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Technology Sourcing and Reverse Productivity Spillovers from FDI: Global or Regional Phenomenon?

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Abstract

The focus of this paper is the importance of geography in technology transfer by the multinational firm. Specifically, we focus on an issue that has become known as knowledge or technology sourcing via 'reverse spillovers'. Traditionally this issue has presented a challenge for IB scholars, in terms of firstly identifying the phenomenon, and secondly determining the success of this strategy. This paper seeks to present a solution to these questions, within the context of the debate of globalisation /regionalisation. For a set of some 4,500 subsidiaries of multinationals across a wide range of countries we show that technology sourcing is significant, but that it tends to be concentrated within 'triad regions' rather than across them.

Keywords: knowledge sourcing, regionalisation, reverse spillovers, firm performance.

1. Introduction

This paper examines the importance of geography within the evolving literature on interfirm technology transfer. As this special issue overview outlines, the relationship between location and business strategy cannot be overlooked. We examine this in the context of the importance of internationalisation and regionalisation in international knowledge transfer and its performance effects.

It is increasingly recognised that the motivation for foreign direct investment (FDI) is multi-faceted, and as a result the implications for host economies of FDI are equally varied (Driffield and Love 2007). While the traditional model of the technologically superior multinational enterprise (MNE) still dominates, increasingly theoretical and empirical emphasis has moved towards on models of the MNE which do not rely on the assumption of knowledge or technology flowing exclusively, or even primarily, from parent to affiliate, and subsequently to the host economy through 'spillover' effects.

One element of this has been analysis of technology or knowledge sourcing rather than knowledge exploitation as a motivation for FDI. This suggests that FDI may be undertaken not to exploit the technology of an MNE in a new location, but to source the technology or knowledge of a host country and use it to advantage either in the foreign affiliate or in the MNE's home economy. Support for this perspective has come from theoretical work on the existence of multinationals without advantages (Fosfuri and Motta 1999; Siotis 1999), from empirical analysis of the motivation for FDI (Driffield and Love 2005, 2007), and from studies of the importance of knowledge flows from host countries to foreign affiliates and MNE headquarters (Singh 2007; Song and Shin 2008).

This has important implications for the relationship between a host economy and the foreign affiliates operating within it. Under conditions of technology sourcing FDI any productivity spillovers may be very limited, or may run in the reverse way from the conventional model i.e. from domestic to foreign enterprises. This gives rise to the concept of 'reverse spillovers', that is not whether productivity gains occur in domestic firms as the result of inward FDI, but rather the opposite, with the actions of host country firms linked to technological development in the foreign-owned sector. Technology sourcing behaviour may be particularly important in the flows of FDI between technologically advanced countries; indeed Van Pottelsberghe de la Potterie and Lichtenberg (2001) suggest that much of the outward FDI

among the major industrialised countries is of this sort. More recently, it has been suggested that 'reverse spillovers' are also present in locations which are not technology or R&D-intensive, such as China (Wei et al 2008) and some transition economies (Franco and Kozovska 2008)

However, the principle of technology sourcing applies not merely to MNEs benefiting from the presence of indigenous firms, but to MNEs benefiting from each other within a host economy. For example, where there is a significant foreign presence in a given country it is reasonable to expect spillovers to develop between the foreign affiliates as well as between foreign and domestic establishments. This is especially likely where a particular industry is composed principally of multinational affiliates which have chosen – or been encouraged – to enter the host economy specifically because of their superior technology. Under such conditions, local firms may lack the absorptive capacity to benefit from productivity spillovers, and externality effects may be restricted to the foreign sector only. Precisely such a scenario is found in parts of UK manufacturing by Driffield and Love (2005).

There may also be a regional dimension to such reverse spillovers. As Rugman (2005) points out, the level of the region is also important, but neglected in the empirical literature. A very high proportion of the world's FDI flows have been within one of the three regional blocks, occurring either within Europe, within North America, or within Asia. While this tendency is perhaps less concentrated with the growth of the emerging countries in Asia and South America, global FDI flows are still dominated by this pattern. We therefore seek to contribute to the literature on FDI, international technology flows and firm performance by considering the importance of the regional blocks, and whether they mitigate or enhance the importance of FDI for international technology transfer.

