PRODUCTIVITY EFFECTS FROM US MNEs: THE ROLE OF MARKET ORIENTATION AND REGIONAL INTEGRATION

Abstract

This paper considers the role of market orientation and regional integration in FDI spillover effects. Using data of US MNEs operating in 8 industries and 13 OECD countries during 1987-2003, we compare the productivity effects of local-market-oriented FDI *versus* export-oriented FDI, with the latter being spilt into FDI oriented at the parent and that at unaffiliated parties in third countries. Given the expected differential effects of regional integration on these different FDI types, we also consider their productivity effects within two regional agreements: CUSFTA and the EU. The results demonstrate positive productivity effects of local-market-oriented FDI, but even larger effects of parent-firm-oriented FDI. There are also substantial differences in effects of these FDI types between CUSFTA and the EU.

Key words: FDI spillovers, market orientation, regional integration

JEL codes: F23, O33, R11

1. Introduction

It is widely accepted that foreign direct investment (FDI) carried out by multinational enterprises (MNEs) plays an important role in the development of a host country. As a package of capital, technology and managerial skills, FDI transfers tangible and intangible resources, creates jobs, promotes competition, helps resource allocation, fosters international trade and augments human capital. But most importantly, it is an important channel for productivity spillovers across borders (Balasubramanyam et al., 1996). Productivity spillovers occur when MNEs 'cannot capture all quasi-rents due to its productive activities, or after the removal of distortions by the subsidiary's competitive pressure' (Caves, 1974).

The identification of whether there are FDI spillovers has been a subject of considerable interest since pioneering studies of MacDougall (1960) and Caves (1974), and it has also generated a number of survey articles including Blömstrom and Kokko (1998), Görg and Strobl (2001), Crespo and Fontoura (2007) Javorcik (2008) and Smeets (2008). Despite decades of efforts, there is no general consensus on the existence and magnitude of FDI spillovers. More recent studies, therefore, have started to involve more nuances and details of the spillover process in their research. For instance, some studies have started to look at the vertical (inter-industry) spillover effects of FDI, in addition to the horizontal (intra-industry) effects (e.g. Javorcik, 2004; Liu et al. 2008), others have taken into account the influence of mediating factors such as absorptive capacity and geography (e.g. Girma, 2005; Barrios et al., 2006). Scholars have also focused more on MNE heterogeneity, and the way in which this may affect the spillover process (e.g. Driffield and Love, 2007; Javorcik and Spatareanu, 2008; Girma et al., 2008).

This paper proceeds along the lines of these recent developments, and makes a number of contributions. First of all, we investigate how MNE heterogeneity[i] in terms of market orientation affects host-country productivity effects, both horizontal and vertical. Similar to Girma et al. (2008), we distinguish between local-market oriented FDI and export orientated FDI, but we take a step forward by disaggregating the latter into exports from the subsidiary back to the parent, and exports to third countries (mainly unaffiliated parties). We theorize on their potential different productivity effects.

Our second contribution is to consider the effect of Regional Economic Integration (REI) or Regional Integration Agreements (RIA) on the effects of these different types of FDI. There is a rather extensive literature concerning the effects of RIAs on the amount and composition of (inward) FDI (Dunning, 2000; Buckley et al., 2003). To the best of our knowledge, there is no study investigating the influence of RIAs on productivity effects of FDI. Given that the effects of RIAs on FDI depend to a large extent on the market orientation of FDI, this topic is particularly relevant in analyzing the spillover effects of FDI. Our sample setup allows us to consider and compare two different RIAs: The Canadian-United States Free Trade Agreement (CUSFTA) and the European Union (EU).

The empirical part of our study utilizes a newly collected database of US MNEs' investment in 8 sectors and 13 OECD countries over the period of 1987-2003. By employing this sample, we address the critique regarding the gap between firm-level research in micro-productivity studies, *versus* the high level of aggregation at the regional or country level in the growth literature (Mancusi, 2004). Moreover, as argued by Bitzer and Görg (2008), analyzing FDI spillovers in a larger panel of (host) countries can give us more general conclusions.

Finally, we deal with the possible endogeneity of FDI and other explanatory variables by adopting the system-GMM (Generalized Method of Moments) estimator by Blundell and Bond (1998). As argued by Görg and Strobl (2001), earlier studies employing industry-level or cross-sectional data tend to find positive spillover effects partly because endogeneity issues are inadequately dealt with: The higher average productivity of industries that have a high concentration of FDI may be an indication that MNEs self-select into industries with high productivity.

The remainder of this paper is organized as follows. Section 2 reviews the literature and develops hypotheses on the productivity effects of FDI with different market orientations, and the additional effects of RIAs. The data and variable construction are presented in Section 3. Section 4 outlines the estimation strategy. Estimation results are presented in section 5. Finally, section 6 offers concluding remarks and discusses policy implications.

2. Literature & Theory

As a response to the ambiguity in empirical findings of FDI spillover effects, recent contributions have increasingly paid attention to the nuances of the diffusion process and the nature and motives of the parties involved (Smeets, 2008). One approach in this vain has started to acknowledge that MNEs are heterogeneous (Feinberg and Keane, 2005): They may differ in terms of e.g. entry mode (Liu and Zou, 2007), ownership structure (Javorcik and Spatareanu, 2008) or investment motive (Girma, 2005; Driffield and Love, 2007). All these studies subsequently investigate if and how these different forms of MNE heterogeneity interact with the extent of knowledge diffusion to local (host-country) firms. The conclusion is that MNE heterogeneity indeed matters, and that it needs to be taken into account when assessing the effects of FDI on the host countries.

Girma et al. (2008) and Beugelsdijk et al. (2008) have considered MNE heterogeneity in terms of their market orientation. Following Girma et al. (2008) we consider the differential effects of FDI with a local market orientation and an export orientation, but extend their analysis by further disaggregating export-oriented FDI into that towards parent firm and that towards the third countries, and by including multiple host countries in the empirical part. Moreover, following the literature on RIAs and its effects on the amount and composition of FDI, we also consider the impact of RIAs on the productivity effects of different FDI types.

