0.011)	(0.055)
The interaction term	**0.067*** **	**0.067*** **	**-0.035**
Spillovers * Absorptive capacity	**(0.015)**	**(0.016)**	**(0.072)**
Profitability	0.831***	0.827***	0.887***
	(0.018)	(0.019)	(0.074)
Exporters	0.176***	0.157***	0.211***
	(0.010)	(0.011)	(0.027)
Capital to labor ratio	0.117***	0.117***	0.113***
	(0.003)	(0.003)	(0.009)
Size	-0.324***	-0.322***	-0.342***
	(0.011)	(0.012)	(0.039)
Size Squared	0.046***	0.045***	0.044***
	(0.003)	(0.003)	(0.008)
Age	0.123***	0.133***	0.050
	(0.022)	(0.023)	(0.064)
Age squared	-0.032***	-0.035***	-0.043***
	(0.005)	(0.005)	(0.016)
Constant	6.420***	6.532***	4.121***
	(0.740)	(0.737)	(0.534)
lns1_1_1			
Constant	-0.464***	-0.471***	-0.219**
	(0.032)	(0.033)	(0.097)
lns1_1_2			
Constant	-0.420***	-0.429***	-0.467***
	(0.011)	(0.011)	(0.034)

lnsig_e			
Constant	-1.113***	-1.101***	-1.419***
	(0.006)	(0.006)	(0.020)
R-squared			
Observations	25,802	23,278	2,169
Year Dummies	YES	YES	YES
Sector Dummies	YES	YES	YES
ll	-17474.766	-15985.500	-1019.843

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As we can see that the results in the case of domestic owned firms and 'all manufacturing firms' sample are quite similar to what we found in the previous sub-section. Even allowing for random slopes, the spillovers affect negatively and significantly the productivity only in the case of domestically owned firms. At the same time, in case of Foreign ownership, the results are insignificant (differently from previous results) and yet have a positive sign. Interaction term for foreign owned firms are statistically insignificant as well.

Regarding the control variables, it is worth noticing that there is a non-linear relation between some control variables and the firm productivity: age and size. While there seems to be negative relation between size and firm productivity, after a certain size there will cost advantages that might eventually lead to higher firm productivity. Similarly, age variable has a non-linear relation with the firm productivity where an increase in age leads to higher firm productivity until a certain age and afterwards this relation is reversed.

4.4 OLS, Fixed Effects and Random Effects Models

This part will compare the results of different estimation methods, OLS, Fixed Effect and Random Effect firstly for all manufacturing firms given in Table 9, then for domestic manufacturing firms and foreign-owned manufacturing firms given in Table 10 and Table 11 respectively.

Table 9: OLS, Fixed Effects and Random Effects model for all manufacturers

Dependent variable: Productivity*(log)*	OLS Model	FE Model	RE Model
VARIABLES	(1)	(2)	(3)
Spillovers	-0.731***	-0.697**	-0.758**
	(0.280)	(0.354)	(0.334)
Absorptive capacity	0.554***	0.390***	0.446***
	(0.021)	(0.028)	(0.026)
The interaction term	**0.088*** **	**0.081** **	**0.091** **
Spillovers * Absorptive capacity	**(0.032)**	**(0.040)**	**(0.038)**
Profitability	0.015	0.012	0.013*
	(0.014)	(0.010)	(0.011)
Exporters	0.318***	0.144***	0.218***
	(0.013)	(0.017)	(0.015)
Capital to labor ratio	0.171***	0.069***	0.120***
	(0.004)	(0.007)	(0.006)
Size	-0.128***	-0.336***	-0.238***
	(0.013)	(0.027)	(0.021)
Size Squared	0.015***	0.029***	0.036***
	(0.003)	(0.007)	(0.005)
Age	0.200***	0.068	0.103***
	(0.033)	(0.053)	(0.034)
Age squared	-0.068***	-0.004	-0.045***
	(0.005)	(0.030)	(0.006)
Constant	4.757***	6.970***	6.208***
	(0.168)	(0.272)	(0.211)
R-squared	0.473	0.249	
Adjusted R-squared	0.471	0.247	
Observations	25,802	25,802	25,802
Year Dummies	YES	YES	YES
Sector Dummies	YES	YES	YES
ll	-27,617.022	-9.084.494	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Across three different estimation models, the interaction term is statistically significant and positive that is in line with the results found in the earlier parts that can be seen in Table 5 and Table 6 that once more confirms that for greater degrees of absorptive capacity, there is positive relation between export spillovers and firm's productivity. The magnitude of the interaction term is also similar to the earlier ones that is around 0.08. Regarding the control variables age and size have the same relation with the firm productivity that has been found earlier in Table 5 and 6 confirming the non-linearity between age and firm productivity and between size and firm productivity. While the results are very similar to each other across three different estimation models, the results of the Hausman test suggest using Fixed Effect Model compared to Random Effect Model.

