Outward foreign direct investment and domestic performance : In search of a causal link

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by Emmanuel Dhyne and Selen Sarisoy Guerin

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Abstract

The aim of this paper is to examine causal effects of outward foreign direct investment activities of corporations that start expanding abroad on a large number of domestic performance indicators. Our results indicate that there is no evidence in our data to show that FDI has statistically significant impact on productivity, employment and output. The only statistically significant result indicates that FDI causes positive growth in export intensity. On the other hand when we restrict our sample to Belgian manufacturing firms only, we do find that switching to OFDI causes a positive growth in TFP. This effect is coupled with an increase in wages and exports. On the other hand, we do not find any statistically significant evidence that internationalization of Belgian firms causes loss of employment for the unskilled worker as in other studies.

JEL codes: multinational firms; propensity score matching, difference-in-differences
Keyword: F23, D21, C14

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1. INTRODUCTION

Foreign direct investment has become a key driver of the recent wave of globalization as it started growing faster than merchandise trade and world GDP since the early 1990s.

It is now almost unanimously agreed that foreign direct investment flows are the most desirable type of external finance, especially for capital-scarce developing countries. Host countries, both developed and developing, have been actively competing with each other to attract foreign direct investment (FDI) often offering foreign investors costly incentives. As multinational corporations (MNCs) are considered to be better performers than domestic firms, FDI is positively associated with productivity spillovers and growth often via transfer of technology and managerial know-how, however with ambiguous empirical evidence. On the other hand, there is limited empirical evidence on outward FDI and its impact on its capital-exporting firms.

The effect of inward FDI on *host* countries is well researched with several macro empirical studies indicating that the effect of FDI is positive on host country productivity and national growth given certain host country conditions for e.g. level of financial development (Alfaro *et al.*, 2010, Villegas-Sanchez, 2009) or human capital (Borensztein *et al.*, 1998). Several micro studies using firm-level panel data analyze the relationship between domestic firm-productivity and presence of foreign MNCs in the same sector. The results of these studies on *horizontal* spillovers in developing countries finds either a negative or an insignificant effect of FDI in the host country (e.g. Aitken and Harrison, 1999, Djankov and Hoekman, 2000, Haddad and Harrison, 1993, Konings, 2001) whereas the effects are found to be positive and significant in the US (Keller and Yeaple, 2009) and the UK (Haskel *et al.*, 2007). Recently, it has also been shown that presence of MNCs in a sector may enhance aggregate productivity in a host country through *vertical* spillovers (e.g. Blalock and Gertler, 2008, Javorcik, 2004, Schoors and van der Tol, 2002).

In contrast with empirical literature on inward FDI, the theoretical and empirical studies on the impact of outward FDI, especially on the *home* country itself are limited. Outward FDI has attracted attention from policy-makers as there have been concerns over displacement of jobs and capital to mainly low-cost developing countries from capital-exporting countries. Such arguments infer that MNCs' overseas investments export employment and capital that should have been created and invested at home. As a result several studies examined the impact of outward FDI. For example, Konings and Murphy (2006) find negative employment effects of EU outward FDI when the affiliate is based in Northern Europe and no statistically significant impact when the affiliate is located in low-wage regions. Marin (2004) finds that Eastern enlargement of the EU has resulted in small job losses as low-cost jobs in Eastern Europe do not compete with jobs in Germany and Austria. In addition to evidence on employment, Braconier *et al.* (2001) find that outward FDI does not increase total factor productivity of Swedish firms (through technology transfer or R&D), whereas van Pottelsberghe and Lichtenberg (2001) find that outward FDI in R&D rich countries does have positive productivity effects at home. Using data for Japan, studies by Head and Ries (2003) and Blonigen (2001) question whether outward FDI substitutes exports. Results are mixed as they respectively find that exports and FDI are complements or that they can be both substitutes and complements.

Following the seminal paper by Bernard *et al.* (1995) and the theoretical contributions of Melitz (2003), Helpman *et al.* (2004) and Bernard *et al.* (2003), the literature on firm heterogeneity and trade has focused on the firm-level determinants of 'internationalization' of domestic firms. Mainly, the literature that followed primarily investigated the export behavior of firms and contributed to our understanding that it is the sunk costs of entering an international market and heterogeneity in firm-level productivity that explains why not all firms export. Later, Helpman *et al.* (2004) offered a theoretical model that showed that exporting and FDI can be complementary and that the firm's decision to export or FDI is also determined by its own productivity. The main contribution of Helpman *et al.* (2004) is that they showed that it is the most productive firms that decide to become multinational. Exporters are also productive but relatively less so. Finally the least productive firms only served the domestic market. Their model only considered the choice between exporting and horizontal FDI, but Head and Ries (2003) showed that when there are factor price and market size differentials firms invest for vertical motives as well.

The main motivation for this study is to contribute to this body of the literature by empirically testing the causal effects of the decision to invest abroad for the first time on performance at home. There are fewer studies on the ex-post performance (typically on TFP, output and employment) effects of switching to become a multinational firm, i.e. FDI, than on the effects of exporting activities. In the above mentioned literature the direction of causality is generally assumed to run from productivity to internationalization, i.e. that it is the ex-ante productivity that determines the choice of whether or not to export and FDI. In contrast, Clerides *et al.* (1998) show that exporting firms may further increase their productivity through *learning by exporting*, by becoming more innovative (as modelled by Holmes and Schmitz, 2001) and/or by reducing X-inefficiencies. Barba Navaretti and Venables (2006) identify three channels through which a firm that becomes multinational may improve productivity at home. First, setting up subsidiaries abroad may affect productivity at home by exploitation of firm-level and plant-level scale economies. Second, MNCs through their subsidiaries may find different ways of using inputs in production. Finally opening to new channels of international sourcing of technology and managerial know-how may also affect productivity at home. However, Barba Navaretti and Venables (2006) argue that the effects on productivity can go in both directions for all three channels. In other words, the effect of investing abroad on home performance is an empirical question.

Therefore, the aim of this study is to address three questions. First, what is the pecking order of productivity among different types of firms? Second, what are the firm-level determinants of outward FDI? Third, how does the expansion of a domestic firm abroad by way of establishing subsidiaries affect home performance? To address all questions we use firm level data on Belgian firm Annual Accounts, and on Belgian firms FDI and international trade activities, that are collected by the National Bank of Belgium. To the best of our knowledge, there is no study that establishes a causal link between becoming a foreign direct investor and performance at home for Belgium. As such this study will contribute to our understanding of the dynamics through which FDI may affect home performance as well as the larger literature on the firm-level determinants of internationalization. FDI have been particularly important in the recent years in Belgium. However, a large fraction of outward FDI in Belgium in recent years was not motivated by the international expansion of a domestic producer but mostly by international fiscal optimization of foreign MNCs.

Therefore, in order to investigate the domestic impact of Belgian outward FDI a cleaning of the data has been performed in order not to consider the "fiscally" motivated FDI.

Despite this careful cleaning of the data, we do not find strong evidence in our overall results that investing abroad increases productivity of the firm in our sample. The only causal effect we can find in our sample from Belgian firms' internationalization is increased levels of export intensity after the switch. In our robustness test, we find that Belgian firms in the manufacturing sector, however, do experience positive growth in TFP (in t + 2). This effect is coupled with a faster increase in wages among the firms that switched compared to our control group along with an increase in the level of exports. These effects can be causally linked to investing in foreign markets. Evidence of a negative effect on unskilled employment is not found.

This paper is organized as follows. The next section presents an extensive literature review on exports, foreign direct investment and productivity. Section 3 examines the order of productivity of Belgian firms using stochastic dominance of TFP. Section 4 explains our choice of methodology for propensity score matching of Rosenbaum and Rubin (1985) combined with a difference-in-differences approach (Blundell and Costa Dias, 2000, Heckman *et al.*, 1997). In section 5, we first present results of logistic regression on firm-level determinants of outward FDI for the full sample and by destination. Next we discuss our matching results on outcome variables in section 6. Finally, section 7 concludes with suggestions for further analysis.

