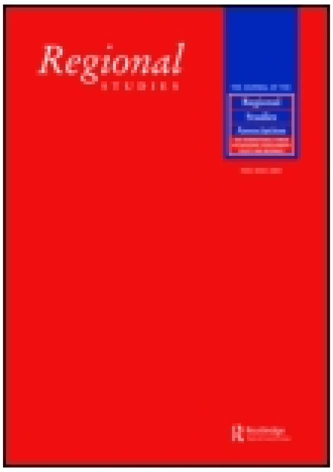

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Productivity Effects of United States Multinational Enterprises: The Roles of Market Orientation and Regional Integration

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Productivity Effects of United States Multinational Enterprises: The Roles of Market Orientation and Regional Integration

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SMEETS R. and WEI Y. Productivity effects of United States multinational enterprises: the roles of market orientation and regional integration, *Regional Studies*. This paper considers the role of market orientation and regional integration in foreign direct investment (FDI) productivity effects. Using data of United States multinational enterprises operating in eight industries and thirteen Organisation for Economic Co-operation and Development (OECD) countries during 1987–2003, the productivity effects of local market-oriented FDI versus export-oriented FDI are compared, with the latter being split into FDI oriented at the parent and that at parties in third countries. Their productivity effects are also considered within two regional agreements: the Canadian–United States Free Trade Agreement (CUSFTA) and the European Union. Robust positive horizontal effects of parent firm-oriented FDI and third-country-oriented FDI are found, with notable differences in the effects of these FDI types between CUSFTA and the European Union.

Foreign direct investment (FDI) spillovers Market orientation Regional integration

SMEETS R. and WEI Y. 美国跨国公司（MNEs）生产力效应：市场导向以及区域整合的作用，区域研究。本文考察了市场导向和区域整合在对外直接投资（FDI）生产力效应中所起到的作用。采用1987–2003 年间美国跨国公司（MNEs）在8大产业以及13个经合组织国（OECD）中运作的相关数据，我们比较了地方市场导向的对外直接投资（FDI）与出口导向的FDI的生产力效应，后者又分为本国的FDI导向与第三国FDI导向两部分。我们同样考虑了其在两大区域协定美加自由贸易协定（CUSFTA）与欧盟协定（the EU）中的生产力效应。研究发现，本国导向的FDI 与第三方国家导向的FDI中都存在较强的正水平效应，但是在美加自由贸易协定与欧盟协定中，不同类别的FDI所产生的作用间存在显著差异。

FDI溢出 市场导向 域整合

SMEETS R. et WEI Y. Les effets productivité des sociétés multinationales aux Ue: le role de l'orientation marché et de l'intégration régionale, *Regional Studies*. Cet article cherche à évaluer le rôle de l'orientation marché et de l'intégration régionale dans les effets productivité de l'IDE. A partir des données sur les sociétés multinationales aux E-U installées dans huit industries et treize pays-membres de l'OCDE entre 1987 et 2003, on compare les effets productivité de l'IDE orienté vers le marché local à l'IDE à vocation exportatrice, ce dernier étant divisé entre l'IDE orienté vers la maison-mère et celui qui est orienté vers des partenaires situées dans des pays tiers. On considère aussi leurs effets productivité dans deux zones régionales: à savoir, la CUSFTA (la zone du libre-échange entre le Canada et les Etats-Unis) et l'Ue. Il s'avère des effets horizontaux positifs soutenus quant à l'IDE orienté vers la maison-mère et les pays tiers, y compris d'importantes différences des effets de ces catégories d'IDE entre la CUSFTA et l'Ue.

Retombées IDE Orientation marché Intégration régionale

SMEETS R. und WEI Y. Produktivitätseffekte multinationaler Unternehmen in den USA: die Rolle der Marktorientierung und regionalen Integration, *Regional Studies*. In diesem Beitrag untersuchen wir die Rolle der Marktorientierung und regionalen Integration auf die Produktivitätseffekte ausländischer Direktinvestitionen. Anhand der Daten US-amerikanischer multinationaler Unternehmen, die zwischen 1987 und 2003 in acht Branchen und 13 OECD-Staaten tätig waren, vergleichen wir die Produktivitätseffekte von am lokalen Markt orientierten Auslandsdirektinvestitionen mit denen von exportorientierten Auslandsdirektinvestitionen, wobei in der zweiten Kategorie zwischen Investitionen, die sich an der Muttergesellschaft orientieren, und Investitionen, die sich an Parteien in Drittländern orientieren, unterschieden wurde. Ebenso untersuchen wir die Auswirkungen

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auf die Produktivität innerhalb von zwei Regionalabkommen: dem CUSFTA und der EU. Wir finden robuste positive horizontale Auswirkungen auf die muttergesellschafts- und drittlandorientierten Auslandsdirektinvestitionen, wobei sich im Vergleich zwischen CUSFTA und EU deutliche Unterschiede hinsichtlich der Auswirkungen dieser Arten von Auslandsdirektinvestitionen zeigen.

Übertragungen durch Auslandsdirektinvestitionen Marktorientierung Regionale Integration

SMEETS R. y WEI Y. Efectos de productividad de empresas multinacionales de los Estados Unidos: los roles de la orientación mercantil y la integración regional, *Regional Studies*. En este artículo analizamos el papel de la orientación mercantil y la integración regional en los efectos de productividad de la Inversión Directa Extranjera (IDE). Con ayuda de datos de empresas multinacionales estadounidenses que operaron en 8 industrias y 13 países de la OCDE durante 1987–2003, comparamos los efectos de la productividad de la IDE en mercados locales con la IDE en mercados de exportación, ésta última dividida entre la IDE para sociedades matrices y partidos en países terceros. Asimismo consideramos sus efectos de productividad en el marco de dos acuerdos regionales: el CUSFTA (Tratado de Libre Comercio entre Canadá y Estados Unidos) y la UE. Observamos sólidos efectos horizontales positivos de la IDE en sociedades matrices y la IDE en países terceros, con notables diferencias en los efectos de estos tipos de IDE entre el CUSFTA y la UE.

