PRODUCTIVITY AND THRESHOLD SPILLOVERS OF THE INTERNATIONALISATION BEHAVIOUR OF BELGIAN FIRMS[1]

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This paper analyses to what extent the decision to start exporting may be subject to spillovers of the internationalisation behaviour of other firms. We distinguish between two possible channels: effects on productivity and effects on the perceived threshold level of sunk costs for exporting. For both channels, we consider geographical and activity or industry-based linkages between firms. For a sample Belgian firms we find evidence of significant spillovers on productivity as well as productivity-independent spillovers on the decision to start exporting at the firm-product-destination level. Spillovers seem more substantial in the geographical dimension than in terms of competitor, client or supplier links, except for the impact of multinationals on the productivity of domestic firms.

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Keywords: Export, FDI, spillovers, sunk cost, region

[1] The authors would like to thank C. Fuss for stimulating comments.

1 Introduction

For the last 30 years the number of firms expanding their activities beyond national boundaries has increased dramatically. Internationalisation can take different forms such as serving the foreign market through exporting, setting up a subsidiary, or a combination of both. With respect to the export decision Melitz (2003) shows that firms will export if their productivity (more specifically their total factor productivity, TFP) exceeds a certain threshold. This is illustrated in the left-hand-side of Figure 1 for firm A and B. Firm A's level of TFP is insufficient to be an exporter, whereas the more productive firm B's TFP exceeds the threshold and thus B is an exporter. In Melitz's model this is subject to a random draw: firms will export if they are lucky in productivity. However, one may ask what may constitute the causal determinants of the export decision. In this contribution we consider possible spillover effects of the internationalisation behaviour of other firms (like firm B) on the decision to start exporting by a non-exporting domestic firm (like firm A). The basic intuition of Melitz (2003) suggests two possible channels for spillover effects, both of them are also illustrated in Figure 1. The first channel is a productivity effect. The internationalisation of firm B (and other internationally active firms alike) could affect domestic firm A's productivity. This is labeled a pure productivity spillover in Figure 1. Provided the effect is positive and sufficiently large, it will lift productivity over the threshold and the non-exporting firm A will start to export. The second channel is the impact of the internationalisation of other firms on the (perceived) threshold itself. By extending the information set available to domestic firms, spillovers could lower the perceived level of sunk costs of exporting and may therefore induce a non-exporter to start exporting. This is labeled a pure threshold spillover in Figure 1. Clearly, both type of spillovers could be at work at the same time, as illustrated in the right-hand-side of Figure 1.

With respect to productivity spillover effects, there is ample research focusing on spillovers from multinational presence in the domestic economy that is largely focused on developing and transition countries (see Görg and Greenaway, 2004, and Meyer and Sinani, 2009). In this literature spillover variables are introduced as additional `inputs' to explain a measure of domestic firms' productivity. The size and significance of the resulting coefficients in a regression analysis are then taken as evidence of spillovers. The literature distinguishes between spillovers to firms in the same industry (horizontal spillovers) and spillovers to firms in other industries linked to the foreign firm through the supply chain (vertical spillovers). Spillover variables are typically measured as the share of foreign firms in industry output or employment. There is a variety of theoretical transmission channels that may lead to either positive or negative spillover effects (see Crespo and Fontoura (2007) for an overview). The rationale underlying possible FDI spillovers is that multinationals use more advanced technology, set higher standards, *etc*. that may benefit (or hurt) domestic