2. THEORETICAL BACKGROUND

The activities of MNCs and their impact on productivity (innovation and/or X-efficiency induced), output, employment and technology transfer have been researched in several theoretical and empirical papers. As the growth rate of multinational sales have surpassed exports in manufactures, international trade theories have sought ways to incorporate FDI activities of MNCs into *new trade theory*. Greenaway and Kneller (2007) present a comprehensive review of the literature on exports, FDI and productivity. Among the early theoretical models, for e.g. Markusen and Venables (1999) propose a flexible model where horizontal MNCs arise endogenously, together with national firms, in a standard *new trade theory* model. Unlike in earlier models (e.g. Helpman, 1984, Helpman and Krugman, 1987), where MNCs arise as a result of fragmentation of production to undertake vertical FDI, where FDI and trade are complements, the models of horizontal FDI see MNC sales as substitute for trade. While these studies helped explain the patterns of trade and FDI, there were few studies that examined the impact of FDI on employment, output or productivity, mainly because of lack of data.

Several studies examined the potentially growth promoting impact of outward FDI in the host country, both using macro (e.g. Aitken *et al.*, 1996) and micro level evidence (e.g. Aitken and Harrison, 1999, Belderbos *et al.*, 2001, Girma *et al.*, 2001, Görg and Strobl, 2001, Javorcik, 2004). In contrast, both theoretical and empirical evidence on the impact of 'becoming a multinational' on performance at *home* are scarce. Instead the literature has sought to answer ex-ante determinants of internationalization patterns of domestic firms by entry into export markets or FDI. The *heterogeneous firm* theory of trade started with the early observations of Bernard *et al.* (1995) that

not all firms in the same industry export. In their study, Bernard *et al.* (1995) examine the characteristics of US exporters using plant-level data and they find that at any given point in time, exporters are better performers than non-exporters: Exporters are larger, more productive, more capital-intensive and pay higher wages. In a following study, Bernard and Jensen (1999) ask the question whether exporting behavior causes increased performance over non-exporters. While they find strong evidence that it is the top-performing firms that become exporters, there is no clear evidence that exporting increases their ex-post performance. Exporting firms often perform worse in terms of productivity or no better at all, whereas they seem to have increased survival rates. Another crucial observation was that the number of exporting firms was small compared to national firms at any time, and that even in a comparative advantage industry there were both exporters and non-exporters at the same time.

Melitz (2003) provided the theoretical explanation that a combination of sunk costs and heterogeneity in firm productivity may explain why all firms do not export. While his work and others, for e.g. Helpman *et al.* (2004), Bernard *et al.* (2003), Bernard *et al.* (2007) and Bernard *et al.* (2012), opened new ways of thinking about the internationalization of firms, via trade or FDI, they provide few testable assumptions on the causal impact of internationalization on the ex-post performance of the exporting firm or the MNC.

Helpman *et al.* (2004) introduce a heterogeneous firms model in a proximity-concentration trade-off setting where firms' choice is between trade and FDI. Their model presents significant differences in terms of firm productivity as the main determinant of mode of internationalization. Their results confirm Melitz (2003) indicating that among domestic firms only the most productive ones engage in international markets. Among those, the more productive ones serve the market via FDI. The least productive firms serve only the domestic market. In that setting, FDI and exports are substitute and all FDI are horizontal. Yeaple (2009) empirically tests the heterogeneous firm and FDI theory using BEA data and confirm that firm selection into FDI is consistent with high productivity. Head and Ries (2003) on the other hand show that productivity ordering of firms involved in FDI and non-FDI firms can be reversed if there are market size and factor price differentials. In other words, if a host country is small and offers a cost-advantage, it is the less productive firms that relocate.

The empirical studies on FDI so far examined within industry substitution of exports and FDI given differences in firm productivity (e.g. Castellani and Zanfei, 2007, Girma *et al.*, 2005, Kimura and Kiyota, 2006, Wagner, 2006). Their findings, in general, support that firms that engage in FDI are the most productive ones. Other empirical work focus on the export behavior of MNCs (e.g. Baldwin and Gu, 2003, Kneller and Pisu, 2004) or on export platform FDI (Ekholm *et al.*, 2007) and/or complementarities between exports and FDI (e.g. Kiyota and Urata, 2008, Lipsey *et al.*, 2000, Lipsey and Weiss, 1984)[1]. Using Norwegian data, Irarrazabal *et al.* (2013) show that firm-level patterns of FDI, in terms of destination are similar to trade patterns. They also find that, when the Helpman *et al.* (2004) model incorporates intermediate inputs, FDI is found to decrease with distance albeit less so than exports.

[1] See Greenaway and Kneller (2007) for a review of literature on firm heterogeneity, exports and FDI.

With the increasing availability of disaggregated data, economists started examining the home country effects of MNCs. Most early studies, which examined the effects on output (e.g. Head and Ries, 2003) and home employment (e.g. Braconier and Ekholm, 2002, 2000, Cuyvers *et al.*, 2010, Konings and Murphy, 2006), did not establish causal link between performance and FDI. However, Barba Navaretti and Castellani (2004), Barba Navaretti *et al.* (2010), Debaere *et al.* (2006) and Hijzen *et al.* (2011) found some effects of FDI at home. Based on a sample of Italian firms, Barba Navaretti and Castellani (2004) find that FDI improves growth of total factor productivity and output, while they find no effect on employment. Debaere *et al.* (2006) examine the employment effects of FDI outflows in South Korea. Their results indicate that locating to a less advanced country decreases a company's employment growth, whereas locating to other advanced countries have no employment effects. Hijzen *et al.* (2011) use a sample of French firms to examine the causal effect of establishing an affiliate on home employment, skill-intensity and productivity. They also conclude that relocation of employment abroad does not hold true.

3. FIRST ORDER STOCHASTIC DOMINANCE OF TFP OF BELGIAN FIRMS

Before analyzing the impact of initial FDI on several domestic indicators (value added, TFP, employment and trade), we first want to illustrate the TFP ranking of Belgian firms according to their degree of internationalization. Firm-level TFP is estimated following Ackerberg *et al.* (2006) based on production functions estimated at the NACE 2 digit level. This method corrects for the colinearity problems in Olley and Pakes (1996) and Levinsohn and Petrin (2003). TFP estimates are computed considering the sample of all Belgian firms registered between 1997 and 2009 in the Belgian Annual Accounts dataset managed by the NBB, after proper annualization and extrapolation of missing data[2]. The Annual Accounts database provides us with the information on the Belgian parents' income statement and balance sheet information. This database, coupled with administrative information available in the Firms' crossroad bank dataset, provides information on sales, value added, turnover, debt-to-equity ratio, employment, wages, date of creation, sector of activity, etc.

The firm level TFP and accounting data has been merged with 2 additional datasets available at the National Bank of Belgium to characterize the degree of internationalization of the firms.

Information on the OFDI activities of firms registered in Belgium is collected through the NBB FDI survey. This survey is conducted on the sample of Belgian firms that fulfils one of the three following criteria : i) financial assets greater than €5 million or, ii) equity greater than €10 million or, iii) balance sheet total greater than €25 million and that either reported foreign participations in their annual accounts or published information related to new investments abroad in the Belgian Official Journal. The survey contains information on both inward and outward FDI. For outward FDI, we specifically observe information on the geographic location and the type of activity (at 2-digit NACE

[2] See Dhyne *et al.*, 2010, for a description of the different transformations applied to the annual account data.

code) of each affiliate of a Belgian firm as well as type (i.e. direct vs indirect) and percentage of equity ownership in each foreign subsidiary.

Finally, to identify Belgian exporters and importers, we use foreign trade data, aggregated at the firm level. We use the same database to calculate the export-intensity, total exports and imports of a Belgian firm.

Merging these different data sources, we end up with a large panel dataset of 1.4 million observations over the period 1998-2007[3]. We identify six distinct groups of firms: domestic firms, exporters only, importers only, two way traders, Belgian MNCs and Belgian affiliates of foreign MNCs[4].

As can be seen in Table 1 we identify a large number of domestic firms that only serve the Belgian market. With an average number of 78,074 firms over the 1998-2007 period, domestic firms that do not trade internationally are the largest group. These firms are the least productive firms based on mean TFP (Table 2). They are also the smallest in size (both in terms of employment and turnover), and the least skill-intensive among other group of firms.