2.1 Market Orientation

2.1.1 Local-market-oriented-FDI

FDI with a local market orientation (hereafter: *Local-FDI*) is expected to be competing with other host-country firms that are serving the local market. At the firm-level, the resulting competition effects can be either negative (if local firms are forced up their average cost curve – cf. Aitken and Harrison, 1999) or positive (if local firms respond by increasing their innovative efforts or adopting better management techniques). At the industry-level – which is the level of our empirical analysis – the overall effect is likely to be positive. This is because the negative competition effect will (initially) tend to force the least productive firms to exit the market, thus increasing – together with the positive competition effect – the average level of industry productivity (Javorcik, 2008).

Second, there also arise knowledge spillover effects from *Local-FDI*. The fact that the MNE is competing with local producers also implies that it exploits locally relevant knowledge and technology, thus increasing the potential for horizontal spillovers. Moreover, previous literature indicates that *Local-FDI* is firmly embedded in local supplier and customer networks, thus increasing the potential for vertical spillovers (Beugelsdijk et al., 2008).

Hypothesis 1: Local-FDI generates positive horizontal effects (H1a) and positive vertical effects (H1b).

2.1.2 Export-market-oriented-FDI

In general, since MNEs' subsidiaries with an export orientation (hereafter: *Export-FDI*) are not directly competing with local host-country producers, we should not expect local competition effects from this type of FDI. However, if the host country depends heavily on the export sector, *Export-FDI* then competes directly for international market shares with export-oriented indigenous firms. In that case, MNEs exert competition effects on indigenous firms' productivity.[ii] As far as knowledge diffusion effects are concerned, the question is whether or not *Export-FDI* still employs locally relevant knowledge and technology in the host country. To the extent that it is, we expect positive horizontal spillover effects.

Regarding vertical knowledge diffusion, there should only be backward diffusion effects, since the customers of the MNE are by definition located abroad (i.e. outside the host-country). However, to the extent that the export orientation of MNEs is an indication of its international (cross-border) integration (Cantwell, 1992), we might expect that it is also sourcing (parts of) inputs abroad instead of from the host-country (Tavares and Young, 2006; Javorcik, 2008), in which case there may be a Lewis-type dualism in the host country (Ruane and Uğur, 2006), and export-oriented MNEs are unlikely to affect the productivity of host country firms in the downstream industry. Hence, our second hypothesis is:

Hypothesis 2: Export-oriented FDI generates zero or positive horizontal effects (H2a) and zero or positive backward linkage effects (H2b).

2.1.3 Parent-firm-oriented-FDI

An additional distinction which has not yet been made in the FDI spillover literature is the extent to which affiliates are integrated in the MNE's global intra-firm network. Yet some recent insights regarding global specialization of US MNEs' affiliates suggest that this distinction might be important for assessing productivity effects. We split up *Export-FDI* into subsidiary exports to the parent-firm (hereafter: *Parent-FDI*), and subsidiary exports to third countries (i.e. other than the host and the home country – hereafter: *Third-Country-FDI*).

Keane and Feinberg (2007) study the determinants of increased intra-firm trade between US MNE parents and their Canadian affiliates during the 1980s and part of the 1990s. They give a detailed account of the extent to which Just-In-Time (JIT) logistics drastically reduced inventory costs in Canadian subsidiaries, decreasing the costs of intra-firm trade, hence increasing the extent of parent-subsidiary trade. Moreover, they state:

> "[…] besides reducing inventory carrying costs of intra-firm trade, JIT adoption is closely linked with other management innovations, like concurrent engineering (CE) and the 'product platform' approach to new product development […]. This increased the efficiency of Canadian affiliates, whose plants had previously been inefficiently small vis-à-vis larger US plants. Thus, JIT adoption was crucial to transforming Canadian affiliates into efficient producers of intermediates for parents." (p. 574).

They argue that adoption of JIT by US MNEs' affiliates in Canada was accompanied by a host of other efficiency improving innovations.

However, a few studies suggest that the improvement in affiliate productivity and the increase in intra-firm trade are not necessarily limited to Canadian affiliates. Antràs and Helpman (2004) demonstrate, in a model on outsourcing *versus* vertical integration decisions by MNEs, that more productive parents are more likely to vertically integrate intermediate suppliers. This is essentially due to the fact that their opportunity costs of default by an outside supplier are larger (relative to less productive firms). Using intra-firm trade data between US MNE parents and their foreign affiliates in a number of host countries, Nunn and Trefler (2007) find macroeconomic empirical evidence for this. Feinberg and Keane (2005) also document that US MNEs' foreign affiliates that are well integrated into the global MNE network by means of intra-firm trade, experience *inter alia* higher growth of fixed capital stocks, have higher real wages and have larger sales.

In sum, subsidiaries that are well integrated in the MNE's global intra-firm network (in this study proxied by *Parent-FDI*) are expected to be generally more productive than those that are not. This leads us to our third hypothesis:

Hypothesis 3: Parent-FDI generates positive and larger horizontal effects than Local-FDI and Third-Country-FDI (H3a) and it generates positive and larger vertical effects than Local-FDI and Third-Country-FDI (H3b).

2.2 Regional Economic Integration (REI)

There is a relatively elaborate literature on the effects of Regional Economic Integration (REI) or Regional Integration Agreements (RIAs) on the amount and composition of trade and FDI flows (Dunning, 2000; Buckley et al., 2003). However, to the best of our knowledge, there is no study that analyzes the impact of RIAs on productivity effects of FDI. Our sample of countries allows us to distinguish between two RIAs: CUSFTA and the EU. They differ in several notable respects: (1) CUSFTA only encompasses two countries, whereas the EU includes (during our sample period) 15 countries; (2) The home country (i.e. the US) is an insider in CUSFTA but an outsider to the EU; (3) CUSFTA allowed its members to pursue their individual third-country trade policies, notably tariffs, the EU requires its members to harmonize their individual trade policies at the external border of the union; (4) The Internal Market Program in the EU ensures free movement of (production) factors – notably labor – between its member states, this is not the case for CUSFTA. These aspects influence the amount and composition of US outward FDI into the member states of the two RIAs differently, and consequently different productivity effects may arise.