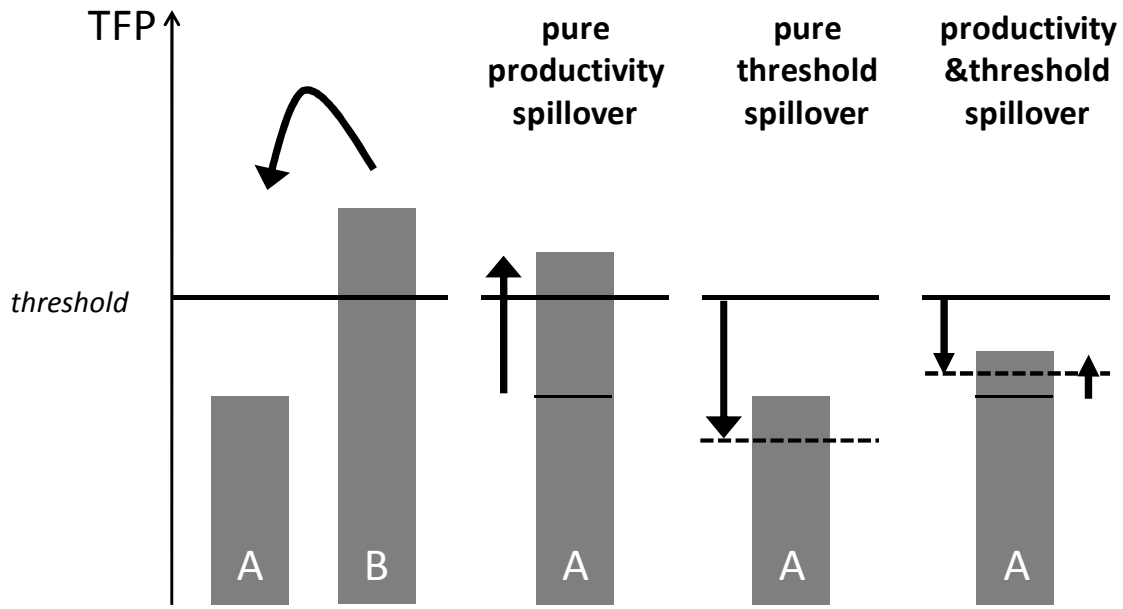

Figure 1 – Productivity and threshold spillovers

firms' productivity levels. Likewise, exporters emerge from many datasets as being on average larger and more productive than their domestic counterparts. Studies on spillovers from exporters to domestic firms' productivity are more scarce and most of these studies focus exclusively on foreign-owned exporters. Using data for Chilean manufacturing plants from 1990 to 1999, Alvarez and Lopez (2008) find evidence that both foreign-owned and domestic exporting plants improve productivity of local suppliers. Horizontal spillovers from exporting are mainly generated by plants with foreign ownership. For a panel of Colombian plants Clerides et al. (1998) find that regional spillover variables tend to be associated with cost reductions both for exporters and domestically oriented producers.

If spillover variables affect the probability to start exporting when controling for productivity, threshold spillover effects emerge. These spillover effects have received somewhat less attention in the literature. Clerides et al. (1998) find some evidence in favour of both geographic and sectoral spillovers on the export status for Colombian plants and Aitken et al. (1997) find that the presence of multinational exporters in the same industry and state increases the probability of being an exporter for a cross-section of Mexican firms. In a more recent study covering about 15 years of UK firm-level data, Greenaway and Kneller (2008) find that regional and industry agglomeration are relevant to successful entry of new exporters. They find strong and positive spillover effects from

exporters in the same industry and a similar (independent) effect from exporters in the same region. The number of exporters in a different region and a different industry has no statistically significant impact. While the aforementioned studies are at the firm level, Koenig et al. (2010) consider local export spillovers at the firm-product-destination level on the decision to start (rather than participate in) exporting. They find that spillovers are stronger when they are product and destination-specific and that they exhibit a spatial decay in France. Not all papers are consistent with the existence of spillovers, however. Using relatively aggregated measures of agglomeration (regions are measured by US states and industries at the 2 digits level) Bernard and Jensen (2004) find no role for geographic spillovers, nor for export activity of other firms in the same industry for their panel of large US plants. For a panel of Spanish firms, Barrios et al. (2003) find no indication of spillover effects through the presence of other exporters or multinationals.

The spillover effects from international activities can thus be linked to several channels and may entail a regional dimension. Although there is related work on each channel separately, we are not aware of research that considers both threshold and productivity spillovers simultaneously. In order to get a comprehensive view, we test for both productivity and threshold spillover effects for a rich panel dataset of Belgian manufacturing firms. The data further enable us to shed some light on the regional and the supply chain dimension of productivity and threshold spillovers in Belgium. Our findings suggest an important geographical dimension. Firm productivity increases with the presence of exporting firms in the same region as well as with supplying to multinational firms. There are indications of negative within-industry spillover effects, which may be linked to a competition or input crowding out effect. At the firm level the decision to start exporting seems to be driven merely by the firm's productivity level and not by threshold spillovers. However, we do find significant threshold spillover effects at the product-destination level. Similar to the productivity spillovers, the geographical dimension is important. Our results thus show that not only information spillovers on the perceived level of sunk costs matter, but so do productivity spillovers.

The remainder of the paper is organised as follows. Section 2 describes the dataset, section 3 defines the spillover variables and the estimation framework. In section 4 we present the results from our analysis and section 5 concludes.