Domestic firms involved in international markets are significantly fewer. The next group with the largest number of firms is the two way traders with an average number of 11,500 firms followed by the two one-way traders firms (8,277 importers and 6,244 exporters). These first 4 groups are strictly Belgian firms with no foreign equity or shareholders. Two way traders seem to be more productive than one way traders and importers only seem to be more productive than exporters only. A similar rank among internationally trading firms is also observed for employment, skill-intensity and wages.

Finally, as indicated in other studies, there are much fewer domestic firms that engage in outward FDI: there are (on average) only 433 Belgian MNCs. The remaining sample is composed of Belgian affiliates of MNCs. In the Belgian case, we find that the most productive firms are the foreign MNCs. Belgian and foreign MNCs are by far the largest in size (both in terms of turnover and employment), most skill-intensive, pay higher wages and have the highest value added. Interestingly in terms of average total factor productivity, two way traders seem to be the most productive firms, even better than firms engage in FDI. However, examining only marginal moments can be misleading in terms of sorting the pecking order of productivity of firms. This is why we continue and rank the cumulative distribution functions of TFP rather than just comparing the means.

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[3] It is important to note that our sample ends in 2007, which was the first year of implementation of the notional interest fiscal deduction (it was adopted in 2006 for the 2007 fiscal exercise). Therefore, our sample is somehow immune from this fiscal deduction which has strongly affected FDI flows in Belgium in the last 7 years. This does not mean that the outward FDI observed in our sample period are completely unaffected by international fiscal optimization. In order to remove most of the fiscal FDI, we will have to restrict our sample of "switchers" (firms that started to invest abroad during our sample period" to firms that are both economically active in Belgium and in the destination country of their initial investment.

[4] This last category could even be split among Belgian affiliates of foreign MNCs which are / are not engage in OFDI.

As mentioned in the literature review, there are an increasing number of studies testing the total factor productivity differences between different groups of firms. Following Delgado *et al.* (2002), we examine the heterogeneity in firm-level productivity by comparing the entire cumulative distribution functions of TFP. These distributions are ranked by the concept of first-order stochastic dominance. Specifically, stochastic dominance between two distributions can be achieved when $F(z)- G(z) \leq 0$ uniformly in $z \in \Re$ with strict inequality for some z, where F and G denote cumulative distribution functions of TFP of two different groups.

We test two hypothesis using Kolmogorov-Smirnov one and two-sided tests:

Two-sided test:

H_0: $F(z) – G(z) = 0$ all $z \in \Re$ vs

H_1: $F(z) – G(z) \neq 0$ some $z \in \Re$

One-sided test:

Ho: $F(z) - G(z)) \leq 0$ all $z \in \Re$ vs

H1: $F(z) - G(z) > 0$ some $z \in \Re$

or

Ho: $F(z) - G(z)) \geq 0$ all $z \in \Re$ vs

H1: $F(z) - G(z) < 0$ some $z \in \Re$

that determine the stochastic dominance of the distribution functions of TFP for each group of firm in the sample. Results are presented in Table 3.

The KS test is applied on the relative ln(TFP) of the firm *vis-à-vis* the industry average for each year to allow comparability with the literature[5]. When both the two-sided test and one of the one-sided test are rejected and the not the second one-sided test, it is said that the distribution of TFP in one group dominates the other. When the 3 tests cannot reject the null, both distributions are considered as equal.

In the first column in Table 3, we compare the cumulative distribution function of productivity of our six sub-samples. A clear ranking of TFP distribution emerges from those tests. Our results indicate that the TFP distribution of domestic firms that only the Belgian markets is statistically dominated by the TFP distribution of the other groups, except in 2007, the group of one-way traders that only export. Then come the two groups of one-way traders which are statistically dominated by the two way traders and the MNCs. Among the two one-way traders groups, the group of exporters seems to statistically dominate the group of importers, except in 2006 and 2007 where the reverse is true. In the right tail of TFP distributions, the group of two-way traders is statistically dominated by the MNCs and the group of Belgian MNCs is statistically dominated by the group of Foreign MNCs.[6]. Hence the pecking order of productivity for Belgian firms is similar to the results from other national studies.

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[5] The KS test is run separately for each year on our sample 1998-2007 in order to avoid violating the independence assumption of the test.

[6] The conditions of stochastic dominance are not met for the two way traders vs Belgian MNCs in 1999 as the two-sided test cannot be rejected.

4. METHODOLOGY

The main question this paper would like to address is whether switching to become a MNC causes a change in the ex-post firm performance. Establishing a causal link between becoming a MNC and ex-post firm performance is similar to the questions addressed in program evaluation literature: to what extent the net difference in observed outcomes (TFP, output, employment and trade) between treated firms (firms that switched to become MNCs) and non treated firms (firms that did NOT switch to become MNCs) group can be attributed to becoming a MNC? Rosenbaum (2002) pointed out that "*the [fact that] treated and control groups differ prior to treatment in ways that matter for the outcomes under study*" induces a bias in observational studies.

As we know that potential MNCs are ex-ante different than non-MNCs before they switch to FDI, one has to be concerned with this type of selection bias, i.e. that more productive firms self-select into becoming MNCs. One way to adjust this potential bias is to use propensity score matching (Rosenbaum and Rubin, 1985) with a difference-in-difference estimator (Heckman *et al.*, 1997).

By combining propensity score matching with a difference-in-differences approach we can identify divergence in the path of performance of switchers and non-switchers. While matching can account for differences in observables, a difference-in-differences analysis can control the effect of unobservable factors (Blundell and Costa Dias, 2000)[7].

As we are strictly interested in the causal relationship between the first FDI outflows and performance, we will conduct our analysis on a subset of Belgian firms that have switched from having no foreign affiliates to becoming a foreign investor during our observation period. As mentioned in the introduction, a significant share of initial outward FDI is performed for fiscal reasons that have nothing to do with economic activity and international expansion of the firm, especially by Belgian affiliates of foreign MNCs. Therefore, in order to select initial outward FDI motivated by some economic activity, we restrict our definition of switchers to Belgian firms that fulfill the three following criteria:

- the Belgian firm is not controlled by a foreign corporation the year of the initial outward FDI ;
- the Belgian firm has at least 20 employees the year before the initial outward FDI;
- the new foreign affiliate of the Belgian firm must have at least 20 employees in at least one of the 4 years after the initial outward FDI.

Because of a sample break in 2001, we also exclude the initial outward FDI that occurred in that particular year.

[7] Blundell and Costa Dias (2000) argue that a DiD analysis can account for unobserved determinants of participation in treatment "as long as it can be represented by separable individual and/or time-specific components of the error term".

We establish a credible counter-factual and find a suitable control group using propensity score matching and compare the difference in the performance of the switchers and the control group after and before the 'switch'.

The control group will consist of Belgian firms that ex-post did not "switch" in year *t* and during the 4 following years, although ex-ante they would have been equally likely to do so. In terms of performance outcome we concentrate on employment, output and total factor productivity.

Unlike in randomized experiments where the researcher can be sure that assignment into treatment and outcome are independent of assignment for each group (i.e. the ignorable treatment assumption), in observational studies this is often not the case. When this assumption is violated, the OLS regression estimate of treatment effect is biased and inconsistent.

In this paper we use propensity score matching model of Rosenbaum and Rubin (1985) to balance the data (between switchers and non-switchers) through matching non-switchers to switchers on probabilities of receiving treatment (i.e. switching to become a MNC). One advantage of the propensity scores is that they reduce the *dimensionality* of covariates into a single score. Rubin (2008) describes this process as the design of observational studies approximating randomized experiments.

While the propensity score matching can be helpful in matching switchers with non-switchers (with least distance in propensity scores) and estimate the average treatment effect for the treated (ATT), this produces an incomplete view of the true effect of switching on outcomes, as it is based on observable firm characteristics and is static.

As the Belgian Annual Accounts and other datasets have both cross-section and time-series dimension, we augment our analysis and use Heckman's difference-in-differences method to estimate a dynamic ATT applying non-parametric regression to data at two-points in time (e.g. one year before switching, $t - 1$, vs i years after switching, $t + i$, with $i = 1$ to n) that can control for divergences due to unobservable firm characteristics.