All the variables are statistically significant except profitability which makes positive relationship between firms' age, size, capital to labor ratio and firms' productivity level on all models. Only export spillovers and size have negative effect on firm i's productivity level while firm's absorptive capacity and its association on spillovers for all the model estimations have positive effect on firms' productivity levels. At statistically significant level export spillovers decrease productivity of the firm. If the manufacturer is an exporter as well, it is more likely for the firm to increase their productivity levels. Differently from the other authors' work firm's size has negative impact on productivity in Fixed Effects and Random Effects models as well.

As it is obvious that, the results are in the same order with Table 6. Domestically owned firms cannot increase their productivity of labor without the association of absorptive capacity with export spillovers effect. According to Table 10, the results are again in line with the results that have been found earlier in Table 5 and Table 6. Again, the positive and statistically significant coefficient of the interaction term indicates that for greater degrees of absorptive capacity, there is positive relation between spillovers and firm's productivity for domestic manufacturing firms. While the magnitude of the interaction term does not change much across different estimation methods, the magnitude of interaction term for all three estimation methods are lower than the magnitude of interaction term found in Table 5 that was 0.42.

Table 10: OLS, Fixed Effects and Random Effects model for domestic manufacturing firms

Dependent variable: Productivity*(log)*	OLS Model	FE Model	RE Model
VARIABLES	(1)	(2)	(3)
Spillovers	-0.789***	-0.706*	-0.779**
	(0.294)	(0.368)	(0.348)
Absorptive capacity	0.527***	0.380***	0.430***
	(0.022)	(0.030)	(0.027)
The interaction term	**0.104*** **	**0.082** **	**0.096** **
Spillovers * Absorptive capacity	**(0.034)**	**(0.042)**	**(0.040)**
Profitability	0.013***	0.010	0.011
	(0.014)	(0.010)	(0.010)
Exporters	0.316***	0.134***	0.204***
	(0.014)	(0.018)	(0.016)
Capital to labor ratio	0.171***	0.068***	0.120***
	(0.004)	(0.007)	(0.006)
Size	-0.110***	-0.338***	-0.234***
	(0.013)	(0.029)	(0.022)
Size Squared	0.010***	0.027***	0.034***
	(0.003)	(0.008)	(0.005)
Age	0.180***	0.067	0.099***
	(0.036)	(0.058)	(0.036)
Age squared	-0.065***	-0.004	-0.045***
	(0.005)	(0.032)	(0.007)
Constant	4.948***	7.068***	6.335***
	(0.176)	(0.285)	(0.220)
R-squared	0.452	0.243	
Adjusted R-squared	0.449	0.240	
Observations	23,278	23,278	23,278
Year Dummies	YES	YES	YES
Sector Dummies	YES	YES	YES
ll	-24,929.470	-8,447.505	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of three estimation methods for foreign-owned manufacturing firms is given in Table 11 below. The results are again in line with the results demonstrated in Table 5 and 6. Unlike the domestic manufacturing firms, here the coefficient of the interaction term is negative meaning that for greater degrees of absorptive capacity, there is negative relation between spillovers and firm's productivity. Here the magnitude of the interaction term changes more visibly across three types of estimation models. The Hausman test was in favor of using Fixed Effect Model where the magnitude of the interaction term is -0.25 and thus the highest among these different estimation methods.

In the Table 9 and Table 10, export spillovers have negative effect on productivity of the firms that have low absorptive capacity. It may be due to negative competition effect (Aitken and Harrison, 1999). If the productivity of the exporting firms increase due to their export market participation it may lead them to get more share of domestic market as well. This results low absorptive capacity non-exporter firms to cut their productivity level as they lose market share to exporter firms.

Table 11: OLS, Fixed Effects and Random Effects model for foreign owned manufacturing firms

Dependent variable: Productivity*(log)*	OLS Model	FE Model	RE Model
VARIABLES	(1)	(2)	(3)
Spillovers	0.450	2.472	1.587
	(1.128)	(1.655)	(1.155)
Absorptive capacity	0.888***	0.855***	0.846***
	(0.086)	(0.159)	(0.104)
The interaction term	**-0.085**	**-0.259**	**-0.172****
Spillovers * Absorptive capacity	**(0.119)**	**(0.176)**	**(0.122)**
Profitability	0.057**	0.087***	0.079***
	(0.029)	(0.013)	(0.013)
Exporters	0.330***	0.160**	0.222***
	(0.044)	(0.065)	(0.055)
Capital to labor ratio	0.168***	0.085***	0.125***
	(0.012)	(0.019)	(0.016)
Size	-0.333***	-0.291***	-0.292***
	(0.055)	(0.096)	(0.075)