2 Data

Our dataset was built using four databases made available by the National Bank of Belgium (NBB): the annual accounts data, the Crossroads bank, the foreign trade data and results of a survey on foreign direct investment. The annual accounts filed by Belgian non-financial companies with the Central Balance Sheet Office (CBSO) constitute the cornerstone of the dataset. They provide measures for the value added, the turnover, the intermediate consumption, the employment expressed in full-time equivalent and the capital stock. All amounts were converted into volumes using deflators at the NACE 2 digits level from the Belgian national accounts. In the database used for this paper, flow variables (i.e. value added, turnover and intermediate consumption) were realigned on the calendar year for those firms that did not close their accounts on the 31st of December. It must be noted that annual accounts data are not available for all Belgian companies as enterprises with unlimited liability, as well as natural persons conducting trade activities, do not file accounts with the CBSO. The database neither includes financial companies. Consolidated accounts were also excluded from the database in order to avoid double counting. Depending on their size, firms must either use a full or an abridged format for their annual accounts. Large firms[2], which use the full format, must report more items, such as turnover and consumption of intermediates, that are only optional in the abridged format filled out by smaller firms.

The foreign trade data are based on information collected via the Belgian customs and through the Intrastat inquiry. They not only allow to identify a firm's export status, but also convey more detailed information. E.g. besides the values and the quantities of the traded commodities, firms have also to declare the country of destination, assign a product code (8 digits combined nomenclature) to each transaction, as well as a category related to its nature (e.g. transactions with change of ownership, goods sent abroad for repairs or processing, etc.). These declarations are sent to the NBB, which uses them to compile extra-community trade statistics. The purpose of the Intrastat inquiry is to collect the same kind of information directly from Belgian firms in order to compile intra-community trade statistics. Contrary to the extra-community trade data received from the customs, whose coverage is almost exhaustive[3], the scope of the Intrastat inquiry concerns only a limited number of firms. A firm has to report its exports to or its imports from other EU Member States only if their annual amounts cross a certain threshold. The inquiry is conducted by the NBB since 1995, but unfortunately reporting thresholds were raised in 1998 and in 2006, thereby restricting the coverage of the inquiry. Therefore, in order to preserve the

[2]In 2005, a firm was considered as large either if it employed at least 100 persons, or if it crossed at least two out of the three following thresholds: (a) yearly average number of employees of 50 persons; (b) turnover of 7,300,000 euro; (c) balance sheet total of 3,650,000 euro.

[3]Customs declarations concern all transactions whose value exceeds 1,000 euro or whose weight is higher than 1,000 Kg.

Table 1 – Number of manufacturing firms (2005 data)

	Total population	Firms with less than 5 employees[1]	Firms with at least 5 employees[1]	Firms with TFP estimates based on the index method[2]	Firms with TFP estimates based on the ACF method[3]
Number of firms	24,027	15,250	8,777	6,114	5,202
Number of exporters	5,632	1180	4,452	3,324	3,162
Number of foreign firms	642	28	614	460	601
of which exporters	*572*	*11*	*561*	*429*	*549*
Number of Belgian multinationals	177	17	160	133	155
of which exporters	*146*	*3*	*143*	*123*	*140*
Sum value added (millions of euro)	47,058	1,402	45,656	35,950	42,487
Sum exports (millions of euro)	92,208	2,672	89,536	73,801	86,608
Average number of export destinations	7.6	3.0	8.8	9.2	10.4
Average number of exported products	11.7	4.3	13.7	14.1	16.3

Sources: Central Balance Sheet Office, Survey on foreign investment and foreign trade data.
'1 On average over 1998-2005.
'2 Firms with 5 employees or more, which reported their tangible fixed assets. Outliers - i.e. TFP estimates falling outside an interval defined by the interquantile range multiplied by 3 - were left aside.
'3 Firms with 5 employees or more, which reported both their tangible fixed assets and their turnover.