As a first step we use propensity score matching to build a 'counter factual': a group of firms that did not switch, but in terms of firm characteristics as similar as possible to firms that switched to become MNCs, hence as likely as the second group to be "treated" (except that they are not).

The propensity score for each firm in period *t* is the estimated conditional probability that a firm will switch in period *t* to become MNC given a set of observable explanatory variables using logistic regression. This regression will be estimated on the sub-sample of firms that fulfills the NBB FDI survey participation criteria. The propensity score will then be used to match switchers with non-switchers. We match switching firms in year *t* with non-switchers in the same 2-digit NACE code and the same year with replacement. Matching within the same sector and year help avoid sector- and year- bias influencing our results.[8] It is not clear in literature whether one should match switching firms with firms that never switched or with firms that did not switch up to year *t*. As

[8] This also ensures that we do not match a switching firm in year *t* with itself in the past.

suggested by Hijzen *et al.* (2011) the relevant question is the timing of the switch, i.e. the decision of the firm to go abroad *now or later*, not to go abroad *now or never*.

We can then estimate the unbiased causal effect of investing abroad on home performance using two different methods. First, we can compute the difference between the switchers and firms in the matched control group in terms of average mean of outcome variables after investment. This is known as the average treatment of the treated (ATT).

$$\hat{\alpha}_{ATT,i} = y(1)_{t+i} - y(0)_{t+i}\,, \quad i = 1,..n \qquad \hat{\alpha}_{ATT,i} = y(1)_{t+i} - y(0)_{t+i}\,, \quad i = 1,..n \qquad \hat{\alpha}_{ATT} = y(1)_{t+n} - y(0)_{t+n} \qquad (1)$$

where $y(1)_{t+i}$ is the average performance of the switchers *i* periods after investing abroad for the first time and $y(0)_{t+i}$ is the average performance of the matched firms for the same horizon[9].

Second, we can use a difference-in differences estimator that compares the difference between the treated firms and the control group before and after the switch. i.e. the difference between each groups' pre- and post-establishment performance.

$$\hat{\alpha}_{DiD,i} = [y(1)_{t+i} - y(1)_{t-1}] - [y(0)_{t+i} - y(0)_{t-1}]\,, \quad i = 1,..n \qquad \hat{\alpha}_{DiD,i} = [y(1)_{t+i} - y(1)_{t-1}] - [y(0)_{t+i} - y(0)_{t-1}]\,, \quad i = 1,..n \qquad \hat{\alpha}_{DiD} = (y(1)_{t+s} - y(1)_{t-1}) - (y(0)_{t+s} - y(0)_{t-1}) \qquad (2)$$

Our dataset includes Belgian firms that have no investments of their own abroad (firms serving only the Belgian market, or firms that are exporters and/or importers, or Belgian affiliates of foreign MNCs) and Belgian firms that are first-time switchers over the period 1998-2007.[10]

5. DETERMINANTS OF INTERNATIONALIZATION BY WAY OF OFDI

As mentioned above, the dataset used for the estimation of the Logit equation of first time investment abroad includes Belgian firms that have no investments of their own abroad (firms serving only the Belgian market, or firms that are exporters and/or importers, or Belgian affiliates of foreign MNCs) and Belgian firms that are first-time switchers over the period 1998-2007. We naturally use the sub-sample of Belgian firms that fulfill the NBB FDI survey participation criteria. Because the participation to the FDI survey is conditional on some selection criteria, the first participation of a firm to the FDI survey may not be necessarily reflecting a new investment. In order to control for that potential identification problem, we identify as a switcher in *t* a firm for

[9] In this paper we estimate the ATT for first time switchers. As in experimental studies, multiple doses of the treatment (becoming MNC in different countries) are possible: several Belgian firms enter 'new' foreign markets several years after their first attempt at 'becoming' a MNC.

[10] Because, information on outward FDI activities of Belgian firms are only available after 1997, switchers can only be identified from 1998 onwards. In order to observe the switchers at least during two years after the switch, our estimation period ends in 2007 instead of 2009.

which an outward FDI is observed for the first time in *t* but that fulfilled the survey criteria in *t*-1 and *t*-2.[11]

Between 1998 and 2010, we observe a total of 765 first-time OFDI firms[12]. Out of those firms, only 78 chose a developing country as a location for their investment indicating that a majority OFDI targeted developed countries.

A first-time OFDI firm acquires equity ownership on average in 3 affiliates typically in multiple locations. There is a huge bias towards the Euro Area for OFDI, as 62% of the foreign affiliates of the first-time OFDI firms are in the Euro Area. The remaining 38% are distributed as follows : 10% for non Euro EU15 member states, 8% for other non Euro EU member state, 5% in the US and the remaining in the rest of the world.

Based on average TFP, first-time OFDI firms are more productive than non-OFDI firms. In contrast, non-OFDI firms' labor productivity is significantly larger. First-time OFDI firms are on average younger, larger in terms of employment and value added and pay higher wages. In terms of trade, OFDI firms have a significantly larger export-intensity as well as higher levels of exports and imports.

The probability to invest abroad for the first time in period *t* is modeled according to a Logit specification

$$Prob[y_{it} = 1] = \frac{exp(x_{it}\beta)}{1 + exp(x_{it}\beta)}$$

where y_{it} is a dummy variable that indicates that firm *i* invested abroad for the first time in period *t* and x_{it} is a set of characteristics, including one period lagged log(TFP), one period lagged log(employment), log(age), the one period lagged ratio of skilled employment[13], the one period lagged log(average wage), one period lagged export and import dummies, one period lagged indicator variable that the firm *i* is foreign owned, year dummies and NACE 2 digit sectoral dummies.

The choice of the determinants for internationalization of a firm by way of establishing a subsidiary abroad comes from the literature reviewed above. Several empirical studies show that there are significant differences between exporters vs non-exporters and exporters vs MNCs often years before the switch, in terms of productivity, size, skill-intensity, wages, etc. As our focus is on estimating the binary choice to switch (1) or not to switch (0) in year *t*, we are interested in factors that will likely determine the probability of selecting into 'switching' (i.e. treatment).

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11 Because annual accounts are typically observed after one year delay, firms are surveyed in t based on accounting information for t-1. Imposing that the survey criteria were also fulfilled in t-2 allows to better identifying switchers.

12 This does not represent the sample of switchers that will be used in the DiD analysis that compares first time OFDI with a control group of domestic firms that do not invest abroad. For the DiD analysis, we only considered a cleaned sample that remove initial OFDI that may not be driven by economic considerations and that could have been initiated by a foreign owner of a Belgian firm for fiscal optimization.

13 The ratio of skilled employment, or skill-intensity, is measured as the ratio of white-collar employees to total average employment.

We present the results of the logistic regression in Table 4. As indicated above all variables are lagged by one period to avoid endogeneity. In column 1 of Table 4, the coefficients indicate the log-odds of a unit increase in an independent variable holding all others constant, while column 2 presents the corresponding average marginal effects. Among the set of explanatory variables, TFP, the skill ratio, total employment and the foreign MNC dummy are statistically significant determinants of becoming an MNC. For example, a one percent increase in TFP increases the log-odds of becoming an MNC by 0.25. While a one percent increase in employment increases the log-odds by 0.33, a unit increase in the ratio of skilled employment increases the log-odds by 0.79. By far the most important factor with a positive effect is being a foreign MNC (based in Belgium) that increases the log-odds by 1.29. Being involved in export and import activities during the previous period, the age of the firm or the wage cost are not significant determinants of the decision to become a first-time MNC.

6. MATCHING AND RESULTS OF DIFFERENCE-IN-DIFFERENCES ANALYSIS

In this section we first proceed with the second step in our empirical strategy and use the propensity scores estimated in the previous section to select a control group, but this control group is only selected to match our cleaned sample of first-time OFDI (see section 4, for the selection criteria of that cleaned sample). The control group of firms is selected so as to minimize the difference in propensity scores between the first-time OFDI firms and firms that did not. Hence the control group is as similar as possible to first-time OFDI firms, ensuring that they represent a credible counter-factual. In order to be sure that a firm is a first-time OFDI firm, we applied the criteria that the first-time OFDI took place at least 4 years after the firm meets the FDI survey participation criteria and excluded 2001 switchers. We use one-to-one matching within calliper with replacement using the program written by Edward and Sianesi (2003).