Desbordamientos de la IDE Orientación mercantil Integración regional

JEL classifications: F23, O33, R11

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, p. 176)

The identification of whether there are FDI spillovers has been a subject of considerable interest since the pioneering studies of MACDOUGALL (1960) and CAVES (1974), and it has also generated a number of survey articles including those by BLOMSTRÖM 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 (for example, JAVORCIK, 2004; and LIU *et al.* 2009); others have taken into account the influence of mediating factors such as absorptive capacity and geography (for example, 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 (for example, DRIFFIELD and LOVE, 2007; JAVORCIK and SPATAREANU, 2008; and GIRMA *et al.*, 2008).

The present paper proceeds along the lines of these recent developments and makes a number of contributions. First, it investigates how MNE heterogeneity in terms of market orientation affects host-country productivity effects, both horizontal and vertical. Similar to the work of GIRMA *et al.* (2008), the present paper distinguishes between local market-oriented FDI and export-oriented FDI, but a step forward is made by disaggregating the latter into exports from the subsidiary back to the parent, and exports to third countries (mainly unaffiliated parties). Their potential different productivity effects are then considered.

The second contribution is to consider the effect of regional economic integration (REI) or regional integration agreements (RIAs) 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). Until now, no studies have investigated 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 analysing the spillover effects of FDI. The present sample set-up allows one to consider and compare two different RIAs: The Canadian–United States Free Trade Agreement (CUSFTA) and the European Union.

The empirical part of this study utilizes a database of US MNEs' investment in eight sectors and thirteen Organisation for Economic Co-operation and Development (OECD) countries over the period 1987–2003.[1] By employing this sample, this paper addresses 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, 2008). Moreover, as argued by BITZER and GÖRG (2008), analysing FDI spillovers in a larger panel of (host) countries can give more general conclusions.

Finally, the paper deals with the possible endogeneity of FDI and other explanatory variables by adopting the system-generalized method of moments (GMM) estimator of 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 the paper is organized as follows. The second section reviews the literature on the productivity effects of FDI with different market orientations, and the additional effects of RIAs. The data and variable construction are presented in the third section. The fourth section outlines the estimation strategy. Estimation results are presented in the fifth section. Finally, the sixth section offers a discussion of the results and concludes with some policy implications, limitations, and areas for future research.

LITERATURE REVIEW

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 vein has started to acknowledge that MNEs are heterogeneous (FEINBERG and KEANE, 2005): they may differ in terms of, for example, 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 the work of GIRMA *et al.* (2008), the present paper considers the differential effects of FDI with a local market orientation and an export orientation, but it extends the analysis of GIRMA *et al.* by further disaggregating export-oriented FDI into that towards the parent firm and that towards 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, the paper also considers the impact of RIAs on the productivity effects of different FDI types.

The previous literature has developed several propositions regarding the relationship between the market orientation of FDI and its associated productivity effects. In addition, the literature dealing with the moderating effect of RIAs on the amount and composition of FDI has yielded some conflicting expectations. This section will review the literature. Instead of deriving specific hypotheses, it will explore the validity of some of the arguments forwarded in existing studies in the empirical analysis section (the fifth section). The general research question that is addressed in this paper is whether and to what extent market orientation and regional integration impact on the productivity effects of FDI.

Market orientation

Local market-oriented foreign direct investment. 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 the present 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).

Export market-oriented foreign direct investment. In general, since MNEs' subsidiaries with an export orientation (hereafter, Export FDI) are not directly competing with local host-country producers, local competition effects from this type of FDI should not be expected. 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.[2] 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 does, positive horizontal spillover effects are expected.

Regarding vertical knowledge diffusion, there should only be backward diffusion effects, since the customers of the MNE are by definition located abroad (that is, 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), it might be expected that it is also sourcing (parts of) its inputs abroad instead of from the host country (TAVARES and YOUNG, 2006; JAVORCIK, 2008), in which case there might 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.

Parent firm-oriented foreign direct investment. 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. The present paper splits Export FDI into subsidiary exports to the parent firm (hereafter, Parent FDI), and subsidiary exports to third countries (that is, 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.

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 integrate intermediate suppliers vertically. 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 (2008) 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. Therefore, one would expect that their productivity effects will also be larger than those of the other FDI types.

Regional economic integration (REI)

There is a relatively elaborate literature on the effects of REI or RIAs on the amount and composition of trade and FDI flows (DUNNING, 2000; BUCKLEY *et al.*, 2003). Until now there has been no study that analyses the impact of RIAs on productivity effects of FDI.

The sample of countries allows one to distinguish between two RIAs: CUSFTA and the European Union. They differ in several notable respects:

- CUSFTA only encompasses two countries, whereas the European Union includes (during the sample period) fifteen countries.
- The home country (that is, the United States) is an insider in CUSFTA, but an outsider to the European Union.
- CUSFTA allowed its members to pursue their individual third-country trade policies, notably tariffs, whereas the European Union requires its members to harmonize their individual trade policies at the external border of the union.
- The Internal Market Program in the European Union ensures free movement of (production) factors – notably labour – between its Member States, but 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 European Union. Insights from new trade theory suggest that an RIA will divert producers away from market-seeking FDI (that is, Local FDI) and towards trade, since the decrease in trade costs increases the opportunity costs of FDI (MARKUSEN, 1984, 2002). This is also known as the proximity–concentration trade-off (BRAINARD, 1997). However, the fact that the United States is an outsider to the European Union and that the Single Market Program only applies to European Union Member States implies that the substitution away from Local FDI and towards exports will be most pronounced in CUSFTA.