First consider the horizontal effects of *Local-FDI* in CUSFTA and the EU. Although insights from new trade theory suggest that a RIA will divert producers away from market-seeking FDI (i.e. *Local-FDI*) towards trade (Brainard, 1997), Rugman (1990) notes that if MNEs have been active in host countries for quite some time prior to the RIA, location-specific advantages have developed to such an extent that it may not be optimal to substitute trade for FDI. This argument is actually used in the US-Canadian context. Considering the long history of US MNE in Canada (Feinberg and Keane, 2006; Keane and Feinberg, 2007) compared to the EU, we therefore expect that the substitution away from *Local-FDI* will be less pronounced for CUSFTA than for the EU. Consequently, the hypothesized positive horizontal effects of this type of FDI (H1a) are arguably larger in CUSFTA than in the EU.

Hypothesis 4a (H4a): Local-FDI generates larger positive horizontal effects in CUSFTA than in the EU.

The extent of *Parent-FDI* is determined by the amount of parent-subsidiary trade. Models of vertical FDI (Helpman, 1984) predict an increase in this type of FDI as a consequence of RIA, since parent-subsidiary trade becomes cheaper with the reduction in transaction costs. It follows that both CUSFTA and the EU will be conducive to *Parent-FDI* that takes place between its member states. Yet a crucial difference between CUSFTA and the EU in this context is that the US is an insider in CUSFTA, but an outsider to the EU. This would imply that the extent of *Parent-FDI* from the US will surely increase in CUSFTA, but not necessarily so in the EU. However, there are two objections to this line of reasoning.

First, Feinberg and Keane (2006) demonstrate that the amount of arms-length trade between US MNEs and Canada indeed increased following tariff reduction, but the extent of intra-firm trade between MNEs and their Canadian affiliates was largely unaffected.[iii] Thus, the increase in *Parent-FDI* due to CUSFTA, as predicted by FDI models, is not observed in practice.

Second, as mentioned above, the parent-orientation of subsidiaries can also be interpreted as its integration in the global network or supply chain of the MNE. That is, the fact that a subsidiary is parent-oriented does not necessarily imply a simple bilateral relationship; it could reflect the subsidiary being an integral part of a global MNE supply chain. From that perspective, this type of FDI may be more likely to be dominant in the EU relative to CUSFTA, since there is free movement of (production) factors within the EU (and hence between subsidiaries located in different countries), and the EU provides more possibilities for slicing up the value chain in more specialized components, due to the large scope for utilizing country-specific advantages (Cantwell, 1989). Based on these two observations we hypothesize:

Hypothesis 4b (H4b): Parent-FDI generates larger (positive) horizontal effects in the EU than in CUSFTA.

Given the large share of exports to unaffiliated parties in *Third-Country-FDI*, this type of FDI can be considered as export-platform FDI (Ekholm et al., 2007). Since it is oriented at parties in third countries, in CUSFTA it is by definition directed to outsiders, whereas in the EU it is very possibly directed to insiders. CUSFTA does not change the conditions under which US MNEs can leverage their Canadian export platforms. However, due to free trade within the EU, export platforms are relatively attractive to serve insider countries within the EU. As a consequence, we would expect to see an increase in so-called "hub-and-spoke" configurations of US MNEs' affiliates, where production or research is concentrated in one or a couple of large centers, which in turn supply several sales subsidiaries in other (insider) countries.

However, Buckley et al. (2003) argue that it is unlikely for MNEs to pursue such a single strategic approach when the group of countries that are involved in the RIA are heterogeneous in terms of e.g. legislation, institutional history and culture. In that case, MNEs are more likely to pursue a "multi-domestic" strategy, which allows them to better cater their products and services to the local needs of their customers. Given the substantial heterogeneity of countries within the EU, the extent of third-country oriented FDI will not be substantial in this RIA.

As a result, the expected effects of the two RIAs considered here on *Third-Country-FDI* will not differ very much, and consequently, nor will their productivity effects:

Hypothesis 4c (H4c): The horizontal productivity effects of Third-country FDI will not differ significantly between CUSFTA and the EU.

Finally, with regard to the vertical effects of FDI, differences may also arise between CUSFTA and the EU. Studies on the input-sourcing pattern of MNEs indicate that international sourcing tends to prevail over local sourcing in the context of liberal trade regimes (Tavares and Young, 2006; Javorcik, 2008). In that case, backward linkages effects of FDI are limited. Analogous to our earlier line of reasoning, it could be argued that the potential for international sourcing is larger in the EU than in CUSFTA. Hence:

Hypothesis 5a (H5a): The productivity effects of FDI through backward linkages will be larger in CUSFTA than in the EU.

As far as the productivity effects of (locally oriented) FDI through forward linkages are concerned, we have no *a priori* reason to expect any differences between CUSFTA and the EU, hence:

Hypothesis 5b (H5b): The productivity effects of FDI though forward linkages will not differ significantly between CUSFTA and the EU.

3. Data

3.1 MNE activities

We use data on US MNEs from the Bureau of Economic Analysis (BEA) to construct measures of FDI presence. BEA provides data on *inter alia* the amount of sales, the number of employees, fixed capital stocks and R&D expenditures of US MNEs' foreign affiliates.[iv] Moreover, sales are disaggregated into sales for the local market and exports, the latter are further disaggregated into exports to the parent-firm and exports to third countries. This distinction allows us to differentiate FDI with respect to its market orientation.

Initially we consider two types of FDI: *Local-FDI* and *Export-FDI*. *Local FDI* is the amount of US MNE activity which is directed toward the local market and a measure of *Local-FDI* for industry *i*, in host country *j* at time *t* is as follows:

(1) $$Local\text{ - }FDI_{ijt} = \frac{local\ sales_{ijt}}{total\ sales_{ijt}} \times FDI_{ijt}$$

where *local sales* and *total sales* represent the amount of US MNEs' affiliates sales on the local market and total sales, respectively. Throughout the empirical analysis we will employ three different measures of *FDI*: affiliate capital stocks, affiliate employment and affiliate R&D stocks. Taking these different measures of MNE presence follows up on an observation by Görg and Strobl (2001) that different measures yield different empirical results. Wei and Liu (2006) and Wei et al. (2008) argue that this may be due to the fact that different measures relate to different diffusion mechanisms. Applying a proxy of foreign capital, the positive spillover effect may simply indicate that the foreign presence produces a positive capital spillover effect. In this case, the positive externalities are closely related to the demonstration effect of the suitability of the project, or the superiority of machinery or equipment embodying updated technologies. Applying a proxy of employment in foreign firms, the spillover effect may be closely associated with employee turnover or contagion between employees in foreign and local firms. Finally, applying a proxy of R&D in foreign firms, the spillover effects are likely to be linked with knowledge diffusion of the superior product or knowledge acquisition via reverse engineering of the product.