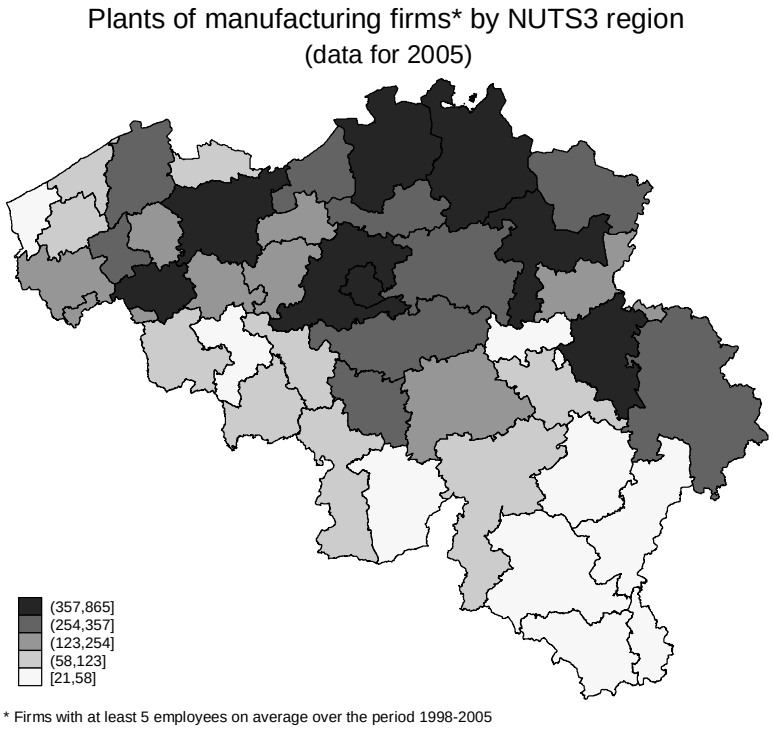

Figure 2 – District-level geographical distribution of manufacturing firms in Belgium

time consistency of firms' exporting status, we decided to limit the sample period to 1998-2005[4]. Furthermore, for the purpose of the empirical investigation, we simplified the foreign trade data in two ways before merging it with the annual accounts. First, we only considered transactions related to changes in ownership. Second, we reduced the number of product categories by collapsing the data to the 4 digits nomenclature.
Establishments of foreign firms and Belgian multinationals are identified by means of the results of the NBB survey on foreign direct investment. Conducted on a yearly basis since 1998, this survey makes a census of firms involved in foreign direct investment relations with non residents, either through direct or indirect ownership links. This includes companies holding at least 10% of the social capital of foreign firms and those of which at least 10% of the shares are owned by foreign investors. Within this framework, firms are required to report their FDI situation at the 31st December of the previous year.

Table 1 gives an overall view of the sample obtained on the basis of these data sources for the year 2005. In all, 24,027 manufacturing firms filed annual accounts with the CBSO. A lot of firms are micro firms with less than 5 employees. Only a very small fraction of these small firms is involved in foreign trade and an even smaller proportion in FDI relations. In our empirical analysis we will focus on a sample of firms with at least 5 employees on average. For the year 2005, this concerns 8,777 firms, of which 4,452 exporters. Some of these firms cannot be included in the regressions as they did not report all the items needed to obtain a TFP measure.

Finally, our data are complemented by information taken from the Crossroads bank, i.e. the registry of Belgian enterprises. The Crossroads bank contains information on the date on which firms started their activities, enabling us to determine their age. More importantly, the Crossroads bank also mentions the address(es) of firms and that of their establishments. These addresses are used to determine whether a firm owns a plant in a given region. This information will allow us to deal with multi-plant firms in the calculation of spillover variables (cf. infra). As a unit of geographical observation we focus on the NUTS 3 level. The NUTS (Nomenclature of territorial units for statistics) classification is a hierarchical system for dividing up the economic territory of the EU. NUTS 3 regions are defined as 'small regions for specific diagnoses' (population between 150,000 and 800,000). At this level Belgium is divided in 43 districts. The use of region or location in the remainder of the paper always refers to the NUTS 3 classification, unless explicitly mentioned otherwise. The geographic distribution of manufacturing firms among the Belgian NUTS 3 regions is represented in Figure 2. The regional distribution of exporters and foreign firms is very similar (see Dumont et al., 2011). The overall picture is a concentration of activity in specific regions. While it serves as indication of possible

[4]During this period, firms had to report their export flows to other EU countries if their yearly total value exceeded 250,000 euro. The same threshold held also for import flows.

geographic spillovers in terms of international involvement, it also points to the need of accurately accounting for other agglomeration effects.