On the other hand, RUGMAN (1990) notes that if MNEs have been active in host countries for quite some time before the RIA, location-specific advantages have developed to such an extent that it might not be optimal to substitute trade for FDI. This argument is actually used in the United States–Canadian context. Considering the long history of US MNEs in Canada (FEINBERG and KEANE, 2006; KEANE and FEINBERG, 2007) compared with the European Union, it would then be expected that the substitution away from Local FDI has been less pronounced for CUSFTA than for the European Union. In sum, there are two conflicting views on the effects of two different RIAs on the amount and composition of FDI and its associated productivity effects. As such, the validity of these opposing arguments will be explored in the fifth section.

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 trade costs. It follows that both CUSFTA and the European Union will be conducive to Parent FDI that takes place between its Member States. Yet, the crucial difference between CUSFTA and the European Union in this context is again that the United States is an insider in CUSFTA, but an outsider to the European Union. This would imply that the extent of Parent FDI from the United States will surely increase in CUSFTA, but not necessarily so in the European Union. However, two objections to this line of reasoning have been forwarded in the literature.

First, FEINBERG and KEANE (2006) demonstrate that the amount of arm's-length trade between US MNEs and Canada indeed increased following tariff reductions, but the extent of intra-firm trade between MNEs and their Canadian affiliates was largely unaffected.[3] Thus, the increase in Parent FDI due to CUSFTA, as predicted by models of vertical FDI, is not observed in practice.

Second, as mentioned above, the parent orientation of subsidiaries can also be interpreted as their 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 European Union relative to CUSFTA, since there is free movement of (production) factors within the European Union (and hence between subsidiaries located in different countries), and the European Union 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).

Hence, in the case of Parent FDI, one also has two opposing views regarding the differential effects of CUSFTA and the European Union on this type of FDI and its associated productivity effects. Again, the validity of these arguments will be explored in the empirical part of the paper.

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 European Union 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 the Single Market Program in the European Union, export platforms are relatively attractive to serve insider countries within the European Union. As a consequence, one 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 centres, 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, for example, 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 European Union, from this perspective the extent of third-country-oriented FDI will not be substantial in this RIA. So yet again, one finds opposing theoretical arguments regarding the effects of the European Union and CUSFTA on the extent and effects of Third-Country FDI.

Finally, with regard to the vertical effects of FDI, differences may also arise between CUSFTA and the European Union. 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 the above line of reasoning, it could be argued that the potential for international sourcing is larger in the European Union than in CUSFTA. As far as the productivity effects of (locally oriented) FDI through forward linkages are concerned, there is no a priori reason to expect any differences between CUSFTA and the European Union.

DATA

Multinational enterprise activities

This section uses data on US MNEs from the Bureau of Economic Analysis (BEA) to construct measures of FDI presence. The BEA provides data on *inter alia* the amount of sales, the number of employees, fixed capital stocks, and research and development (R&D) expenditures of US MNEs' foreign affiliates.[4] Moreover, sales are disaggregated into sales for the local market and exports, with the latter being even further disaggregated into exports to the parent firm and exports to third countries. This distinction allows a differentiation of FDI to be made with respect to its market orientation.

Initially, two types of FDI are considered: Local FDI and Export FDI. Local FDI is the amount of US MNE activity that is directed toward the local market, and the present measure of Local FDI for industry i in host country j at time t is as follows:

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

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 the paper will employ three different measures of FDI: affiliate capital stocks, affiliate employment, and affiliate R&D stocks. Taking these different measures of the presence of MNE 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.* (2009) argue that this may be due to the fact that different measures relate to different diffusion mechanisms. Applying a proxy of foreign capital, a positive productivity 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:

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

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

Export FDI is further split into two: one part measuring exports from the US MNEs' foreign affiliates back to the US parent – termed Parent FDI; and the other part measuring exports from the affiliates to third countries – termed Third-Country FDI:

$$Parent\text{-}FDI_{ijt} = \frac{exports\ to\ US\ parent_{ijt}}{total\ sales_{ijt}} \times FDI_{ijt}$$
$$Third\text{-}Country\text{-}FDI = \frac{exports\ to\ third\ countries_{ijt}}{total\ sales_{ijt}} \times FDI_{ijt} \qquad (3)$$

Next to horizontal (intra-industry) knowledge diffusion, vertical knowledge diffusion, that is, through forward and backward linkages, is also considered. The work of JAVORCIK (2004) is followed and the measures in equations (1)–(3) are multiplied with input–output coefficients. That is, in order to examine the impact of forward linkages of Local FDI in sector h on productivity in sector i, one constructs at variable Forward-Local FDI as follows:

$$Forward\text{-}Local\text{-}FDI_{it} = \sum_h (\sigma_{ih} \times Local\ FDI_{ht}) \qquad (4)$$

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

$$Backward\text{-}Local\text{-}FDI_{it} = \sum_h (\alpha_{ih} \times Local\ FDI_{ht}) \quad \text{s.t. } i \neq h \qquad (5)$$

where α_{ih} is the share of output supplied to industry h 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 Organisation for Economic Co-operation and Development (OECD).[5]

Other variables

The dependent variable is the log of total factor productivity (TFP), which is calculated as the residual of Cobb–Douglas production functions that are estimated – using a generalized least-squares (GLS)-autoregressive (AR) (1) estimator – for each industry separately (cf. GIRMA and GÖRG, 2007), with value added as the dependent variable and labour and capital as the input variables (for a list of industries, see the Appendix). Industry-level data for value added and capital stocks are taken from the STAN OECD database. The data for labour are taken from the Groningen Growth and Development Center (GGDC); and those for capital stocks are taken from the STAN database. Labour 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).

Two control variables were also added: industry-level exports and R&D stocks. Data on exports were collected from the STAN database. The US MNE affiliates' (total) exports were netted out 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 were measured in billions of US dollars and, whenever relevant, were converted to US dollars using 1995 purchasing power parity (PPP) exchange rates and corrected for inflation using sectoral deflators.