Export-FDI relates to the exports of US MNEs' foreign affiliates from their host-countries to other countries and is constructed in a similar fashion as *Local-FDI*:

(2) $$Export\text{ - }FDI_{ijt} = \frac{exports\ to\ other\ countries_{ijt}}{total\ sales_{ijt}} \times FDI_{ijt}$$

where *export to other countries* represent the sales of US MNEs' affiliates to other countries.

We further split up *Export-FDI* into two: One measuring exports from the US MNEs' foreign affiliates back to the US parent – termed *Parent-FDI* – and one measuring exports from the affiliates to third countries – termed *Third-Country-FDI*:

$$Parent\text{ - }FDI_{ijt} = \frac{exports\ to\ US\ parent_{ijt}}{total\ sales_{ijt}} \times FDI_{ijt}$$

(3)

$$Third\text{ - }Country\text{ - }FDI_{ijt} = \frac{exports\ to\ third\ countries_{ijt}}{total\ sales_{ijt}} \times FDI_{ijt}$$

Next to horizontal (intra-industry) knowledge diffusion, we also consider vertical knowledge diffusion, i.e. through forward and backward linkages. We follow Javorcik (2004) and multiply the measures in (1)-(3) with input-output (I-O) coefficients. That's, in order to examine the impact of forward linkages of e.g. *Local-FDI* in sector *j* on productivity in sector *i* we construct at variable *Forward-Local-FDI* as follows:

$$(4) \qquad Forward\text{-}Local\text{-}FDI_{it} = \sum_j (\sigma_{ij} \times Local\ FDI_{jt}) \quad \text{s.t.}\ i \neq j$$

where σ_{ij} is the share of output supplied to industry *i* by industry *j*, not including intra-industry supplies. Backward linkages are computed as:

$$(5) \qquad Backward\text{-}Local\text{-}FDI_{it} = \sum_j (\alpha_{ij} \times Local\ FDI_{jt}) \quad \text{s.t.}\ i \neq j$$

where α_{ij} is the share of output supplied to industry *j* by industry *i*, not including intra-industry supplies. Similar measures are constructed for *Export-FDI, Parent-FDI* and *Third-Country-FDI*. The input-output data were obtained from the OECD.[v]

3.2 Other variables

Our dependent variable is the log of value added, taken from the STAN OECD database. Since we are interested in investigating the effect of US MNEs on *productivity* in host-country sectors, we need control for labor and capital inputs. The data for labor are taken from the Groningen Growth and Development Center (GGDC) and those for capital stocks taken from the STAN database. Labor is measured as total hours worked. Capital stocks were constructed from data on capital expenditures using the perpetual inventory method, while applying a depreciation rate of 5% (cf. Hall and Mairesse, 1995).

We also add two control variables: Industry-level exports and R&D stocks. Data on exports were collected from the STAN database. We netted out the US MNE affiliates' (total) exports to prevent double counting. Data on R&D expenditures were taken from the ANBERD OECD database. R&D stocks were then computed using the perpetual inventory method, while applying a depreciation rate of 15% (cf. Hall and Mairesse, 1995).

All variables are measured in billions of US dollars and, whenever relevant, have been converted to US dollars using 1995 PPP exchange rates and corrected for inflation using sectoral deflators.

3.3 Countries, sectors and period

Although the OECD databases report data for 24 OECD countries, matching these data to those of the BEA eventually leaves us with 13 OECD countries. Also, there is a mismatch between the sector classification of the OECD (using ISIC Rev. 3) versus that of the BEA (using SIC 1987). On top of that, the level of aggregation in the BEA data is rather high, eventually leaving us with 8 sectors in the analysis. Finally, the period that we consider is 1987-2003. However, because of lack of data on subsidiary-parent exports and foreign affiliate R&D stocks in the first two years, whenever these variables are used in the analysis, the period is reduced to 1989-2003. A full list of countries and industries is provided in the Appendix. Table 1 below presents some summary statistics and correlations.[vi]

TABLE 1 HERE

4. Estimation Method

The model to be estimated takes the following form (with lower case letters denoting logs):

(6) $$y_{ijt} = \beta_0 + \beta_1 l_{ijt} + \beta_2 k_{ijt} + \boldsymbol{\beta}_{\mathbf{4}}\mathbf{FDI}_{\mathbf{ijt}} + \boldsymbol{\beta}_{\mathbf{5}}\mathbf{X}_{\mathbf{ijt}} + D_i + D_j + D_t + \varepsilon_{ijt}$$

where *i*, *j* and *t* index country, industry and time respectively, *y* is value added, *l* is the total number of hours worked, *k* is the capital stock, **FDI** is a vector with (the log of) different types of FDI, **X** is a vector of control variables (i.e. (the log of) R&D stocks and (the log of) exports), *D* denotes fixed effects and *ε* is an error term. The parameters of interest are contained in the vector β_4 which measure the effect of (different types of) FDI on productivity. In order to test the influence of CUSFTA and EU, we will also interact the **FDI** vector with two RIA dummy variables.

The potential endogeneity of FDI is a well-known problem: If foreign investors set up their subsidiaries in more productive countries, sectors or regions, any inferred productivity effects from FDI in model (6) will be spurious. Reverting to instrumental variable (IV) regression analysis would provide a way out of this situation (Beugelsdijk et al. 2008), but such an approach is not straightforward in the present context: Even though the gravity literature provides a number of potentially exogenous instruments for FDI, these mainly function at the country level rather than the industry level that we explore in this paper.