We impose the common support rule that implies that a treated observation (i.e. a switching firm) with a higher p score than the highest p score in the non-treated group, are left unmatched. Following from the program evaluation literature, we match first-time OFDI firms with firms from the control group that did not invest in the same year and in the 4 years after but are in the same sector (2-digit NACE). This implies that among the matched control group can be found firms that never invested during the entire sample period (1998-2007) as well as firms that did not invest in year t, but might have in the later periods.

Hence, in our benchmark results, we employ the idea that first-time OFDI firms should be compared to firms that did not self-select into FDI in that year and during the 4 consecutive years that follow.

We measure different aspects of domestic *performance* of first-time OFDI firms. In order to examine impact on efficiency, we use both TFP and labor productivity. We also examine impact on employment and wages, in detail with a breakdown on impact on skilled vs unskilled employment. We use value added to measure output performance of the firm. Finally, we examine the impact of OFDI on trade and use export-intensity and the level of exports and imports as outcome variables.

The matched controls are chosen so as to minimize the difference in the propensity scores of switchers and non-switchers. After the cleaning, we identified 89 firms as switchers (out of a total 270 firms that switched to become a MNC in our sample. Of those switchers, 77 were exporters, 82 were importers and 76 were both in the previous year to the switch. This suggests that internationalization and FDI is part of a learning process (see Conconi *et al.*, 2013), as past experience in international markets play a significant role in the internationalization of Belgian firms. If none of these switchers are foreign controlled, 25 of them are still minority owned by a foreign corporation.

Before presenting the results from difference-in-differences analysis, we test balancing of our variables after matching. In Table 5, we perform a t-test for equality of the means in the treated and non-treated group after matching. Column 1 presents the mean of the balancing variables that can be compared to the mean of the same for the matched control group in column 2. In Column 3 a standardized bias is calculated as the difference of the sample means in the treated and non-treated sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (following Rosenbaum and Rubin, 1985). Column 4 then gives the t-score for the equality of the means. Results in column 3 indicates that after matching, significant bias reduction has been achieved and that based on the *t*-test the equality of means cannot be rejected for any of the variables, except total lagged employment, at 10 percent significance level.

In Table 6 we present results of difference-in-differences analysis on our outcome variables. We examine each variable at 3 different intervals[14]. After matching, we calculate the difference in each variable, e.g. in TFP, one year after switching and one year before switching for both the matched control and treated group. We subsequently calculate the difference after 2 and 3 years and one year before switching as well. In column 1 we present results on the difference between ex-post and ex-ante performance for the treated group. The second column then presents the same results for the matched control group. The third column is the difference between the treated and the control group with standard errors in parenthesis. The standard errors are then estimated by bootstrapping with 1000 replications.

Table 6 presents the results for the full sample and then in the following table we test the robustness of our benchmark results by breaking the sample into a sub-sample of manufacturing firms only.

Productivity

The entry into a foreign market for a domestic firm has varying impact on TFP over the four-year horizon. Our benchmark semi-parametric estimates indicate that first-time OFDI firms experience on average a small but positive growth rate one year after entry into a foreign market and negative growth rates in TFP in the second year, followed by another year of positive growth and then negative growth again in the fourth year (column 1 Table 6). Even though the difference in TFP between the treated and control group seem large at times, the difference cannot be casually

[14] Except for TFP where we use 4 year window to assess impact on longer horizon.

attributed to switching to become an FDI firm as our results are not statistically significant. When we examine TFP in levels among the treated group, we observe a negative outcome four years in a row. Nevertheless, we cannot say that such a pattern in productivity is caused by the switch as the control group does not seem to be statistically different than our treatment group. When we examine labor productivity, similar to results on TFP levels, we cannot find statistically significant evidence that the switch had a causal effect on the growth and the levels of labor productivity in the years to follow.

Employment and wages

The impact of internationalization of firms, especially by way of OFDI, on employment and the skill composition of employment is widely debated in policy circles. In our sample, employment growth seems to slow down after the switch (Column 1 Table 6), however, we cannot identify if the negative growth was caused by the switch or not. In order to have a better idea on the employment effects of OFDI, we examine employment among skilled vs unskilled labor in Belgian firms. The results indicate that the number of skilled labor has increased both among the treated and control groups. On the other hand, the number of unskilled labor employed has been decreasing. Taken together, on average the treated firms have been becoming more skill-intensive however, we do not find statistically significant evidence that this was caused by the switch. The increasing skill-composition in Belgian firms may explain our results in wages as well. We observe that wages have increased in the years following the switch both for the treated and the control group, albeit we cannot establish a causal link.

Output and trade

Several studies mentioned in our literature review examined the performance of the treated firms in terms of output and used value added as a measure. To facilitate in comparison, we examine both the growth rate and the level of the value added of the firm. On average we observe that the growth rates have slowed down both in the treated and control groups, whereas the level of output has increased vis-à-vis the year before the switch. Nevertheless the difference between the two groups cannot be attributed to a causal link between becoming a first-time OFDI firm and ex-post performance. The impact of FDI on trade is an important effect that has been widely debated also. In this section we examine the impact of OFDI on the export-intensity and the export level both in goods and services trade of the firms. We can see that export-intensity of the treated firms increase in the years following the switch and the effect is casually attributable to the internationalization of the firm, as this result is statistically significant 2 and 3-years after the treatment. On the other hand in the three years that follow, the treated firms have on average increased export levels in goods but decreased export levels in services.

Robustness checks

As a robustness check, we restrict our sample to manufacturing firms only. This reduces the number of matched pairs by more than 30 percent, but provides us with a more detailed examination of the manufacturing by leaving out the services firms. Table 7 reports only statistically significant results. For the firms in the manufacturing sector, we find that becoming a MNC causes positive growth in TFP (t + 2) among the treated whereas the growth in TFP is negative for the

control group. This is the first statistically significant effect of internationalization of the firm on productivity we find in our sample and is in line with other country studies. Switching to become a MNC causes also an increase in wages in $t + 3$ among the manufacturing sector, along with an increase in exports in the same period.

Reflecting on the overall results, in our full sample including services as well as manufacturing firms the performance outcomes for the treated vs control group are indiscernible. This may be because internationalization motivations of services firms may be driven by other factors such as survival. It may also be that simply our measures of performance outcome are not appropriate for services (i.e. TFP for measuring productivity in services).

The literature reviewed indicates that even though entry into export markets may not cause higher growth rates in productivity or other measure of firm performance, there is evidence that engaging in foreign markets increases the chances of survival of a firm (Bernard and Jensen, 1999, Bernard and Wagner, 2001). In addition, there is positive evidence on engaging in export markets and its subsequent effect on aggregate productivity through resource reallocation (Bernard and Jensen, 2004, Falvey *et al.*, 2004). Greenaway and Kneller (2007) explain that in a Melitz (2003) type set up, i.e. a dynamic industry model with heterogeneous firms, the interaction of fixed cost of entry into foreign markets, firm productivity and exporting raises industry productivity. In other words, 'exporting increases expected profit, which induces entry, pushes up the productivity threshold for survival and drives out the least efficient firms in a Schumpeterian wave of 'creative destruction'" (Greenaway and Kneller, 2007).

Almost all Belgian firms that switch to become a MNC are or have been exporters and /or importers. In section 3, the results of the first order stochastic dominance tests show that FDI-firms are more productive than exporters. However, similar to results from other studies on engaging in export markets (e.g. Bernard *et al.*, 1995) evidence on the causal effects of switching to OFDI on Belgian firms' productivity is not straightforward. Overall we do not have strong evidence in our results that investing abroad increases productivity of the firm in our full sample. It is rather the case that productivity improvements may have taken effect before the internationalization decision of the firm. However in the manufacturing sector, we find that Belgian firms do experience a growth in TFP in the aftermath of the switch in the second year.