Countries, sectors and, period

Although the OECD databases report data for twenty-four OECD countries, matching these data to those of the BEA eventually leaves thirteen OECD countries. In addition, there is a mismatch between the sector classification of the OECD (using International Standard Industrial Classification (ISIC) Rev. 3) versus that of the BEA (using Standard Industrial Classification (SIC) 1987). On top of that, the level of aggregation in the BEA data is rather high, eventually leaving eight sectors in the analysis. Finally, the period being considered is 1987–2003. However, because of a lack of data on foreign affiliate R&D stocks in the first two years, whenever this proxy is 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 presents some summary statistics and correlations.[6]

ESTIMATION METHOD

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

$$y_{ijt} = \beta_0 + \beta_1 y_{ijt-1} + \boldsymbol{\beta}_2\mathbf{FDI_{ijt}}_{-1} + \boldsymbol{\beta}_3\mathbf{X_{ijt}} + \eta_i + \nu_j + \varepsilon_{ijt} \tag{6}$$

where i, j, and t index country, industry, and time respectively; y is total factor productivity (TFP); $\mathbf{X}$ is a vector of control variables (that is, (the log of) R&D stocks and (the log of) exports); η and ν are fixed effects; and ϵ is an idiosyncratic error term. FDI is a vector with (the log of) different types of FDI. One-period lagged FDI variables are employed here to take into account the lag between MNE activity and productivity change, that is, it takes time for FDI to have its full impact on productivity. The parameters of interest are contained in the vector $\boldsymbol{\beta}_2$, which measures the effect of (different types of) FDI on productivity. In order to test the influence of CUSFTA and European Union, the FDI vector was interacted 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. Using lagged FDI variables could to some extent address this problem. However, this solution is less suited in situations where the series are persistent over time. Reverting to instrumental variable (IV) regression analysis would provide an alternative 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 (cf. FRANKEL and ROMER, 1999), these mainly function at the country level rather than the industry level that is explored in this paper.

Additionally, the lagged dependent variable y_{ijt-1} captures dynamic adjustments of sectoral productivity. To the extent that productivity depends on its past realizations (for example, due to learning effects or business cycles), its inclusion is important to control for 'sluggish' adjustment of the productivity and to obtain unbiased coefficient estimates of the other explanatory variables (BAUM, 2006). However, it again induces endogeneity since y_{ijt-1} is by definition correlated with the error term.

Under these circumstances, it is appropriate to revert to generalized method of moments (GMM) estimation (BAUM, 2006; ROODMAN, 2009). One specific estimator in this context is difference-GMM by ARRELANO and BOND (1991), which transforms the model in (6) into first differences:

$$\Delta y_{ijt} = \beta_1 \Delta y_{ijt-1} + \boldsymbol{\beta}_2\Delta\mathbf{FDI_{ijt}}_{-1} + \boldsymbol{\beta}_3\Delta\mathbf{X_{ijt}} + \Delta\varepsilon_{ijt} \tag{7}$$

This removes the fixed effects in the error term, but it does not solve the endogeneity problem since y_{ijt-1} in Δy_{ijt-1} is now correlated with ϵ_{ijt-1} in $\Delta\epsilon_{ijt}$. However, under the assumptions that the error term is not serially correlated and that explanatory variables are not correlated with *future* realizations of the error term, deeper lags of the explanatory variables are orthogonal to the error term, and hence may serve as proper instruments (cf. CARKOVIC and LEVINE, 2005). Thus, the following moment conditions are used:

$$E(y_{i,t-s} \cdot (\varepsilon_{it} - \varepsilon_{i,t-1})) = 0$$
$$\text{such that} \quad s \geq 2;\ t = 3, \ldots, T$$
$$E(FDI_{i,t-s} \cdot (\varepsilon_{it} - \varepsilon_{i,t-1})) = 0$$
$$\text{such that} \quad s \geq 2;\ t = 3, \ldots, T$$

Table 1. Descriptive statistics and correlation matrix (n = 547)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total factor productivity[a]	1.00												
2. Lag total factor productivity[a]	0.92	1.00											
3. R&D[a]	0.19	0.19	1.00										
4. Exports[a]	−0.06	−0.09	−0.63	1.00									
5. Local FDI[b]	−0.17	−0.13	−0.32	0.19	1.00								
6. Export FDI[b]	0.19	0.14	−0.20	0.11	−0.43	1.00							
7. Parent FDI[b]	0.22	0.19	0.08	−0.16	0.00	0.34	1.00						
8. Third-Country FDI[b]	0.07	0.03	−0.25	0.20	−0.45	0.83	−0.25	1.00					
9. Backward-Local FDI[b]	−0.03	−0.02	−0.04	0.08	0.16	−0.22	0.01	−0.23	1.00				
10. Backward-Export FDI[b]	0.04	0.04	0.03	0.03	0.05	−0.20	0.01	−0.21	0.82	1.00			
11. Backward-Parent FDI[b]	0.10	0.11	0.12	−0.05	0.10	−0.10	0.33	−0.30	0.50	0.56	1.00		
12. Backward-Third-Country FDI[b]	−0.02	−0.03	−0.03	0.06	0.00	−0.17	−0.19	−0.06	0.68	0.86	0.08	1.00	
13. Forward-Local FDI[b]	−0.11	−0.12	−0.39	0.32	0.25	0.13	0.29	−0.04	0.33	0.14	0.16	0.06	1.00
Mean	0.13	0.10	8.20	9.35	3.59	2.77	0.55	2.22	0.40	0.26	0.07	0.20	0.93
Standard deviation	0.35	0.35	1.52	1.23	1.75	1.56	0.90	1.52	0.53	0.39	0.19	0.34	0.71

Notes: [a]Variables are in logs.
[b]Lagged values.
Foreign direct investment (FDI) variables are calculated using foreign affiliates' capital stocks.
R&D, research and development.