Under these circumstances, it is appropriate to use Generalized Method of Moments (GMM) estimation (Roodman, 2006). One specific estimator in this context is difference-GMM by Arrelano and Bond (1991) which transforms the model into first differences and uses lagged levels of the endogenous variables as its instruments.[vii] Blundell and Bond (1998) extend this approach by introducing the system-GMM estimator which builds a system of equations in both levels and differences. The instrument set consists of lagged differences for the level equation, and lagged levels for the difference equation. It also employs a feasible estimator of the variance-covariance matrix of the error term, thus correcting for heteroskedasticity and serial correlation (Roodman, 2006). We will adopt the system-GMM estimator as it exploits more information in the data than the difference-GMM estimator.

Given the relatively limited amount of observations in our sample (N = 640 in the largest sample), we are forced to restrict the number of lags used, otherwise the number of instruments in the estimation becomes too large relative to the number of observations, resulting in overfitting of the model (Roodman, 2006). Following Driffield and Love (2007), we impose a maximum lag structure of 4 years. Moreover, we employ the one-step estimator. As Madariaga and Poncet (2007) argue, although the two-step estimator is more efficient, it is only appropriate in relatively large samples as otherwise it heavily biases the coefficient estimates. Finally, we utilize the small sample correction proposed by Roodman (2006), and report robust standard errors.

5. Empirical Results

5.1 Local-FDI versus Export-FDI

Table 2 presents the GMM results, with *Local-FDI* and *Export-FDI* as the variables of interest. The first three columns only consider horizontal effects, and each column utilizes a different measure of *FDI*: capital stocks (column 1), employment levels (column 2), and R&D stocks (column 3). *Local-FDI* is positive and significant for all three measures of *FDI*, a result which is consistent with H1a. *Export-FDI* does not show up significantly in any of the regressions, which appears to be consistent with H2a. The other explanatory variables are all significant and with the expected sign, except for R&D stocks, which remains insignificant throughout all the regressions.[viii]

TABLE 2 HERE

Columns 4-6 report results including backward and forward linkages from *Local-FDI*, whereas columns 7-9 including backward linkages from *Export-FDI*.[ix] Again we observe positive and significant horizontal effects of *Local-FDI*. *Export-FDI* is positive and marginally significant in four out of six occasions. Although this still largely supports H2a, it also hints at the importance of the disaggregation of *Export-FDI*. Regarding the vertical linkages, there appear to be no significant effects from either type of FDI in any of the models, thus rejecting H1b and confirming H2b. Regarding the H1b, the implication is that though MNEs may be aiming for the local market, they tend to be biased towards global suppliers. Given the relative liberalized environment in OECD countries, locally-oriented MNEs may find it easier to use global suppliers through their global network (cf. Javorcik, 2008).[x]

In sum, we find very consistent and strong support for H1a and H2b and reject H1b. The empirical evidence on H2a is mixed as we find both zero and positive effects when different measures are used. The distinction in the destination of the affiliate exports might provide additional insights. We now turn to this issue.

5.2 Parent-FDI versus Local- and Third-Country-FDI

Table 3 has a similar setup as Table 2, but we further disentangle export orientation into parent-firm and third-country orientation. Similar to the results in Table 2, *Local-FDI* has a consistently positive and significant effect, regardless of whether or not vertical linkages of any type of FDI are included in the model. The vertical impact of *Local-FDI* in columns 4-6 is never significant. These results again lend support to H1a, but reject H1b.

TABLE 3 HERE

Next consider the effects of *Parent-FDI*. We find consistently positive and significant effect of *Parent-FDI* and its coefficient estimate is always larger than that of *Local-FDI* and *Third-Country-FDI*. This provides support for H3a and corroborates the findings of Keane and Feinberg (2007) and Nunn and Trefler (2007).

Third-Country-FDI is positive and significant when capital stocks are used as the proxy for FDI, which seems to indicate that this proxy for export-platform FDI mainly generates productivity effects through capital demonstration effects. This provides partial support for H2a. Finally, we find no backward linkage effects in columns 7-9, hence rejecting H3b (and implicitly supporting H2b) with the implication that export-oriented affiliates largely source their inputs abroad, through their global network.

5.3 Regional Economic Integration

We now distinguish the productivity effects of FDI between those in CUSFTA *versus* the EU, by interacting the **FDI** vector with a CUSFTA dummy (taking value 1 for

Canada and 0 otherwise) and the EU dummy (taking the value 0 for Canada and 1 otherwise). Table 4 presents the results.

TABLE 4 HERE

First consider *Local-FDI*. In all the models, *Local-FDI* has a positive significant effect in CUSFTA, and its coefficient estimate is consistently larger than that in the EU, which supports H4a. In the EU, *Local-FDI* is also positive and significant, except for the models in which affiliate employment levels are used as the FDI proxy, in which case it is insignificant.

The productivity effects of *Parent-FDI* are also consistently positive and significant in the EU, and are substantially larger than those in CUSFTA. This is in accordance with H4b. The superior effect of *Parent-FDI* is especially notable when employment is used as a proxy for FDI, a fact to which we will return in the discussion. In CUSFTA, *Parent-FDI* also generates positive and significant effects, except for columns (4)-(5), where the effects seem to be diverted to forward linkages of *Local-FDI*. Additionally, in the EU the coefficient estimate of *Parent-FDI* is consistently larger than that of both *Local-FDI* and *Third-Country-FDI*, yielding support for H3a. However, the opposite holds in CUSFTA.

The effects of *Third-Country-FDI* are generally insignificant in both regions, although it sometimes becomes positive and significant in the EU. As such, these findings provide partial support for H4c.

Regarding the backward linkage effects, we see that none of them generate productivity effects in the EU, which appears consistent with the large scope for international input-sourcing in the EU. However, in CUSFTA we actually observe mainly negative and significant productivity effects through backward linkages from *Local-FDI* and *Parent-FDI*, and positive effects from *Third-Country-FDI*. Combined, these findings are neither consistent across the different columns, nor are they in accordance with H5a.

Finally, the results for forward linkages of *Local-FDI* indicate that these effects are generally larger in CUSFTA than in the EU: In columns (4)-(5), the effects are positive and significant in CUSFTA and insignificant in the EU, whereas in column (6) they are insignificant in CUSFTA and significantly negative in the EU. These findings thus reject H5b.