7. CONCLUSION

In this paper we examine the impact of the internationalization behavior of the Belgian firms, by way of establishing subsidiaries abroad, on firm-level performance. Our main motivation is to contribute to international trade literature on the consequences of internationalization of the firm. Unlike the literature on exports, there are only few studies that examine the impact of outward FDI on domestic firm performance and these studies are primarily motivated to address the public fear that outward FDI relocates jobs to developing countries. Our study is closely related to Melitz (2003), Helpman *et al.* (2004) and the recent literature that examined the causal impact of FDI on home performance, rather than earlier studies that only established a 'statistical association' (Barba Navaretti and Castellani, 2004, Javorcik, 2004).

As empirical evidence suggests, firms become 'better performers' several years before the entry into foreign markets. Helpman *et al.* (2004) show that only the most productive firms engage in foreign markets. Among those, the most productive choose to become a MNC, whereas the least productive firms serve only the domestic market. There are now several studies that compare the productivity of exporters vs MNCs confirming the hierarchy in productivity as a determinant of FDI. However, these studies do not address the question whether FDI causes a higher growth in productivity, output or employment. We find that the Belgian case fits well: as exporters are more productive than importers and domestic firms, and OFDI firms are more productive than exporters.

We examine the relationship between outward FDI and firm performance in two steps. First we identify the key variables that determine the odds of a firm switching to become a MNC and estimate the propensity scores to be used in matching. We find that firm-level productivity (TFP), size (in terms of employment), skill-intensity (the ratio of white-collar employees to total average employment) are positively associated with the odds of becoming a MNC. However, the most significant determinant of outward FDI in our Belgian sample is being a Belgian affiliate of a foreign multinational company.

Results of difference-in-differences analysis indicate that there is no evidence in our data to show that FDI has statistically significant impact on productivity, employment and output. The only statistically significant result in our full sample indicates that FDI causes positive growth in export intensity. On the other hand when we restrict our sample to Belgian manufacturing firms only, we do find that switching to OFDI causes a positive growth in TFP. This effect is coupled with an increase in wages and exports. On the other hand, we do not find any statistically significant evidence that internationalization of Belgian firms causes loss of employment for the unskilled worker as in other studies.

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Table 1. Total number of different types of firms in Belgium

	Purely domestic	One way traders (exporters)	One way traders (importers)	Two way traders	Belgian MNC	Foreign MNC
1998	69451	6168	7366	11210	418	1353
1999	73029	5903	7634	11434	395	1389
2000	74601	6244	7653	11871	373	1482
2001	74173	6497	7892	11595	513	1873
2002	74971	7088	8378	12108	484	1959
2003	76482	7461	8423	12263	469	2075
2004	78936	7351	8584	12395	475	2006
2005	80472	7725	8814	12423	415	1833
2006	89055	4015	8598	9775	399	1770
2007	89565	3988	9426	9919	388	1720

Table 2. Summary statistics on Belgian firms

	Purely domestic	One way traders (exporters)	One way traders (importers)	Two way traders	Belgian MNC	Foreign MNC
lnTFP	8.50	8.77	8.92	9.06	8.86	9.01
	(1.03)	(1.05)	(1.05)	(1.12)	(1.20)	(1.33)
Employment	5.70	12.77	14.88	33.21	372.13	278.33
	(39.49)	(67.12)	(154.87)	(249.53)	(2258.75)	(970.94)
Skilled employment ratio	0.44	0.47	0.60	0.59	0.63	0.70
	(0.45)	(0.40)	(0.39)	(0.36)	(0.34)	(0.32)
Ln average wage	10.22	10.41	10.41	10.57	10.82	11.02
	(0.47)	(0.42)	(0.42)	(0.40)	(0.41)	(0.43)
Ln real value added	11.87	12.76	12.76	13.66	15.43	15.96
	(1.21)	(1.32)	(1.34)	(1.40)	(1.81)	(1.58)
Ln turnover	13.03	14.50	14.63	15.72	16.85	17.30
	(1.30)	(1.46)	(1.41)	(1.32)	(1.93)	(1.72)
Ln operating profits	10.07	10.93	11.05	11.96	13.96	14.40
	(1.46)	(1.46)	(1.51)	(9.05)	(1.86)	(1.71)

Table 3. First order stochastic dominance of TFP of different groups of firms

	(1) Purely domestic firms vs (2) One way traders (exporters)			(1) Purely domestic firms vs (3) One way traders (importers)			(1) Purely domestic firms vs (4) Two way traders			(1) Purely domestic firms vs (5) Belgian MNCs			(1) Purely domestic firms vs (6) Foreign MNCs		
Null hypo.	(1)≥(2)	(1)≤(2)	(1)=(2)	(1)≥(3)	(1)≤(3)	(1)=(3)	(1)≥(4)	(1)≤(4)	(1)=(4)	(1)≥(5)	(1)≤(5)	(1)=(5)	(1)≥(6)	(1)≤(6)	(1)=(6)
1998	0.077	0.000	0.077	0.040	-0.002	0.040	0.128	0.000	0.128	0.183	-0.001	0.183	0.263	-0.002	0.263
	(0.000)	(0.998)	(0.000)	(0.000)	(0.966)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.999)	(0.000)	(0.000)	(0.991)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
1999	0.077	0.000	0.077	0.033	-0.001	0.033	0.117	0.000	0.117	0.166	-0.004	0.166	0.255	-0.001	0.255
	(0.000)	(1.000)	(0.000)	(0.000)	(0.979)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.987)	(0.000)	(0.000)	(0.997)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
2000	0.076	0.000	0.076	0.031	-0.004	0.031	0.121	0.000	0.121	0.194	-0.006	0.194	0.261	0.000	0.261
	(0.000)	(1.000)	(0.000)	(0.000)	(0.806)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.971)	(0.000)	(0.000)	(1.000)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
2001	0.080	-0.001	0.080	0.035	-0.003	0.035	0.115	0.000	0.115	0.196	-0.012	0.196	0.248	-0.001	0.248
	(0.000)	(0.996)	(0.000)	(0.000)	(0.915)	(0.000)	(0.000)	(0.999)	(0.000)	(0.000)	(0.865)	(0.000)	(0.000)	(0.996)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
2002	0.072	0.000	0.072	0.045	-0.003	0.045	0.111	0.000	0.111	0.182	-0.008	0.182	0.248	-0.001	0.248
	(0.000)	(1.000)	(0.000)	(0.000)	(0.907)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.938)	(0.000)	(0.000)	(0.995)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
2003	0.063	-0.002	0.063	0.045	-0.001	0.045	0.119	0.000	0.119	0.184	-0.001	0.184	0.254	-0.003	0.254
	(0.000)	(0.971)	(0.000)	(0.000)	(0.989)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.999)	(0.000)	(0.000)	(0.966)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
2004	0.073	0.000	0.073	0.036	-0.001	0.036	0.116	0.000	0.116	0.187	-0.003	0.187	0.269	0.000	0.269
	(0.000)	(1.000)	(0.000)	(0.000)	(0.990)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.993)	(0.000)	(0.000)	(1.000)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
2005	0.067	0.000	0.067	0.045	0.002	0.045	0.116	0.000	0.116	0.191	-0.004	0.191	0.278	-0.001	0.278
	(0.000)	(0.999)	(0.000)	(0.000)	(0.999)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.987)	(0.000)	(0.000)	(0.999)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
2006	0.030	-0.008	0.030	0.047	0.000	0.047	0.110	0.000	0.110	0.183	-0.002	0.183	0.257	-0.001	0.257
	(0.001)	(0.639)	(0.002)	(0.000)	(0.999)	(0.000)	(0.000)	(0.999)	(0.000)	(0.000)	(0.996)	(0.000)	(0.000)	(0.995)	(0.000)
	(2) dominates (1)			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		
2007	0.036	-0.025	0.036	0.051	-0.001	0.051	0.121	0.000	0.121	0.190	-0.002	0.190	0.249	0.000	0.249
	(0.000)	(0.010)	(0.000)	(0.000)	(0.984)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.998)	(0.000)	(0.000)	(1.000)	(0.000)
	Non conclusive			(3) dominates (1)			(4) dominates (1)			(5) dominates (1)			(6) dominates (1)		