However, to the extent that these explanatory variables are persistent over time or close to a random walk, lagged levels contain little information about future changes, and as such they will make weak instruments (Carkovic and Levine, 2005; Roodman, 2009).

Blundell and Bond (1998) solve this problem by extending the outlined approach also to include the levels equation in model (6), and using lagged differences – that is, $\Delta y_{ij,t-s}$ and $\Delta FDI_{ij,t-s}$ – to instrument the endogenous variables y and FDI. These instruments are uncorrelated with the fixed effects in the error term, that is:

$$E((y_{ij,t-s} - y_{ij,t-s-1}) \cdot (\eta_i + \nu_j + \varepsilon_{ijt})) = 0 \quad \text{such that} \quad s \geq 1$$
$$E((FDI_{ij,t-s} - FDI_{ij,t-s-1}) \cdot (\eta_i + \nu_j + \varepsilon_{ijt})) = 0 \quad \text{such that} \quad s \geq 1$$

For estimation purposes, the Blundell–Bond estimator builds a system of both models in (6) and (7), but treats them as a single equation. As such, this estimator is called the system-GMM estimator, and it is adopted as it exploits more information in the data than the difference-GMM estimator alone.

Given the relatively limited amount of observations in the sample ($n = 550$ in the largest sample), the number of lags used in instrumentation are restricted to avoid over-fitting of the model (Roodman, 2009). Following the work of Driffield and Love (2007), a maximum lag structure of four years is first imposed.[7] However, further inspection indicates that the error term in model (6) is autocorrelated up to AR(4), which renders the first four lags of the instruments for the endogenous variables invalid. Hence, in Tables 2–4, lags 5–8 are used to instrument the endogenous variables. Moreover, the one-step estimator is employed. As Madariaga and Poncet (2007) argue, although the two-step estimator is more efficient, it is only appropriate in relatively large samples, otherwise it heavily biases the coefficient estimates. Finally, the small sample correction proposed by Roodman (2009) is utilized, time dummies are included in order to minimize the occurrence of contemporaneous (cross-section) correlation, and robust standard errors are reported.

EMPIRICAL RESULTS

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 (column 2), and R&D stocks (column 3). Local FDI is positive and significant for the first measure of FDI only. Export FDI, on the other hand, shows up significantly in all three regressions.

Regarding the other explanatory variables, a clear positive and highly significant feedback effect of previous productivity levels is observed. R&D stocks show the expected positive effect, and are always significant. Exports are also positive and generally highly significant.

Finally, the bottom of Table 2 provides the statistical tests of the models. The Sargan–Hansen test statistics of over-identifying restrictions are never significant, suggesting that the null hypothesis of valid (that is, exogenous) instruments can be accepted. The AR

Table 2. Generalized method of moments (GMM) estimates of knowledge diffusion from US foreign direct investment (FDI) – market orientation

FDI measures	(1) Capital	(2) Labour	(3) R&D	(4) Capital	(5) Labour	(6) R&D	(7) Capital	(8) Labour	(9) R&D
Lag (log) TFP[a]	0.922**	0.941**	0.946**	0.932**	0.943**	0.923**	0.927**	0.936**	0.943**
	(0.028)	(0.029)	(0.029)	(0.020)	(0.026)	(0.024)	(0.024)	(0.026)	(0.026)
(log)R&D stock	0.033**	0.031**	0.021**	0.027**	0.027**	0.023*	0.029**	0.031**	0.024*
	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)
(log)Exports	0.022*	0.023*	0.019**	0.016*	0.014	0.011	0.009†	0.017†	0.015†
	(0.008)	(0.009)	(0.008)	(0.007)	(0.010)	(0.009)	(0.017)	(0.009)	(0.008)
Local FDI[a,b]	0.017*	0.007	0.003	0.018*	0.022†	0.000	0.014†	0.011	−0.003
	(0.008)	(0.014)	(0.006)	(0.009)	(0.013)	(0.005)	(0.008)	(0.011)	(0.005)
Forward-Local FDI[a,b]				−0.019	−0.044	−0.014			
				(0.013)	(0.027)	(0.017)			
Backward-Local FDI[a,b]				−0.003	−0.020	−0.017			
				(0.012)	(0.024)	(0.016)			
Export FDI[a,b]	0.027**	0.042**	0.015*	0.032**	0.056**	0.017*	0.023**	0.040**	0.012*
	(0.009)	(0.015)	(0.008)	(0.007)	(0.016)	(0.008)	(0.008)	(0.014)	(0.006)
Backward-Export FDI[a,b]							−0.012	−0.014	−0.016
							(0.014)	(0.020)	(0.016)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	105.5**	104.9**	122.9**	157.1**	110.1**	129.5**	149.6**	119.5**	143.1**
AR (1)	−4.98**	−5.00**	−4.82**	−4.90**	−4.90**	−4.92**	−4.89**	−4.88**	−4.81**
AR (5)	−0.98	−0.94	−1.59	−1.00	−1.05	−1.48	−1.27	−1.16	−1.56
Sargan−Hansen statistic	48.3	46.7	38.8	43.7	43.8	41.1	44.9	46.4	42.7
Sample size (*n*)	547	550	453	547	550	453	550	561	453

Notes: [a]Treated as an endogenous variable
[b]Lagged values.
Dependent variable is (log)TFP. System GMM estimates – one-step robust estimator, lags 5–8 are used for endogenous variables.
Figures in parentheses are robust standard errors.
**Significant at the 1% level; *significant at the 5% level; and †significant at the 10% level.
AR, autoregressive; R&D, research and development; TFP, total factor productivity.

statistics indicate first-order autocorrelation, as would be expected (given the inclusion of the lagged dependent variable), but no serial correlation from AR(5) onwards, confirming that the use of period 5–8 lagged instruments is valid (cf. the fourth section).