6. Discussion and conclusion

In this study, we continue in the vain of recent advances in the empirical FDI knowledge diffusion literature, investigating the extent to which MNE heterogeneity, in combination with regional integration, affects the productivity effects of MNEs' foreign operations. Our key results are as follows

(1) Local-market-oriented-FDI generates consistently positive horizontal effects, but vertical effects are largely absent.

(2) Export oriented FDI, on average, is insignificant, but after splitting up this type of FDI into exports back to the US parent *versus* exports to third countries, we find – in accordance with recent research – that the former type generates positive horizontal effects, and that these effects are larger than those of local-market-oriented-FDI.

(3) Comparing the effects of different types of FDI in CUSFTA and the EU, we find that the positive horizontal effects of local-market-oriented-FDI are consistently

larger in CUSFTA than in the EU, but that the reverse holds for parent-firm-oriented-FDI. The vertical effects are largely absent in the EU.

One possible explanation for the absence of backward effects is the fact that our sample only contains developed (OECD) countries. As argued by Javorcik (2008), the supplier base in these countries is generally highly developed, which makes it unlikely that they experience significant productivity increases as a result of MNE activity in downstream sectors. Alternatively, we already mentioned that US MNEs might be sourcing their inputs mainly internationally, hence not yielding *local* productivity effects through backward linkages. Such an explanation would be consistent with the observation by Cantwell (1992) that already in the 1970s and 1980s US MNEs were engaged in increased rationalization of their foreign production activities, both along horizontal and vertical dimensions.

Another interesting finding is the substantially larger effect of parent-firm-oriented-FDI in the EU compared to CUSFTA when affiliate employment is used as the FDI proxy. We noted that this proxy is most closely related to labor turnover or migration as the knowledge diffusion channel. As such, an explanation for this finding could be related to the free movement of labor between EU member states: This enhances knowledge diffusion along this channel, a point also raised by Blomström et al. (2000). Additionally, given that high parent-firm-oriented-FDI activity indicates a high degree of integration into the global MNE supply chain, this makes labor movement a particularly well-suited knowledge diffusion channel for this type of FDI.

The consistently positive productivity effects from parent-firm-oriented-FDI – both in CUSFTA as well as the EU – in combination with the observations made by Keane and Feinberg (2007), entail some good news for business practitioners and policy makers in host countries: Indeed, innovations in logistics and management practices, as well as in processes appear to positively affect the local business environment. This implies that a too narrow focus on attracting R&D intensive multinational activities may be unwarranted. Non-technical innovations clearly also generate positive productivity effects.

Additionally, recent developments in national policies of some countries have shown a tendency to aim at attracting MNEs into export processing zones in order to boost the local or regional economy. Our empirical results indicate that the resulting export-oriented MNE activity is unlikely to automatically boost productivity at the industry-level (although other effects in terms of e.g. employment increases may still be present). Event though parent-firm-oriented-FDI appears to generate positive productivity effects, we have argued that this effect is most probably not due to its export-orientation, but rather to the accompanying logistic and managerial innovations. The policy implication which can be derived from this finding is that a liberal regime which facilitates MNEs to integrate indigenous firms into the global network may have a better chance of increasing the productivity of indigenous firms.

This study suffers from some limitations. The most obvious one is the high level of aggregation across industries, which may create problem for interpreting the empirical findings. For example, another alternative and plausible explanation to the absence of vertical linkage effects may be that the level of aggregation in our industries is too large to properly disentangle horizontal and vertical effects. That is, what is captured now as horizontal effects may very well also include vertical effects across industries at a lower level of aggregation. This somewhat clouds the interpretation of our results, but they nonetheless imply that at lower levels of aggregation either the horizontal or vertical effects still exist. Unfortunately, in combining host country and industry information of the foreign activities of US

MNEs, this is the lowest level of aggregation the BEA provides in its public databases. Lower levels of aggregation at the industry level are publicly available, but in this case the relevant host country is unknown. Confidential databases possibly do provide more information, hence future research along these lines could have value-added over and above the present study. The same applies to the number of host countries, which due to industry-level information on *inter alia* exports and R&D was necessarily limited to include OECD countries. An extension to include developing countries would most certainly be a fruitful exercise, as it would surely affect the variation across the different FDI types distinguished here, thus better enabling identification of the parameters of interest.

Appendix

Countries	Sectors
Belgium	Computers & electronic products
Canada	Chemicals
Denmark	Machinery
Finland	Electrical equipment, appliances & components
France	Transportation equipment
Germany	Food & kindred products
Ireland	Primary & fabricated metals
Italy	Utilities
Netherlands	
Norway	
Spain	
Sweden	
United Kingdom	

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Table 1: Descriptive statistics and correlation matrix (N = 563)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Value added[a]														
2. Labor[a]	0.91													
3. Capital[a]	0.83	0.76												
4. R&D[a]	0.56	0.55	0.48											
5. Exports[a]	0.60	0.57	0.51	0.59										
6. Local-FDI	0.49	0.50	0.38	0.34	0.13									
7. Export-FDI	-0.01	-0.08	-0.07	0.23	0.20	-0.38								
8. Parent-FDI	-0.04	-0.07	-0.12	-0.02	-0.09	0.02	0.34							
9. Third-Country-FDI	0.01	-0.05	-0.01	0.25	0.25	-0.40	0.85	-0.22						
10. Backward-Local-FDI	0.28	0.37	0.17	0.10	0.08	0.15	-0.19	0.02	-0.21					
11. Backward-Export-FDI	0.22	0.33	0.15	0.04	0.10	0.07	-0.16	0.03	-0.18	0.83				
12. Backward-Parent-FDI	0.04	0.06	-0.01	-0.07	0.00	0.10	-0.07	0.34	-0.27	0.49	0.55			
13. Backward-Third-Country-FDI	0.24	0.35	0.18	0.08	0.11	0.03	-0.15	-0.16	-0.06	0.72	0.88	0.09		
14. Forward-Local-FDI	0.48	0.55	0.31	0.45	0.35	0.22	0.16	0.28	0.01	0.38	0.20	0.17	0.14	
Mean	9.26	5.17	10.2	8.10	9.16	3.46	2.66	0.52	2.14	0.33	0.23	0.06	0.17	0.72
standard deviation	1.15	1.13	1.88	1.58	1.51	1.76	1.57	0.86	1.51	0.46	0.35	0.17	0.30	0.63

Notes: The FDI variables are calculated using foreign affiliates' capital stocks.
a: Variables are measured in logs.