3 Estimation and spillover measurement

With respect to productivity spillover effects we follow the established approach in the FDI spillover literature (see Meyer and Sinani, 2009). We relate an indicator of total factor productivity (*cf. infra*) for firm *i* in industry *j* in year *t* to different productivity spillover variables, which are discussed below, a set of control variables at the firm and industry level, and firm fixed effects. All explanatory variables are lagged one year. Because we are specifically interested in whether spillovers could lift domestic firms' productivity enough to cover the sunk costs of becoming an exporter, we focus on the specific subsample of domestic non-exporters.

With respect to threshold spillover effects, we follow the literature (e.g. Aitken et al., 1997, Roberts an Tybout, 1997, and Greenaway and Kneller, 2008) and model the firm's decision to start exporting (rather than its export status) as a logit model. Since we focus on the decision to start exporting, we create a variable that indicates whether a firm is a "*new exporter*". We consider a firm as a new exporter in year *t* if the firm exports in *t* but was not exporting in *t-1* and *t-2*. Although this allows for multiple start spells, less than two percent of new exporters, start more than a single export spell. We only consider single-plant firms for the estimation, but for the calculation of spillover variables we do take multi-plant firms into account. The decision to start exporting is related to firm productivity (*TFP*), threshold spillover variables, and firm-level controls. By including *TFP* as an explanatory variable, we can interprete the sign and significance of our spillover variables as evidence of threshold spillover effects since *TFP* will capture possible productivity spillover effects. As common in the literature *TFP* and threshold spillover variables are lagged to avoid reverse causality issues (Bernard and Jensen, 2004). Since a region with more export favourable infrastructure will host more exporters, we need to account for regional differences in export-supporting institutions because this effect will otherwise be picked up by our spillover variables. Therefore we control for region fixed effects. Finally industry, time, destination, and product fixed effects are also included among the explanatory variables.

3.1 Measurement of spillover effects

The literatures with respect to productivity and threshold spillover effects have proposed a different basis to measure spillover variables. Clerides et al. (1998) indicate that the number of exporters is more likely to affect the prevalence of knowledge about foreign technologies and markets, while volumes produced and sold more likely affect the size and efficiency of supplying industries. A similar reasoning can be applied to domestic multinationals and foreign firms in the domestic economy. Therefore with respect to

productivity spillover effects, our basis of the spillover variables -in line with the FDI spillover literature (see Görg and Greenaway, 2004)- is the share in value added of firms that are internationally active. This proxies the probability of having business relationships with internationalised firms which likely increases with their share in total transactions. For threshold spillover effects that are linked to the knowledge about foreign markets, we use the number of internationally active firms as a basis for the spillover variables (see e.g. Koenig et al., 2010, and Greenaway and Kneller, 2008). This type of information spillovers likely varies only little with the 'intensity' of internationalisation.

Griliches (1992) points out that the main problem in measuring spillover effects is the adequate definition of proximity between firms. Firms can be expected to borrow different amounts of knowledge from different sources according to their distance from these sources. The definition of distance regarding spillover effects from internationalisation behaviour can at least be twofold, either referring to physical distance or to economic distance. The latter is determined by the intensity of purchases and sales of internationally active suppliers and customers or the presence of internationally active competitors. Within a customer-supplier framework, spillover effects may result from exporting clients who demand higher quality inputs, which allows the supplier firm to increase its productivity and export as well. Similarly, exporting suppliers may provide a firm with higher quality or lower cost inputs, which enables their clients to enter foreign markets. This distinction is also relevant for more 'disembodied' spillover effects such as demonstration effects that may either originate from physically neighbouring firms or 'economic' proximate firms (i.e. suppliers, competitors, or clients). In our analysis we consider both spillovers that are linked to economic or geographic distance.

Spillovers and geographical distance

In line with previous studies such as Aitken et al. (1997), and most recently Koenig et al. (2010), we investigate the impact of internationalisation behaviour of geographically nearby firms. Based on the literature on FDI spillovers (see Meyer and Sinani, 2009), we then construct productivity spillover variables in NUTS 3 region r at time t as the share of exporters or multinationals in total regional value added. To simplify, we do not discriminate between Belgian MNEs and foreign MNEs and we do not discriminate between exporting and non-exporting MNEs. The sum of the coefficients on the export spillover variable and the MNE spillover variable can therefore be interpreted as the total spillover from MNEs. Threshold spillover variables are defined as counts of the number of firms. This approach follows the approach in Greenaway and Kneller (2008) and Koenig et al. (2010). For the estimations we first add 1 and then take logarithms of these count variables. We do so because we believe that the impact of an additional exporter in spillover terms is decreasing in the number firms that are exporting.