Columns 4–6 report results including backward and forward linkages from Local FDI, whereas columns 7–9 include backward linkages from Export FDI.[8] Again, positive and significant horizontal effects of Local FDI when capital stock measurement is used are observed. Export FDI is positive and significant in all occasions. Regarding the vertical linkages, there appear to be no significant effects from either type of FDI in any of the models.[9]

In sum, very consistent and strong evidence is found for the positive productivity effects of Export FDI, regardless of the proxy used. In the case of Local FDI, only consistently positive effects are found when capital stocks are used as the FDI proxy.

Parent FDI versus Local and Third-Country FDI

Table 3 has a similar set-up as Table 2, but export orientation is further disentangled into parent firm and third-country orientation. Similar to the results in Table 2, Local FDI has a consistent positive effect when capital stocks are used to proxy FDI. Moreover, columns 4–6 demonstrate a fairly consistent and significant *negative* forward productivity effect and an insignificant backward effect of Local FDI.

Next, consider the effects of Parent FDI and Third-Country FDI. Consistently positive and significant horizontal effects are found across all specifications. The coefficients on Parent FDI are mostly larger than those of Local FDI and Third-Country FDI. The results in columns 7–9 show that the vertical productivity effects of both Parent FDI and Third-Country FDI are consistently statistically insignificant.

Regional economic integration

The productivity effects of FDI between those in the European Union versus CUSFTA are now distinguished by interacting the FDI vector with a European Union dummy (taking the value of zero for Canada; and 1 otherwise) and a CUSFTA dummy (taking a value of 1 for Canada; and zero otherwise). Table 4 presents the results.[10]

Table 3. Generalized method of moments (GMM) estimates of knowledge diffusion from US foreign direct investment (FDI) – splitting up export-oriented FDI

FDI measures	(1) Capital	(2) Labour	(3) R&D	(4) Capital	(5) Labour	(6) R&D	(7) Capital	(8) Labour	(9) R&D
Lag (log) TFP[a]	0.927**	0.928**	0.899**	0.921**	0.924**	0.884**	0.939**	0.940**	0.903**
	(0.025)	(0.031)	(0.040)	(0.017)	(0.026)	(0.034)	(0.019)	(0.025)	(0.032)
(log) R&D stock	0.035**	0.033**	0.028*	0.025**	0.020*	0.022*	0.021**	0.020*	0.025
	(0.009)	(0.011)	(0.014)	(0.007)	(0.008)	(0.011)	(0.007)	(0.008)	(0.012)
(log) Exports	0.019*	0.022*	0.020*	0.020*	0.011	0.024**	0.008	0.007	0.013
	(0.009)	(0.009)	(0.010)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.018)
Local FDI[a,b]	0.018†	0.010	0.002	0.012†	0.006	0.001	0.008	0.005	−0.001
	(0.010)	(0.014)	(0.007)	(0.007)	(0.009)	(0.006)	(0.008)	(0.010)	(0.006)
Forward-Local FDI[a,b]				−0.025†	−0.049†	−0.061†			
				(0.016)	(0.025)	(0.033)			
Backward-Local FDI[a,b]				−0.001	0.027	0.020			
				(0.014)	(0.023)	(0.021)			
Parent FDI[a,b]	0.029**	0.037**	0.032**	0.041**	0.061**	0.045**	0.027**	0.036**	0.023*
	(0.006)	(0.013)	(0.010)	(0.006)	(0.013)	(0.014)	(0.006)	(0.008)	(0.009)
Backward-Parent FDI[a,b]							−0.050	0.004	0.220
							(0.038)	(0.047)	(0.179)
Third-Country FDI[a,b]	0.031**	0.036†	0.030*	0.030**	0.049**	0.030*	0.015†	0.028†	0.025*
	(0.010)	(0.019)	(0.014)	(0.008)	(0.017)	(0.013)	(0.009)	(0.016)	(0.012)
Backward-Third-Country FDI[a,b]							−0.018	−0.017	−0.047
							(0.015)	(0.002)	(0.099)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	153.6**	107.2**	173.6**	341.4**	179.0**	207.9**	214.4**	248.5**	272.3**
AR(1)	−5.05**	−5.01**	−4.90**	−4.96**	−4.93**	−4.79**	−4.99**	−4.93**	−4.89**
AR(5)	−1.01	−0.88	−1.59	−0.80	−0.95	−1.48	−1.18	−0.89	−1.67
Sargan−Hansen statistic	49.2	47.6	43.8	44.4	47.2	28.4	42.9	46.4	41.4
Sample Size	547	550	453	547	550	453	547	550	453

Notes: [a]Treated as an endogenous variable.
[b]Lagged values.
Dependent variable is (log)TFP. System GMM estimates – one-step robust estimator, lags 5–8 are used for endogenous variables.
Figures in parentheses are robust standard errors.
**Significant at the 1% level; *significant at the 5% level; and †significant at the 10% level.
AR, autoregressive; R&D, research and development; TFP, total factor productivity.

First consider Local FDI. When using capital stocks as the FDI proxy, Local FDI has a positive and significant effect both in the European Union and CUSFTA, although the horizontal effects are not completely robust to the inclusion of backward linkage variables in columns 7–9. Regarding the vertical productivity effects of Local FDI in columns 4–9, evidence is found of negative forward productivity effects and positive backward effects in CUSFTA and both negative backward and forward effects in the European Union. However, these results are not completely robust to a change in the FDI proxy.

The horizontal productivity effects of Parent FDI are consistently positive and significant in both regions for all specifications. However, in the European Union, the coefficients on Parent FDI are consistently (much) larger than in CUSFTA. Moreover, in both RIAs the coefficients on Parent FDI are consistently and substantially larger than those of Local FDI and Third-Country FDI. In terms of the vertical productivity effects associated with Parent FDI, some evidence is found of positive effects in the European Union, but some negative effects in CUSFTA (see columns 7–9).

The horizontal effects of Third-Country FDI are positive and significant in the European Union, but are insignificant in CUSFTA. Finally, there is some evidence of negative backward productivity effects in the European Union, but positive effects in CUSFTA (see columns 7–9).