Despite the theoretical possibility and potential importance of reverse spillovers, relatively little empirical research has been carried out on the subject. What evidence exists is often restricted to analysis of a single host economy, and examines the scale or nature of domestic-foreign or foreign-foreign spillovers within that country. The present study contributes to the literature in a number of ways. First, we examine the presence and scale of reverse productivity spillovers accruing to multinational affiliates using a large firm-level database covering almost 50 countries, and are therefore able to draw conclusions on the nature and scale of such spillovers on a much more general basis than previous research.

Second, we are able to examine the extent to which both reverse spillovers (i.e. domestic-foreign) and spillovers within the foreign-owned sector (i.e. foreign-foreign) are regionally or globally bounded. If, has been suggested, the scope and activities of most MNEs are actually regionally rather than globally based (Rugman 2005; Rugman and Verbeke, 2004a,b) this should be reflected in the accrual of spillovers by MNE affiliates operating abroad. If, by contrast, MNE strategies are inherently global (Yip 1995) we should detect little evidence of a regional dimension in our assessment of productivity spillovers accruing to foreign affiliates. Finally, we are able to consider whether the nature and strength of the regional effect of reverse spillovers varies between the three main 'triad' regions of North America, Europe and Asia.

2. Reverse productivity spillovers: literature review and hypotheses

The decision to engage in FDI is traditionally seen as deriving from the desire to exploit internationally some competitive or 'ownership' advantage. Knowledge-based, firm-specific assets may be hazardous to exploit by contractual means such as licensing, because of the property rights and transaction cost problems inherent in the highly imperfect market for knowledge and technology, thus giving an incentive to engage in FDI (Dunning 1979, 1998; Horstmann and Markusen 1996). This form of investment can be described as technology exploiting FDI, and is the form of FDI generally associated with positive productivity spillovers from the foreign sector to the domestic sector.

However, there may be other important motives for FDI. Fosfuri and Motta (1999) and Siotis (1999) present models of the FDI decision which embody the possibility of knowledge or technology sourcing, involving positive spillover effects associated with locational proximity to a technological leader in the foreign country. There is a more recent literature that seeks to infer technology sourcing by linking the location of multinational affiliates to the dynamic capabilities of the host country sector, see for example Driffield et al (2010) or Cantwell (1995). The rationale for this is discussed in more detail in Driffield and Love (2003), who present a test of the necessary condition for technology sourcing based on the existence of 'reverse spillovers', that is externalities generated by domestic firms and appropriated by the foreign sector, and show that such spillovers do indeed occur in the UK. This approach has since been extended to consider the importance of geographic location within a country (de Propris and Driffield, 2006) and the R&D spend in the home country

(Griffith et al 2006). However, this literature is typically focussed on only one country and so is unable to link with any generality to the literature on the increasing internationalisation of R&D (Cantwell, 1995, Song and Shin 2008) or the assertion that technology sourcing is an important determinant of the international location of R&D by multinationals (for further discussion of this literature see Filippaios et al 2009). In addition, there is no theoretical reason why the source of such spillovers has to be confined to the domestic sector: the technological leader in any given country or industry could be an existing foreign affiliate, generating the possibility of MNEs learning from each other in a third (host) country.

Despite the theoretical possibility and potential importance of reverse spillovers, relatively little empirical research has been carried out on the subject, and what evidence exists is often restricted to analysis of a single host economy. The first detailed study of both reverse spillovers and foreign-foreign spillovers is Driffield and Love (2005). Using industry-level data for UK manufacturing between 1984 and 1997 they find consistent evidence of reverse spillovers from indigenous firms to foreign MNE affiliates, which appears to be targeted at R&D-intensive sectors. By contrast, the evidence on foreign-foreign spillovers is mixed: productivity spillovers within the foreign-owned sector are also largely restricted to knowledge intensive sectors, but are offset by strong competition effects (i.e. 'market stealing') among foreign affiliates operating in the UK. Indeed, Driffield and Love conclude that the principal source of competition for foreign affiliates in both high- and low-R&D sectors appears to be other foreign affiliates, not indigenous establishments.