Spillovers and economic distance

Economic distance linked spillovers occur through the internationalisation behaviour of competitors in the same industry and through the internationalisation behaviour of suppliers and clients. We also follow the approaches in the productivity and threshold spillover literatures and construct two types of variables. When estimating spillover effects on total factor productivity, the horizontal spillover variable is defined as the share of exporters or multinationals in total industry value added. Vertical spillovers are defined as effects between firms that are linked through the supply chain. The backward spillover effect is defined as the impact of supplying goods to an internationalised firm. In line with the literature we employ input-output tables for intermediate consumption to construct technical coefficients that indicate the strength of linkages between industries. We then combine these technical coefficients with the horizontal spillover variables to obtain the share of industry output sold to downstream domestic markets with a given level of exporter/foreign presence. Doing so we avoid a potential endogeneity problem that arises when exporters or foreign firms choose more productive domestic firms as their suppliers because firms cannot easily switch industries where they buy their inputs. In the same spirit, forward spillover variables are defined to capture the impact from the relationship between domestic firms and their internationalised suppliers. For threshold spillover effects we create two within industry (horizontal) spillover variables as the number of exporters and the number of multinationals in the same NACE 2 digit industry. Forward and backward spillovers measures are then constructed using the same procedure as for productivity spillover variables.

3.2 Productivity measures

The different methods that have been proposed to derive a measure of productivity at the firm level are all known to have advantages as well as limitations and no single method appears to dominate under all circumstances (see Van Biesebroeck, 2007). Total factor productivity can be computed or otherwise estimated as a residual from a production function regression. Computing total factor productivity using the index number approach has the obvious advantage that it does not impose a specific functional form on the production function and thereby acknowledges possible cross-firm differences in production technology. However, some of the rather strong assumptions that are imposed call for caution in the interpretation of index-based TFP growth, as a measure of technical efficiency.

For the estimation of TFP using a production function regression, semi-parametric methods (e.g. Olley and Pakes, 1996; Levinsohn and Petrin, 2003) seem to have become more popular than generalized method of moments (e.g. Blundell and Bond 2000). These procedures take into account the endogeneity bias that would occur in Ordinary Least

Squares estimation if part of the residual is known to the management of firms but not to the researcher who estimates the production function. The endogeneity problem is presumed to result in overestimation of the labour coefficient of the production function and -although to a lesser extent- underestimation of the capital coefficient. Ackerberg et al. (2006) have questioned the validity of the control function estimation proposed by Olley and Pakes(1996) and Levinsohn and Petrin (2003), arguing that both suffer from a collinearity problem. They propose an alternative estimation procedure that alleviates the collinearity problem. We will use TFP growth computed with the index number approach as in Good et al. (1996) as our benchmark. We obtain the usual ranking with MNEs being the most productive firms, followed by exporters and the domestic firms (see also Dumont et al., 2010). We will use firm-level TFP estimates obtained from a production function estimated by Ordinary Least Squares and by the Ackerberg et al. (2006) procedure as a robustness check. The disadvantage of the latter approach is that it results in a substantial loss of observations (some 60% of the observations, obtained with the index approach or the Ordinary Least Squares estimation, are lost), which hampers the robustness check.

4 Results

4.1 Productivity spillover effects

Table 2 presents the results for the estimation of the impact of spillover variables on total factor productivity. All explanatory variables are lagged one period and results in Table 2 are based on a sample of non-exporting domestic firms, except those in the last column that are based on a sample of non-exporting domestic firms that never start to export in the estimation period.

We find a positive and significant impact of the number of exporters in the region in column (1). The importance of multinationals in the region does not additionally affect domestic firm productivity. But since nearly all multinationals are exporters, the contribution to tfp of multinational presence in the region is still positive though not different from domestic exporters. Spillover effects from exporters seem regional as we find no impact of the presence of exporters in the same industry, nor in industries linked through the supply chain. There are some indications that in industries with a higher importance of MNEs, domestic non-exporters are less productive. This may indicate a negative competition effect. Supplying inputs to multinationals in client industries is beneficial to domestic firms' productivity. This is a common finding in the spillover literature on developing and transition countries. Being downstream of industries with more multinational presence, by contrast, seems to be associated with lower productivity levels. The literature suggests that inputs bought from MNEs may be more expensive or simply too complicated for domestic firms to benefit from upstream MNEs. Introducing the different spillover measures one by