DISCUSSION AND CONCLUSION

This study continues in the vein of recent advances in the empirical foreign direct investment (FDI) knowledge diffusion literature, investigating the extent to which multinational enterprise (MNE) heterogeneity in terms of market orientation, in combination with regional integration, affects the productivity effects of MNEs' foreign operations. The key results are as follows.

Table 4. Generalized method of moments (GMM) estimates of knowledge diffusion from US foreign direct investment (FDI) – regional integration

FDI measures	(1) Capital	(2) Labour	(3) R&D	(4) Capital	(5) Labour	(6) R&D	(7) Capital	(8) Labour	(9) R&D
Lag (log) TFP[a]	0.935**	0.942**	0.887**	0.935**	0.951**	0.887**	0.940**	0.937**	0.904**
	(0.021)	(0.025)	(0.039)	(0.021)	(0.023)	(0.034)	(0.017)	(0.024)	(0.032)
(log) R&D stock	0.030**	0.026**	0.024†	0.029**	0.024**	0.022*	0.022**	0.024*	0.024*
	(0.009)	(0.010)	(0.012)	(0.008)	(0.008)	(0.010)	(0.007)	(0.010)	(0.010)
(log) Exports	0.016†	0.017†	0.024*	0.016*	0.014	0.022*	0.013	0.009	0.014†
	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)	(0.008)	(0.010)	(0.010)	(0.008)
Local FDI[a,b] × EU	0.019†	0.002	0.002	0.017†	0.006	−0.000	0.006	−0.005	0.002
	(0.011)	(0.017)	(0.007)	(0.009)	(0.016)	(0.007)	(0.011)	(0.019)	(0.006)
Forward-Local FDI[a,b] × EU				−0.008	−0.005	−0.055*			
				(0.011)	(0.014)	(0.028)			
Backward-Local FDI[a,b] × EU				−0.012	−0.027†	0.005			
				(0.013)	(0.014)	(0.014)			
Local FDI[a,b] × CUSFTA	0.014†	0.016	0.000	0.021*	0.008	−0.000	0.006	−0.004	0.011
	(0.008)	(0.016)	(0.008)	(0.010)	(0.014)	(0.006)	(0.008)	(0.013)	(0.007)
Forward-Local FDI[a,b] × CUSFTA				−0.086**	−0.080	−0.115**			
				(0.031)	(0.052)	(0.041)			
Backward-Local FDI[a,b] × CUSFTA				0.033	0.115**	0.081**			
				(0.028)	(0.039)	(0.029)			
Parent FDI[a,b] × EU	0.066**	0.108*	0.078*	0.078**	0.105*	0.090**	0.057**	0.107*	0.066*
	(0.023)	(0.050)	(0.033)	(0.024)	(0.046)	(0.034)	(0.021)	(0.049)	(0.033)
Backward-Parent FDI[a,b] × EU							0.332*	0.035	0.334*
							(0.140)	(0.260)	(0.141)
Parent FDI[a,b] × CUSFTA	0.035**	0.048**	0.030**	0.065**	0.070**	0.059**	0.026**	0.039**	0.035**
	(0.007)	(0.010)	(0.006)	(0.016)	(0.026)	(0.013)	(0.007)	(0.011)	(0.006)
Backward-Parent FDI[a,b] × CUSFTA							−0.067*	−0.030	0.526
							(0.028)	(0.055)	(0.243)
Third-Country FDI[a,b] × EU	0.026*	0.028*	0.021†	0.023**	0.025*	0.019†	0.016†	0.013*	0.020†
	(0.010)	(0.012)	(0.012)	(0.009)	(0.012)	(0.011)	(0.010)	(0.006)	(0.010)
Backward-Third-Country FDI[a,b] × EU							−0.047*	−0.010	−0.043
							(0.027)	(0.039)	(0.248)
Third-Country FDI[a,b] × CUSFTA	0.036	−0.235	0.082	−0.113	−0.229	−0.038	0.024	−0.093	−0.163
	(0.049)	(0.157)	(0.081)	(0.085)	(0.143)	(0.089)	(0.066)	(0.145)	(0.107)
Backward-Third-Country FDI[a,b] × CUSFTA							0.879†	0.689	−3.69
							(0.462)	(0.659)	(2.45)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	351.7**	350.0**	219.6**	326.4**	328.0**	349.8**	414.8**	367.6**	334.1**
AR(1)	−5.07**	−5.00**	−4.91**	−5.02**	−4.97**	−4.88**	−5.03**	−4.96**	−4.84**
AR(5)	−1.05	−0.87	−1.57	−0.89	−0.40	−1.44	−1.18	−1.23	−1.42
Sargan–Hansen statistic	42.8	38.5	43.5	37.7	39.3	41.6	33.2	38.3	40.0
Sample Size	547	550	453	547	550	453	547	550	453

Notes: [a]Treated as an endogenous variable.
[b]Lagged values.
Dependent variable is (log)TFP. System GMM estimates – one-step robust estimator, lags 5–6 are used for endogenous variables.
Figures in parentheses are robust standard errors.
**Significant at the 1% level; *significant at the 5% level; and †significant at the 10% level.
AR, autoregressive; CUSFTA, Canadian–United States Free Trade Agreement; EU, European Union; R&D, research and development; TFP, total factor productivity.

(1) Local market-oriented FDI generates consistently positive horizontal effects when capital stocks are used as the FDI proxy, and there is some evidence of negative forward productivity effects, but not of backward productivity effects.

The former finding is in accordance with the expectations formulated in the second section and indicates that this type of FDI indeed yields efficiency and generates knowledge diffusion. The fact that these effects only occur through affiliate capital stocks might indicate that capital demonstration effects are the most important in this respect (WEI and LIU, 2006). The negative forward productivity effects could indicate the products supplied to local customers by the US MNEs may be more expensive or may not be adequately adapted to local requirements, hence a negative forward linkage effect may follow (SCHOORS and MERLEVEDE, 2007).