In arguably the most complete study of productivity spillovers of different types carried out on a single country, Iyer et al (2010) examine 12 distinct forms of spillovers in New Zealand manufacturing over the period 200-07, including domestic-foreign 'reverse' spillovers and spillovers between foreign affiliates in new Zealand (i.e. foreign-foreign spillovers). They find no evidence of either type of productivity spillover, which they attribute principally to the particularly low level of R&D intensity within New Zealand manufacturing. In a subsequent larger follow-up study Iyer et al (2011) find some evidence of positive reverse spillovers of a (vertical) inter-industry nature, specifically finding that foreign affiliates are able to assimilate knowledge from indigenous domestic suppliers

Implicit in the reverse spillover argument is that such effects are likely to occur among technologically-leading countries and sectors, where the opportunities for accessing

technology and learning are relatively high. However, Wei et al (2008) argue that reverse spillovers might also occur in less technology-advanced countries where local firms have knowledge of local markets which can be assimilated by foreign affiliates and combined productively with the MNEs knowledge-based 'ownership' advantage. Wei et al argue that local knowledge has some of the attributes of a public good (i.e. it is non-rivalrous and only partially excludable) and thus can have an externality effect on foreign firms, manifest as a reverse productivity spillover. This method of overcoming the inherent 'liability of foreignness' may occur through, for example, learning-by-watching by foreign affiliates. Thus while foreign affiliates may be more technologically advanced than indigenous firms in developing countries, adapting this technology to local conditions might be aided by absorbing local knowledge of market conditions. Using Chinese firm-level panel data from 1998-2001, they find evidence of productivity spillovers running both ways i.e. foreign-domestic and domestic-foreign, suggesting that foreign and local firms learn from each other even where 'technology sourcing' in the conventional sense is unlikely to be a motive for market entry by an MNE.

Support for this position comes from Franco and Kozovska (2008), who test for the existence of mutual productivity spillovers between domestic firms and foreign affiliates in Romania and Poland. Results are somewhat mixed for the two countries: however, the authors find evidence of both conventional and reverse spillovers. Interestingly the latter effect occurs in both high- and low-technology sectors; the fact that reverse spillovers can occur in low-tech sectors suggests to Franco and Kozovska that foreign firms can have asset-seeking motivations which are not necessarily targeted to the appropriation of some sort of R&D-based technology, lending support for the arguments of Wei et al (2008) reviewed above.

In summary, there is substantial theoretical and empirical support for the contention that technology sourcing can be a motive for FDI. In addition, there is increasing evidence that the necessary condition for technology sourcing, reverse spillovers, are not restricted to highly developed, R&D-intensive countries and sectors, but may occur both in advanced countries which are relatively poorly endowed in R&D terms such as New Zealand (Iyer et al 2011), and even within developing and transition economies where technology sourcing is unlikely to be the motivation for FDI entry, such as Poland, Romania and China (Franco and Kozovska 2008; Wei et al 2008). By contrast, there is relatively little evidence on the

existence of foreign-foreign spillovers: only two studies appear to have considered this issue, and have quite different findings (Driffield and Love 2005; Iyer et al 2010). In addition, there is almost nothing on the geography of spillovers accruing to foreign firms within a host economy, just some hints in the available literature. For example, the work of Driffield and Love (2005) and Driffield et al (2010) find that technology sourcing is not confined to the links between inward investors and host country firms, but also that there exist learning effects between inward investors in a host country setting. The most important determinant of this is the performance of the foreign sector. This may be linked to agglomeration effects: where a given (knowledge intensive) industry has a high degree of foreign ownership and large quantities of inward FDI, the opportunity for both rent and pure knowledge spillovers is greatest, consistent with the case study evidence from industries such as pharmaceuticals, chemicals and electronics, all of which are global industries (Cantwell and Piscitello, 2005; Bowen and Wiersema 2005; Álvarez and Molero 2005).