Table 2 – Productivity spillovers

	(1)	(2)	(3)	(4)
productivity measure	index	OLS	ACF	index
exporters' share in region va	0.130***	0.099**	-0.028	0.092**
	[0.038]	[0.041]	[0.067]	[0.045]
MNEs' share in region va	-0.026	-0.017	0.023	-0.017
	[0.017]	[0.018]	[0.029]	[0.020]
exporters' share in industry va	-0.105	-0.064	0.014	0.054
	[0.147]	[0.185]	[0.381]	[0.182]
IO weighted exporters' share in client industries va	-0.133	0.015	0.140	-0.171
	[0.123]	[0.146]	[0.250]	[0.150]
IO weighted exporters' share in supplier industries va	-0.164	0.255	0.494	-0.405*
	[0.177]	[0.229]	[0.386]	[0.216]
MNEs' share in industry va	-0.145*	0.005	0.242	-0.278***
	[0.083]	[0.131]	[0.285]	[0.107]
IO weighted MNEs' share in client industries va	0.449***	0.318*	0.189	0.474***
	[0.124]	[0.172]	[0.299]	[0.173]
IO weighted MNEs' share in supplier industries va	-0.271*	-0.664***	-0.654*	-0.069
	[0.156]	[0.197]	[0.355]	[0.189]
Observations	13053	14919	5690	9003
R-squared	0.061	0.076	0.067	0.068

Dependent variable is log TFP growth according to the index-methodology, except for columns (2) and (3) that use OLS and ACF TFP respectively; standard errors are clustered at industry-region level; *** p<0.01, ** p<0.05, * p<0.1; spillover variables are lagged one period; regressions include time, region, and industry dummies as well as firms' lagged productivity growth, age, import status and industry competition; industries are defined at Nace 2-digit level (IO table classification); regions are defined at NUTS 3 level; the estimation sample consists of all non-exporting firms in a given year except for column (4) that restrict the sample to firms that never export

one (not reported) does not suggest any potential collinearity problems and confirms the result on regional exporter presence and backward spillover effects. Columns (2) and (3) repeat the same specification using tfp measures obtained using simple OLS estimates of the production function and the Ackerberg et al. (2006) methodology. Note that the number of observations decreases considerably due to lack of sufficient data for the latter estimation algorithm. The OLS result suggests that the estimated impact of exporter presence in the region is robust. The backward spillover effect is still positive and significant but only at the 10% level though. Buying inputs from MNEs is associated with lower productivity levels. The latter result is the only one that still (marginally) holds when using the ACF measure. The considerable reduction in the number of observations makes it difficult to compare results, however.

If firms invest in productivity to become an exporter, our spillover effects may still to some extent pick up threshold spillover effects. As the perceived level of sunk costs decreases

through information spillovers, more firms would be induced to pursue productivity increasing investment and this would show up as a significant spillover effect. Therefore column (4) estimates spillover effects for firms that do not start exporting in our sample. Our results from column (1) are confirmed, providing an additional indication that our results suggest the existence of pure productivity spillover effects.

4.2 Threshold spillover effects

The results of the logit estimation at the firm--product-destination level are presented in Table 3. In this case a firm is considered as an export starter of product *p* to destination *d* in year *t* if it exports *p* to *d* in year *t* while it did not in *t-1* and *t-2*. Our dependent variable thus equals 1 if the firm starts exporting product *p* to destination *d* for the first time, i.e. the first time a specific product *p* exported to a specific destination *d*. Estimation samples only include single plant firms. The sample is restricted by selecting combinations of destinations and product categories that were exported by at least ten firms on average during 1998-2005. We then further reduced the sample by selecting only those combinations of NACE 5 digits manufacturing industries, destinations, and products where we observe at least 1 export starter over the period 2000-2005. The obtained reduced estimation sample includes information on 56 destinations and 266 products. Column headings in table 3 refer to different industry aggregation levels (NACE 2-3-4 digits) for calculating the spillover variables. All regressions include industry, time, region, destination, and product fixed effects. Our spillover variables only refer to either other exporters in the same industry and the same region or other exporters in the same industry but different regions, because nearly all exporters of a given product belong to the same industry.