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

(2) Export-oriented FDI yields consistent positive and significant horizontal effects, regardless of the FDI proxy used. This result remains after splitting up this type of FDI into exports back to the US parent versus exports to third countries. Moreover, the coefficient estimate on parent-oriented FDI is consistently larger than that of local market-oriented FDI. But vertical productivity effects of either FDI type are absent.

These results are also in accordance with the expectations formulated in the second section. They indicate that MNEs with an outward orientation might still bring in locally relevant knowledge from which domestic firms may benefit. In addition, the dominant effect of parent-oriented FDI is in accordance with the findings of KEANE and FEINBERG (2007) and NUNN and TREFLER (2008). The absence of any consistent vertical productivity effects could indicate that the Lewis-type dualism mentioned by Ruane and Uğur (2006) and explained in the second section indeed occurs.

(3) Comparing the effects of local market-oriented FDI in different regional integration agreements (RIAs) – the Canadian–United States Free Trade Agreement (CUSFTA) and the European Union – one finds some evidence of positive horizontal effects, but negative forward linkage effects in both regions. In addition, there appear to be positive backward linkage effects in CUSFTA.

These results seem to support RUGMAN's (1990) argument that foreign affiliates of US MNEs will remain in Canada even after a reduction in trade costs. In addition, given the long historical collaborations between US MNEs and their suppliers in Canada, it is unsurprising to see that the latter continuously benefit from the former in terms of backward productivity effects.

(4) A clear distinguishing feature between the European Union and CUSFTA is that horizontal productivity effects of third-country-oriented FDI only occur in the former, whereas those of parent-oriented FDI occur in both regions, but they are substantially larger in the European Union than in CUSFTA. For backward effects, the evidence is mixed.

Regarding the positive horizontal effects of third-country-oriented FDI in the European Union, the insights from export platform FDI theory seem to be supported. The results on the positive effects of parent-oriented FDI in both European Union and CUSFTA are in line with both the predictions from models on vertical FDI as well as the findings by *inter alia* FEINBERG and KEANE (2006). The fact that the effects are larger in the European Union than in CUSFTA might indicate the free movement of production factors, and the larger opportunities to slice up the value chain in the European Union are indeed very conducive to positive effects.

The consistently positive productivity effects from parent firm-oriented FDI in CUSFTA and the European Union, 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 positively to affect the local business environment. This implies that a too narrow focus on attracting research and development (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. The present empirical results indicate that the resulting export-oriented MNE might indeed boost productivity at the industry level. On the other hand, in the case of parent firm-oriented FDI, it has been argued herein that the positive effects are most probably not due to its export orientation, but rather to the accompanying logistic and managerial innovations. To the extent that the effects of third-country-oriented FDI are related to its integration in the broader global MNE network, a similar argument might apply in this case as well. The policy implication would then be that a liberal regime that 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 is the high level of aggregation across industries, which may create problems for interpreting the empirical findings. For example, another alternative and plausible explanation for the absence of consistent vertical linkage effects may be that the level of aggregation in the industries is too large to disentangle horizontal and vertical effects properly. 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 the results, but they nonetheless imply that at lower levels of aggregation either the horizontal or the 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 Bureau of Economic Analysis (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 herein, thus better enabling identification of the parameters of interest.

Finally, the paper is confined to productivity analysis. It would also be useful in future research to consider the impact of FDI on wages, employment, and performance (for example, survival and profitability). In reviewing wage spillovers, LIPSEY and SJÖHOLM (2005) find that relative to productivity studies, few studies examine the effect of FDI on wages in domestically owned firms. Among the few, there is again mixed evidence. In addition, conventional international business theories such as DUNNING's (2000) eclectic paradigm predict that MNEs can have higher performance than their local counterparts in a host country as they possess ownership advantages which enable them to overcome the 'liability of foreignness'. While superior economic or financial performance of foreign-invested firms over local ones has often been reported, again there are studies that offer mixed or even opposite results (BELLAK, 2004). All these deserve further investigation of the effects of FDI on the host economy.

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APPENDIX

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

NOTES

1. The analysis is restricted to one source country (the United States) since, as reviewed by CRESPO and FONTOURA (2007), country of origin of FDI is also a determinant of FDI spillover effects.
2. This situation may arise, for example, in cases where MNEs enter host country export enclaves.
3. 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).
4. Data on all majority-owned non-bank affiliates are used because for these types of subsidiaries the data are most comprehensive.
5. A couple of comments apply here. First, the sector definitions and levels of aggregation of the OECD and BEA differ; the OECD data are appropriately aggregated before constructing valid input–output shares. Second, for most OECD countries, input–output data are only available for 1995 and 2002. The 1995 data were used for the years 1987–1995, and the 2002 data for the years 1996–2003. Alternative assignments have been used, and the qualitative results remain.
6. For reasons of space, FDI measures computed with foreign affiliates' capital stocks have only been incorporated. Results are very similar when using employment or R&D stocks.
7. Additionally, because the panel exhibits some gaps, instead of transforming the data using first differences the work of ROODMAN (2009) is followed and orthogonal deviations are used. This entails subtracting the time-averaged value of all foregoing realizations of a variable instead of just its previous (one-period) observation (cf. ROODMAN, 2009, pp. 104–105). This also implies that the AR test reported in Tables 2–4 is run on differenced residuals.
8. Backward linkages from Export FDI and Local FDI are not simultaneously included in these regressions because of the high correlation (cf. Table 1).
9. Including Forward-Local FDI in columns 7–9 of Table 2 left the results largely unaffected.
10. Due to the fact that the number of FDI variables has doubled in Table 4 relative to Table 3, the number of lags of the instruments has been limited to two in order to prevent over-fitting of the model (also see the discussion in the fourth section).

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