	(2) One way traders (exporters) vs (3) One way traders (importers)			(2) One way traders (exporters) vs (4) Two way traders			((2) One way traders (exporters) vs (5) Belgian MNCs			(2) One way traders (exporters) vs (6) Foreign MNCs		
Null hypo.	(2)≥(3)	(2)≤(3)	(2)=(3)	(2)≥(4)	(2)≤(4)	(2)=(4)	(2)≥(5)	(2)≤(5)	(2)=(5)	(2)≥(6)	(2)≤(6)	(2)=(6)
1998	0.003 (0.958)	-0.047 (0.000)	0.047 (0.000)	0.075 (0.000)	0.000 (1.000)	0.075 (0.000)	0.111 (0.000)	-0.002 (0.997)	0.111 (0.000)	0.224 (0.000)	-0.002 (0.993)	0.224 (0.000)
	(2) dominates (3)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
1999	0.001 (0.994)	-0.051 (0.000)	0.051 (0.000)	0.062 (0.000)	-0.007 (0.670)	0.062 (0.000)	0.103 (0.000)	-0.008 (0.951)	0.103 (0.000)	0.211 (0.000)	-0.001 (0.996)	0.211 (0.000)
	(2) dominates (3)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
2000	0.000 (1.000)	-0.050 (0.000)	0.050 (0.000)	0.070 (0.000)	-0.002 (0.953)	0.070 (0.000)	0.147 (0.000)	-0.013 (0.885)	0.147 (0.000)	0.217 (0.000)	-0.002 (0.990)	0.217 (0.000)
	(2) dominates (3)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
2001	0.001 (0.987)	-0.049 (0.000)	0.049 (0.000)	0.059 (0.000)	-0.002 (0.964)	0.059 (0.000)	0.140 (0.000)	-0.020 (0.696)	0.140 (0.000)	0.211 (0.000)	-0.001 (0.995)	0.211 (0.000)
	(2) dominates (3)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
2002	0.013 (0.268)	-0.032 (0.000)	0.032 (0.001)	0.071 (0.000)	-0.001 (0.993)	0.071 (0.000)	0.141 (0.000)	-0.011 (0.897)	0.141 (0.000)	0.217 (0.000)	-0.003 (0.973)	0.217 (0.000)
	(2) dominates (3)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
2003	0.009 (0.515)	-0.021 (0.030)	0.021 (0.058)	0.070 (0.000)	-0.001 (0.985)	0.070 (0.000)	0.149 (0.000)	-0.003 (0.993)	0.149 (0.000)	0.226 (0.000)	-0.007 (0.848)	0.226 (0.000)
	(2) dominates (3)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
2004	0.010 (0.478)	-0.042 (0.000)	0.042 (0.000)	0.072 (0.000)	0.000 (0.999)	0.072 (0.000)	0.147 (0.000)	-0.004 (0.984)	0.147 (0.000)	0.237 (0.000)	-0.002 (0.990)	0.237 (0.000)
	(2) dominates (3)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
2005	0.011 (0.373)	-0.031 (0.000)	0.031 (0.001)	0.066 (0.000)	-0.001 (0.989)	0.066 (0.000)	0.145 (0.000)	-0.013 (0.880)	0.145 (0.000)	0.248 (0.000)	-0.001 (0.996)	0.248 (0.000)
	(2) dominates (3)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
2006	0.037 (0.000)	-0.003 (0.952)	0.037 (0.001)	0.108 (0.000)	-0.001 (0.994	0.108 (0.000)	0.189 (0.000)	-0.004 (0.986)	0.189 (0.000)	0.261 (0.000)	-0.003 (0.976)	0.261 (0.000)
	(3) dominates (2)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		
2007	0.069 (0.000)	-0.004 (0.908)	0.069 (0.000)	0.130 (0.000)	-0.001 (0.999)	0.130 (0.000)	0.210 (0.000)	-0.004 (0.997)	0.210 (0.000)	0.265 (0.000)	0.000 (1.000)	0.265 (0.000)
	(3) dominates (2)			(4) dominates (2)			(5) dominates (2)			(6) dominates (2)		

	(3) One way traders (importers) vs (4) Two way traders			(3) One way traders (importers) vs (5) Belgian MNCs			(3) One way traders (importers) vs (6) Foreign MNCs			(4) Two way traders vs (5) Belgian MNCs			(4) Two way traders vs (6) Foreign MNCs			(5) Belgian MNCs vs (6) Foreign MNCs		
Null hypo.	(3)≥(4)	(3)≤(4)	(3)=(4)	(3)≥(5)	(3)≤(5)	(3)=(5)	(3)≥(6)	(3)≤(6)	(3)=(6)	(4)≥(5)	(4)≤(5)	(4)=(5)	(4)≥(6)	(4)≤(6)	(4)=(6)	(5)≥(6)	(5)≤(6)	(5)=(6)
1998	0.104	0.000	0.104	0.157	-0.002	0.157	0.241	-0.002	0.241	0.063	-0.006	0.063	0.151	-0.002	0.151	0.133	-0.018	0.133
	(0.000)	(0.999)	(0.000)	(0.000)	(0.998)	(0.000)	(0.000)	(0.990)	(0.000)	(0.042)	(0.968)	(0.074)	(0.000)	(0.988)	(0.000)	(0.000)	(0.823)	(0.000)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		
1999	0.096	0.000	0.096	0.138	-0.004	0.138	0.242	-0.001	0.242	0.058	-0.009	0.058	0.150	-0.001	0.150	0.143	-0.020	0.143
	(0.000)	(1.000)	(0.000)	(0.000)	(0.986)	(0.000)	(0.000)	(0.996)	(0.000)	(0.076)	(0.941)	(0.136)	(0.000)	(0.996)	(0.000)	(0.000)	(0.792)	(0.000)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			Non conclusive			(6) dominates (4)			(6) dominates (5)		
2000	0.102	-0.001	0.102	0.175	-0.011	0.175	0.245	-0.001	0.245	0.081	-0.014	0.081	0.148	-0.001	0.148	0.092	-0.019	0.092
	(0.000)	(0.993)	(0.000)	(0.000)	(0.914)	(0.000)	(0.000)	(0.998)	(0.000)	(0.009)	(0.871)	(0.016)	(0.000)	(0.998)	(0.000)	(0.007)	(0.799)	(0.011)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		
2001	0.086	0.000	0.086	0.169	-0.013	0.169	0.226	-0.002	0.226	0.090	-0.029	0.090	0.155	-0.003	0.155	0.085	-0.021	0.085
	(0.000)	(0.998)	(0.000)	(0.000)	(0.846)	(0.000)	(0.000)	(0.991)	(0.000)	(0.000)	(0.435)	(0.001)	(0.000)	(0.978)	(0.000)	(0.003)	(0.713)	(0.005)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		
2002	0.075	0.000	0.075	0.146	-0.010	0.146	0.221	-0.002	0.221	0.076	-0.015	0.076	0.148	-0.005	0.148	0.090	-0.025	0.090
	(0.000)	(1.000)	(0.000)	(0.000)	(0.906)	(0.000)	(0.000)	(0.987)	(0.000)	(0.005)	(0.802)	(0.008)	(0.000)	(0.911)	(0.000)	(0.002)	(0.624)	(0.003)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		
2003	0.080	-0.001	0.080	0.150	-0.001	0.150	0.228	-0.004	0.228	0.085	-0.012	0.085	0.165	-0.011	0.165	0.097	-0.013	0.097
	(0.000)	(0.997)	(0.000)	(0.000)	(0.998)	(0.000)	(0.000)	(0.946)	(0.000)	(0.001)	(0.887)	(0.002)	(0.000)	(0.637)	(0.000)	(0.001)	(0.877)	(0.001)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		
2004	0.093	-0.001	0.093	0.163	-0.003	0.163	0.246	-0.001	0.246	0.084	-0.013	0.084	0.173	-0.005	0.173	0.109	-0.009	0.109
	(0.000)	(0.996)	(0.000)	(0.000)	(0.990)	(0.000)	(0.000)	(0.997)	(0.000)	(0.002)	(0.850)	(0.003)	(0.000)	(0.916)	(0.000)	(0.000)	(0.936)	(0.000)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		
2005	0.083	-0.001	0.083	0.159	-0.012	0.159	0.246	-0.001	0.246	0.082	-0.023	0.082	0.184	-0.001	0.184	0.118	-0.008	0.118
	(0.000)	(0.991)	(0.000)	(0.000)	(0.900)	(0.000)	(0.000)	(0.998)	(0.000)	(0.004)	(0.647)	(0.007)	(0.000)	(0.997)	(0.000)	(0.000)	(0.960)	(0.000)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		
2006	0.073	-0.001	0.073	0.154	-0.010	0.154	0.226	-0.003	0.226	0.098	-0.018	0.098	0.165	-0.003	0.165	0.098	-0.014	0.098
	(0.000)	(0.998)	(0.000)	(0.000)	(0.930)	(0.000)	(0.000)	(0.975)	(0.000)	(0.001)	(0.776)	(0.001)	(0.000)	(0.966)	(0.000)	(0.002)	(0.886)	(0.003)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		
2007	0.074	-0.001	0.074	0.144	-0.004	0.144	0.201	0.000	0.201	0.085	-0.012	0.085	0.139	-0.006	0.139	0.084	-0.003	0.084
	(0.000)	(0.997)	(0.000)	(0.000)	(0.991)	(0.000)	(0.000)	(1.000)	(0.000)	(0.004)	(0.902)	(0.007)	(0.000)	(0.913)	(0.000)	(0.011)	(0.993)	(0.018)
	(4) dominates (3)			(5) dominates (3)			(6) dominates (3)			(5) dominates (4)			(6) dominates (4)			(6) dominates (5)		