Table 2: GMM estimates of knowledge diffusion from US FDI – Market Orientation

FDI Measures	*(1) Capital*	*(2) Labor*	*(3) R&D*	*(4) Capital*	*(5) Labor*	*(6) R&D*	*(7) Capital*	*(8) Labor*	*(9) R&D*
(Log)Labor[a]	0.615**	0.613**	0.689**	0.608**	0.587**	0.697**	0.592**	0.581**	0.703**
	(.074)	(.077)	(.056)	(.064)	(.079)	(.070)	(.075)	(.075)	(.069)
(Log)Capital[a]	0.111**	0.121**	0.100**	0.114**	0.119**	0.097*	0.123**	0.133**	0.098*
	(.037)	(.035)	(.037)	(.039)	(.040)	(.043)	(.042)	(.043)	(.042)
(Log)R&D Stock[a]	-0.013	-0.051	-0.076	0.017	0.002	-0.045	-0.014	-0.027	-0.052
	(.052)	(.058)	(.061)	(.048)	(.053)	(.057)	(.047)	(.051)	(.061)
(Log)Exports[a]	0.163*	0.186**	0.193**	0.140*	0.161*	0.175*	0.168*	0.191**	0.177*
	(.074)	(.062)	(.067)	(.067)	(.063)	(.067)	(.067)	(.057)	(.069)
***Local-FDI*[a]**	0.105*	0.148*	0.083*	0.097*	0.141*	0.084**	0.137**	0.163*	0.080**
	(.044)	(.068)	(.036)	(.038)	(.067)	(.02)	(.045)	(.064)	(.030)
***Export-FDI*[a]**	0.092	0.165	0.101	0.105	0.197†	0.125†	0.120†	0.178†	0.097
	(.071)	(.109)	(.069)	(.066)	(.116)	(.071)	(.067)	(.101)	(.075)
***Forward-Local-FDI*[a]**				-0.058	-0.013	0.063			
				(.075)	(.139)	(.128)			
***Backward-Local-FDI*[a]**				-0.037	-0.117	-0.147			
				(.069)	(.140)	(.102)			
***Backward-Export-FDI*[a]**							-0.050	-0.064	-0.078
							(.099)	(.120)	(.116)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	45.6**	50.9**	38.1**	44.9**	55.5**	44.4**	48.0**	57.3**	45.6**
AR(1)-*Z* (Arrelano-Bond)	-0.30	-0.32	-0.73	0.02	-0.32	-0.64	-0.42	-0.51	-0.61
N	640	643	520	640	643	520	640	643	520

Notes: Dependent variables is (Log)Value Added

System GMM-estimates – One step robust estimator, lags 2-4 used for endogenous variables

** 1% sig; * 5% sig; † 10% sig.

a: Treated as endogenous variable

Table 3: GMM estimates of knowledge diffusion from US FDI – Splitting up export-oriented FDI

FDI Measures	*(1) Capital*	*(2) Labor*	*(3) R&D*	*(4) Capital*	*(5) Labor*	*(6) R&D*	*(7) Capital*	*(8) Labor*	*(9) R&D*
(Log) Labor[a]	0.604**	0.602**	0.696**	0.616**	0.593**	0.700**	0.597**	0.567**	0.663**
	(.063)	(.073)	(.052)	(.056)	(.057)	(.061)	(.061)	(.081)	(.058)
(Log) Capital[a]	0.141**	0.136**	0.104*	0.127**	0.117**	0.102*	0.124**	0.137**	0.107*
	(.041)	(.039)	(.040)	(.042)	(.042)	(.042)	(.043)	(.046)	(.041)
(Log) R&D Stock[a]	-0.022	-0.050	-0.079	-0.010	-0.018	-0.039	-0.031	-0.010	-0.037
	(.049)	(.056)	(.066)	(.049)	(.055)	(.057)	(.049)	(.051)	(.055)
(Log) Exports[a]	0.110†	0.157**	0.172**	0.135*	0.166**	0.164*	0.161**	0.162**	0.153*
	(.057)	(.051)	(.062)	(.059)	(.061)	(.068)	(.060)	(.059)	(.062)
Local-FDI[a]	0.113**	0.152*	0.080**	0.102**	0.154**	0.081**	0.144**	0.136*	0.078**
	(.041)	(.067)	(.026)	(.037)	(.058)	(.026)	(.038)	(.055)	(.025)
Parent-FDI[a]	0.173*	0.258**	0.183*	0.177*	0.261*	0.215*	0.195*	0.234*	0.174*
	(.072)	(.110)	(.079)	(.077)	(.130)	(.085)	(.075)	(.106)	(.076)
Third-Country-FDI[a]	0.116†	0.166	0.087	0.108†	0.129	0.097†	0.130*	0.078	0.090
	(.062)	(.115)	(.069)	(.059)	(.111)	(.057)	(.062)	(.102)	(.057)
Forward–Local-FDI[a]				-0.045	-0.069	-0.141			
				(.060)	(.108)	(.141)			
Backward-Local-FDI[a]				-0.016	0.016	-0.042			
				(.054)	(.103)	(.084)			
Backward-Parent-FDI[a]							-0.085	-0.861	0.039
							(.106)	(.527)	(.291)
Backward-Third-Country-FDI[a]							-0.020	-0.022	-0.036
							(.112)	(.133)	(.102)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	35.4**	43.2**	33.4**	38.2**	50.0**	54.1**	48.4**	40.7**	39.2**
AR(1)-Z (Arrelano-Bond)	0.71	-0.05	-0.66	-0.01	-0.37	-0.58	-0.78	-0.24	-0.31
N	563	565	494	563	565	494	563	565	494

Notes: Dependent variables is (Log) Value Added

System GMM-estimates – One step robust estimator, lags 2-4 used for endogenous variables