Size Squared	0.052***	0.021	0.040***
	(0.009)	(0.018)	(0.013)
Age	0.167	0.112	0.155
	(0.130)	(0.175)	(0.131)
Age squared	-0.072***	-0.005	-0.060***
	(0.018)	(0.079)	(0.022)
Constant	2.205***	2.694*	5.116***
	(0.836)	(1.521)	(1.000)
R-squared	0.607	0.479	
Adjusted R-squared	0.595	0.465	
Observations	2,169	2,169	2,169
Year Dummies	YES	YES	YES
Sector Dummies	YES	YES	YES
ll	-2063.203	-69,682	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This part comparing the results of different estimation methods (Fixed Effect, Random Effect and OLS) for domestic firms, foreign-owned firms and all manufacturing firms confirmed the earlier findings in Table 5 and Table 6. The key findings are that while domestic firms can benefit from the export spillover effect in assistance with their high absorptive capacity, the foreign-owned firms do not seem to benefit from the export spillover effects even if they have relatively higher absorptive capacity. Schoors et. al. (2002) discusses the productivity differences between domestic owned firms and foreign-owned firms. Earlier, this study underlined the issue of endogeneity occurring mainly from potential reverse causality between spillovers and firm productivity meaning that firm's productivity may also affect the degree of spillover at the same time. Taking into account this reverse causality issue and the productivity differences between domestic owned firms and foreign owned firms (Schoors et. al., 2002), these two factors together may also account for why foreign-owned firms do not benefit from the export spillover effect in case of high absorptive capacity unlike the domestic owned firms. Because if such reverse causality is present and if the local firms are initially more productive than the foreign-owned firms, while local firms benefit from the spillover effect in association with their high absorptive capacity, the foreign-owned firms may not benefit from the same spillover effect despite of their high absorptive capacity (Schoors et. al, 2002).

5 CONCLUSIONS

This dissertation was aimed at capturing the effects of export spillovers on firm's productivity levels taking into account their absorptive capacities. This study focuses on manufacturing firms operating in Estonia, distinguishing in analyses of export spillovers between both domestic and foreign-owned manufacturing firms.

The review of the literature highlighted the fact that the specific dimensions that were discussed in this dissertation have been investigated also by other researches in other countries. Therefore, the author tried to provide insights in the case of Estonia, adding to prior analysis of export spillovers in Estonia (Masso et. al., 2015) with the help of previously available literature.

The first main finding of this study is that while the export spillover seems to have a statistically significant effect on other firm's decision to export, this is only the case if the absorptive capacity is high thus this study found out the importance of the absorptive capacity in order to see the impact of spillovers on firm's productivity. This finding suggests that the firms cannot simply benefit from the spillover effect occurred by other firm's exporting, but they need to be ready to absorb the positive externalities occurring from this export spillovers. Thus, in terms of the policy implications, this finding suggests that in order to benefit from the spillover effect created by the other firms, firms should be building on their absorptive capacity for instance through higher R&D investments.

The other main finding is that while domestic owned firms seem to benefit from the export spillover effect with the association of high absorptive capacity, the foreign-owned firms do not seem to benefit from the export spillover effect through their absorptive capacity. The potential reasoning behind has been discussed above linked with the reverse causality issue and the potential differences between firm productivity. Thus, other studies addressing this reverse causality might be useful to understand the mechanism behind more clearly.

Moreover, the negative spillover effects on firms found in this paper suggests potential role for competition effects. Exporting firms may increase productivity levels due to participation in foreign markets, this higher performance and higher productivity may lead exporter firms have greater market shares in domestic market: causing the non-exporting firms lower their productivity levels as non-exporting firms start losing their share in the domestic market.

Overall this study contributed to the literature by finding out the importance of the absorptive capacity in order to benefit from the export spillovers. This study also acknowledges the limitations of its analyses such as the quality of the data source, as there were many missing and mismatching

observations between 2005 and 2015 which was obtained from the Estonian Business registry by Statistics and Statistics Estonia. And more importantly, the main limitation of the econometric analyses was regarding the endogeneity issue occurring from the omitted variables that might explain firm's productivity and the potential reverse causality between firm productivity and spillovers. As explained in the earlier parts, due to the challenge of finding a valid instrument for export spillover, the reverse causality issue is not addressed. However other studies addressing these issues for instance with more sophisticated estimation methods such as GMM might complement our findings.

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APPENDICES

Appendix 1: Total number of exporters by firm ownership

	Domestic Firms	Foreign Firms	Total
Non-Exporter	36,247	1,441	37,688
Exporter	7,532	2,516	10,048
Total	43,779	3,957	47,736

Appendix 2: Summary statistics for manufacturing firms in 2005-2013 in Estonia

Variable	Observations	Mean	Std. Dev.
Spillovers	63,763	0.568	0.330
Absorptive Capacity	29,688	8.427	0.836
Profitability	49,127	-0.143	22.012
Exproting (dummy)	49,991	0.210	0.407
Capital to labor ratio	33,265	8.600	1.565
Size	36,442	1.637	1.304
Size Squared	36,442	4,381	5.313
Age	63,074	1.903	0.847
Age Squared	63,074	4.340	2.822
Foreign owned (dummy)	57,615	0.088	0.283

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