Note : p-values in parenthesis

Table 4. Determinants of Internationalization of Belgian Firms - Logit

	Full sample	
	Logit coefficients	Average marginal effects
$Ln(TFP)_{t-1}$	0.25	0.003
	(0.10)***	(0.001)***
$Ln(AGE)_{t-1}$	-0.08	-0.001
	(0.07)	(0.001)
Skill ratio $_{t-1}$	0.79	0.01
	(0.31)***	(0.004)***
$ln(employment)_{t-1}$	0.33	0.004
	(0.06)***	(0.001)***
Ln(average wages) $_{t-1}$	-0.19	-0.002
	(0.23)	(0.003)
Exporter $_{t-1}$	0.11	0.001
	(0.21)	(0.003)
Importer $_{t-1}$	0.16	0.002
	(0.25)	(0.003)
MNC dummy	1.29	0.02
	(0.15)***	(0.003)***
2-digit sector dummies	Yes	
Time dummies	Yes	
N	22567	
Pseudo R2	0.12	
LR chi2	395.45	
Log likelihood	-1417.90	

Note: 2-digit sector and year dummies included. The coefficients are log odds of switching to become a MNC compared to not-switching estimated by logistic regression. Standard errors in parenthesis. *** indicates significance level at 1 percent, ** at 5 percent and * at 10.

Table 5. Test on the balancing properties-difference of means

	Treated	Control	% bias reduction	t-score
$Ln(TFP)_{t-1}$	9.01	9.02	91.2	-0.06
$Ln(AGE)_{t-1}$	2.96	2.89	25.3	0.64
Skill ratio $_{t-1}$	0.50	0.54	54.5	-0.73
$ln(employment)_{t-1}$	5.13	4.75	78.6	2.21
Ln(Cost per employee) $_{t-1}$	10.73	10.60	-165.9	1.12
Exporter $_{t-1}$	0.89	0.88	96.0	0.24
Importer $_{t-1}$	0.94	0.94	100.0	0.00
MNC dummy	0.29	0.30	94.1	-0.17

Table 6. Semi-parametric matching and difference-in-difference-Benchmark results

Growth lnTFP	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	0.0002	-0.05	0.05 (0.09)	80
DiD $_{t+2}$	-0.002	-0.09	0.09 (0.07)	78
DiD $_{t+3}$	0.003	-0.04	0.05 (0.07)	75
DiD $_{t+4}$	-0.06	-0.10	0.04 (0.08)	70

lnTFP in levels	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	-0.05	-0.06	0.006 (0.08)	85
DiD $_{t+2}$	-0.07	-0.03	-0.04 (0.08)	83
DiD $_{t+3}$	-0.07	-0.01	-0.06 (0.08)	78
DiD $_{t+4}$	-0.09	-0.09	0.003 (0.11)	72

Growth in Labor productivity	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	0.01	-0.04	0.05 (0.10)	80
DiD $_{t+2}$	0.01	-0.003	0.02 (0.05)	78
DiD $_{t+3}$	0.01	0.03	-0.01 (0.06)	75

Labor productivity	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	-0.006	-0.056	0.051 (0.11)	85
DiD $_{t+2}$	-0.004	-0.12	0.12 (0.13)	83
DiD $_{t+3}$	-0.007	0.007	-0.014 (0.068)	78

Growth in employment	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	-0.060	0.007	-0.067 (0.049)	82
DiD $_{t+2}$	-0.064	-0.014	-0.049 (0.039)	81
DiD $_{t+3}$	-0.066	-0.052	-0.014 (0.048)	76

Total employment	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	0.062	0.094	-0.032 (0.053)	85
DiD $_{t+2}$	0.073	0.152	-0.079 (0.063)	83
DiD $_{t+3}$	0.091	0.131	-0.04 (0.075)	78

Skilled employment	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	0.067	0.099	-0.033 (0.061)	85
DiD $_{t+2}$	0.097	0.110	-0.013 (0.083)	83
DiD $_{t+3}$	0.143	0.123	0.021 (0.083)	77

Note : Standard errors in parenthesis.

Unskilled employment	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	0.022	0.015	0.008 (0.066)	71
DiD $_{t+2}$	-0.023	0.071	-0.094 (0.081)	71
DiD $_{t+3}$	-0.024	0.112	-0.137 (0.101)	68

Average wages	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	0.084	0.171	-0.086 (0.096)	85
DiD $_{t+2}$	0.125	0.19	-0.066 (0.098)	83
DiD $_{t+3}$	0.151	0.115	0.036 (0.025)	78

Growth in real VA	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	-0.062	-0.039	-0.023 (0.084)	80
DiD $_{t+2}$	-0.049	-0.103	0.054 (0.073)	78
DiD $_{t+3}$	-0.070	-0.099	0.029 (0.076)	75

Real VA	Treatment group	Control group	Difference	No of matched pairs
DiD $_{t+1}$	0.026	0.074	-0.048 (0.078)	85
DiD $_{t+2}$	0.042	0.137	-0.096 (0.087)	83
DiD $_{t+3}$	0.058	0.149	-0.091 (0.10)	78

Export intensity	Treatment group	Control group	Difference	No of matched pairs
DiD t+1	0.0054	-0.004	0.009 (0.013)	55
DiD t+2	0.0047	-0.028	0.033 (0.015)**	50
DiD t+3	0.006	-0.018	0.024 (0.014)*	43

Log (Exports)	Treatment group	Control group	Difference	No of matched pairs
DiD t+1	0.188	-0.176	0.364 (0.304)	69
DiD t+2	0.267	0.208	0.059 (0.31)	71
DiD t+3	0.144	-0.342	0.486 (0.31)	67

Log (Exports in services)	Treatment group	Control group	Difference	No of matched pairs
DiD t+1	-0.551	0.045	-0.595 (0.937)	27
DiD t+2	-0.661	-0.584	-0.078 (0.949)	22
DiD t+3	-0.603	-0.778	-0.175 (1.134)	16

Note: Standard errors in parenthesis.

Table 7. Manufacturing firms only

TFP	Treatment group	Control group	Difference	No of matched pairs
DiD t+2	0.004	-0.134	0.141 (0.083)*	48

Wages	Treatment group	Control group	Difference	No of matched pairs
DiD t+3	0.148	0.101	0.047 (0.025)**	49

Log (Exports)	Treatment group	Control group	Difference	No of matched pairs
DiD t+3	0.197	-0.478	0.675 (0.377)*	46

Note: Standard errors in parenthesis.

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