** 1% sig; * 5% sig; † 10% sig.

a: Treated as endogenous variable

Table 4: GMM estimates of knowledge diffusion from US FDI – Regional integration

FDI Measures	*(1)* ***Capital***	*(2)* ***Labor***	*(3)* ***R&D***	*(4)* ***Capital***	*(5)* ***Labor***	*(6)* ***R&D***	*(7)* ***Capital***	*(8)* ***Labor***	*(9)* ***R&D***
(Log) Labor[a]	0.598**	0.622**	0.695**	0.610**	0.639**	0.752**	0.616**	0.623**	0.688**
	(.051)	(.060)	(.051)	(0.61)	(.061)	(.064)	(.055)	(.072)	(.060)
(Log) Capital[a]	0.143**	0.138**	0.096*	0.141**	0.133**	0.088*	0.123**	0.133**	0.099*
	(.043)	(.043)	(.040)	(.043)	(.044)	(.041)	(.040)	(.046)	(.039)
(Log) R&D Stock[a]	-0.005	-0.014	-0.040	-0.004	-0.013	-0.037	-0.025	-0.012	-0.024
	(.048)	(.056)	(.050)	(.049)	(.057)	(.051)	(.047)	(.057)	(.048)
(Log) Exports[a]	0.124*	0.164**	0.180**	0.127*	0.171**	0.178**	0.162**	0.177**	0.159**
	(.053)	(.051)	(.066)	(.057)	(.056)	(.065)	(.053)	(0.56)	(.056)
Local-FDI × EU[a]	0.096*	0.065	0.062*	0.096*	0.081	0.069*	0.129**	0.054	0.054[†]
	(.043)	(.079)	(.028)	(.042)	(.085)	(.032)	(.045)	(.081)	(.030)
Local-FDI × CUSFTA[a]	0.122**	0.164**	0.130**	0.113**	0.152**	0.134**	0.159**	0.170**	0.136**
	(.031)	(.042)	(.026)	(.035)	(.055)	(.026)	(.034)	(.045)	(.023)
Parent-FDI × EU[a]	0.537**	1.13[†]	0.551**	0.530**	1.21[†]	0.590**	0.573**	1.11[†]	0.545*
	(.188)	(.661)	(.206)	(.191)	(.642)	(.184)	(.175)	(.662)	(.208)
Parent-FDI × CUSFTA[a]	0.116**	0.146*	0.106**	0.037	0.007	0.087**	0.141**	0.124*	0.092**
	(.035)	(.056)	(.026)	(.047)	(.075)	(.032)	(.038)	(.061)	(.029)
Third-Country-FDI × EU[a]	0.063	0.041	0.056	0.069	0.076	0.072[†]	0.095*	0.025	0.053
	(.040)	(.056)	(.036)	(.042)	(.069)	(.042)	(.045)	(.059)	(.036)
Third-Country-FDI × CUSFTA[a]	-0.075	-0.374	-0.225	-0.020	-0.054	-0.126	0.008	-0.428	-0.387
	(.223)	(.323)	(.293)	(.301)	(.380)	(.283)	(.272)	(.422)	(.320)
Forward-Local-FDI × EU				-0.059	-0.183	-0.183*			
				(.065)	(.129)	(.078)			
Forward-Local-FDI × CUSFTA				0.178*	0.334*	0.038			
				(.084)	(.142)	(.067)			
Backward-Local-FDI × EU				0.018	0.150	0.069			
				(.068)	(.134)	(.089)			
Backward-Local-FDI × CUSFTA				-0.134	-0.381	-0.278*			
				(.146)	(.231)	(.137)			
Backward-Parent-FDI × EU							-0.678	-0.985	0.010
							(2.04)	(3.08)	(.201)
Backward-Parent FDI × CUSFTA							0.207	-2.75**	-1.99**
							(.139)	(.647)	(.455)

Backward-Third–Countr-							0.017	-0.053	-0.030
FDI × EU							(.138)	(.129)	(.118)
Backward-Third-Country-							-4.23**	13.8**	13.54**
FDI × CUSFTA							(1.52)	(5.96)	(4.18)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	39.8**	43.3**	37.0**	37.5**	51.1**	444.6**	58.6**	60.5**	651.2**
AR(1)-*Z* (Arrelano-Bond)	-0.02	-0.43	-0.74	-0.20	-0.51	-0.82	-1.21	-0.66	-0.31
N	563	565	494	563	565	494	563	565	494

Notes: Dependent variables is (Log) Value Added

System GMM-estimates – One step robust estimator, lags 2-4 used for endogenous variables

** 1% sig; * 5% sig; † 10% sig.

a: Treated as endogenous variable

[i] We restrict our analysis to one source country – US. As reviewed by Crespo and Fontoura (2007), country-of-origin of FDI is also a determinant of FDI spillover effects.

[ii] This situation may arise e.g. in cases where MNEs enter host country export enclaves.

[iii] As explained above, the extent of intra-firm trade was mainly accounted for by inventory-cost reducing innovations such as JIT (Keane and Feinberg, 2007).

[iv] We use data on all majority-owned non-bank affiliates as for these types of subsidiaries the data are most comprehensive.

[v] A couple of comments apply here. First, the sector definitions and levels of aggregation of the OECD and BEA differ, we appropriately aggregated the OECD data before constructing valid I-O shares. Second, for most OECD countries, I-O data are only available for 1995-2002. We therefore used the 1995 data for the years 1987-1995, and the 2002 data for the years 1996-2003. We have used alternative assignments and the qualitative results remain.

[vi] For reasons of space, we have only incorporated FDI measures computed with foreign affiliates' capital stocks. Results are very similar when using employment or R&D stocks and are available from the authors upon request.

[vii] In the differenced equation, time-invariant variables such as country and sector fixed effects are no longer present.

[viii] A tentative explanation is that an individual industry's R&D may not be significant enough to enhance its own productivity. More region- or country-wide knowledge contributes to productivity gains. Alternatively, the relatively high degree of correlation with exports (cf. Table 1) may be an explanation for this.

[ix] We do not simultaneously include backward linkages from *export FDI* and linkage effects from *Local-FDI* in these regressions because of the high correlation (cf. Table 1).

[x] We also experimented with including *Forward-Local-FDI* in columns 7-9 of Table 2. The results remain unaffected.