In all regressions in Table 3, the lagged tfp level is important in explaining the decision to start exporting. A border dummy is significant in all regressions. The results on the number of other products exported to the same destination and the number of other destinations the same product is exported to during the previous year are always significantly positive. This confirms the importance of within-firm learning from past export experience with other products and other destination markets. Columns (1) to (3) present the results for spillover variables defined on basis of the total number of exporters, while columns (4) to (6) report results for a split-up between starters and established exporters. The results in the first three columns clearly suggest that spillovers are to be found in the same region, with some indication that being in the 'wrong' region for a firm's own narrowly defined industry may actually lower the probability to start exporting. Results on the split-up between starters and established exporters suggest that this might be a crowding out effect driven by recent starters. For the split-up we further find that especially the established exporters in the same region of product *p* to destination *d* generate positive spillover effects, whereas starters in the same region do not seem to generate threshold spillover

effects.

In Dumont et al. (2010) we perform a similar analysis at the firm level. These results indicate that threshold spillovers seem unimportant at the firm level.

Table 3 – Threshold spillovers at the firm-product-destination level

	(1)	(2)	(3)	(4)	(5)	(6)
NACE industry aggregation level	**2-digit**	**3-digit**	**4-digit**	**2-digit**	**3-digit**	**4-digit**
lagged TFP-level (index, in logs)	0.814***	0.814***	0.813***	0.814***	0.810***	0.812***
	[0.034]	[0.034]	[0.034]	[0.034]	[0.035]	[0.035]
border-dummy	0.139***	0.140***	0.140***	0.138***	0.140***	0.139***
	[0.047]	[0.047]	[0.047]	[0.047]	[0.047]	[0.047]
# other products exported to the same destination	0.866***	0.866***	0.866***	0.867***	0.867***	0.867***
	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]
# other destinations same product is exported to	1.009***	1.008***	1.008***	1.010***	1.008***	1.006***
	[0.042]	[0.042]	[0.042]	[0.042]	[0.042]	[0.042]
# exporters of p to d, same industry-same region	0.176***	0.211***	0.196***			
	[0.028]	[0.033]	[0.037]			
# exporters of p to d, same industry-other regions	0.018	-0.009	-0.075***			
	[0.022]	[0.022]	[0.022]			
# starters of p to d, same industry-same region				0.077*	0.087*	0.030
				[0.045]	[0.052]	[0.056]
# starters of p to d, same industry-other regions				-0.013	-0.049*	-0.166***
				[0.024]	[0.028]	[0.032]
# est. exporters of p to d, same industry-same region				0.210***	0.260***	0.282***
				[0.033]	[0.039]	[0.044]
# est. exporters of p to d, same industry-other regions				0.063**	0.041	-0.001
				[0.026]	[0.026]	[0.026]
Observations	1685751	1685751	1685751	1683575	1675201	1670601

Dependent variable is a "new exporter" dummy that equals 1 if a firm exports product *p* to destination d in year t while it did not in t-1 and t-2 (see text for full definition); standard errors are clustered at industry-region level; *** p<0.01, ** p<0.05, * p<0.1; spillover variables are count variables, they are transformed by adding 1 and taking logs, in the regressions they are lagged one period; spillover are defined at different Nace industry classifications as indicated in column headings; regressions include time, region, industry, destination, and product dummies; industries are defined at Nace levels indicated in column headings; regions are defined at NUTS 3 level

5 Conclusions

In this contribution we analyse the impact of the internationalisation behaviour of domestic and foreign firms on the decision of domestic non-exporters to start exporting using firm-level data provided by the National Bank of Belgium. We consider two possible channels for spillovers to affect the decision to start exporting. On the one hand internationalised firms may have a direct impact on the productivity of domestic non-exporters, possibly to the extent of lifting them over the threshold at which firms start exporting. A second channel that we investigate is that internationalised firms may convey information to non-exporters and as such decrease the latter's perceived level of sunk cost. If the decrease is large enough, non-exporters may start to export since their productivity level is now sufficient to cover the lower perceived level of sunk costs. Both productivity and threshold spillovers may stem either from geographical proximity of internationalised firms or from economic proximity, i.e. internationalised firms that are in the same industry or different industries (competitors, clients, or suppliers). We find that firm productivity increases with the presence of exporting firms in the same NUTS 3 region as well as with supplying multinational firms. There are indications of negative within-industry spillover effects, which may be linked to a competition or input crowding out effect. We then estimate --controlling for lagged productivity levels- threshold spillovers on the decision to start exporting. We find significant threshold spillover effects at the product-destination level, but not at the firm level. Similar to the productivity spillovers, the geographical dimension seems important. Our results extend the findings by Koenig et al. (2010) by showing that in addition to information spillovers, productivity spillovers also matter.

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