This review of the literature on reverse spillovers suggests that such effects may be widespread, are by no means restricted to knowledge-intensive countries or regions, and that spillovers from both domestic enterprises and within the foreign-owned sector may be expected. This leads to our first hypotheses:

H1a: There is systematic evidence of reverse productivity spillovers from host country enterprises to foreign affiliates.

H1b: These effects comprise both domestic-foreign spillovers and spillovers within the foreign-owned sector.

Although knowledge or technology-based spillovers are, in principle, not spatially bounded, there may be practical reasons why such effects may be more likely to occur within broad regional areas. But in an age of globalization, why should geography limit the extent of knowledge spillovers? While information is often codified and easily interpreted, and can be transmitted in the form of manuals, prototypes and other tangible forms, knowledge is often vague, hard to codify and has uncertain value. This is especially true where the knowledge is tacit, which is difficult to convey in a standardized medium and where face-to-face contact may be essential. Thus the marginal cost of transmitting knowledge, especially tacit knowledge, rises with distance in a way that is not true of information. Proximity for repeated face-to-face contact is often important for the transmission of

knowledge spillovers (intended or otherwise) and so geographical proximity becomes important (Breschi and Lissoni 2001).

This has implications for the issue of reverse spillovers. Rugman and Verbeke (2004a,b) find that, despite their strong geographical dispersion in terms of sourcing and production activities, most of the world's largest MNEs are oriented towards their home triad region in terms of the distribution of their sales, with very few truly global in terms of sales distribution. They argue that this reflects an implicit regional strategy within many MNEs, which in turn reflects in part the political and institutional requirements of operating in regional cooperation agreements such as NAFTA and the EU. This may mean that the benefits to be gained from internationally dispersed networks of affiliates, including accessing knowledge-related externalities, may be more location-based than previously considered within the theory of the MNE (Rugman and Verbeke 2004a: page 16). The key point here is that even though the distribution of affiliates of the largest MNEs may be global, the existence in many of them of an implicit or explicit regional strategic mindset implies a strong regional dimension to their ability to benefit from reverse spillovers or foreign-foreign spillovers in host economies.

This also has links with the literature on multinationality and performance. Multinational firms face liabilities from increased coordination and management costs and from cultural diversity (Denis et al., 2002). Other related liabilities include that of foreignness and newness (Li 2007, Zaheer 1995), issues surrounding the establishment of internal management systems and external business networks (Lu and Beamish, 2004), and the complexity of managing foreign exchange fluctuations (Kostova and Zaheer 1999). Firms experience increasing transaction costs with international diversification (Hitt et al 1997; Contractor 2007), and this may lead ultimately to strategic failure and to performance decline after a given level of multinationality. Hitt et al. (1997), for a example, suggest that while coordination between parents and overseas affiliates is necessary to exploit economies of scope within internal resources, the coordination cost raised by multiple transactions among many geographically diverse affiliates outweighs the returns to foreign direct investment when multinationals experience over-diversification in geographic or product terms. This again stresses the potential performance benefits of intra-regional activity.

We can extend this analysis with reference to the more general IB literature on the importance of 'distance'. This may incorporate the importance of cultural distance (Mani *et al*. 2007),

while Spencer and Gomez (2011) stress the importance of institutions and institutional distance in terms of firm performance. Equally, Habib and Zurawicki (2001) build on Johanson and Wiedersheim-Paul (1975) and Johanson and Vahlne (1977, 1990) to argue that companies seek markets perceived to be similar to their own. This literature typically focusses on the final market as the source of 'distance', but we extend this to consider technology transfer or spillover effects. In the context of technology for example, firms are less likely to transfer technology to environments with which they are less familiar, especially where institutional protection for intellectual property rights differs from the home country. As such, technology transfer or spillover effects are expected to be larger in triad regions, not merely because FDI flows within these regions are greater, but because distance effects diminish the technology transfer effects of this FDI.

There is some indirect empirical support for this. Driffield and Love (2005) show that that the foreign sector in UK manufacturing derives substantial productivity spillovers from UK-owned firms, and from each other, but that this effect is restricted to relatively knowledge intensive industries. They interpret this as being indicative of an agglomeration effect, where a given (knowledge intensive) industry has a high degree of foreign ownership and large quantities of inward FDI. Although these foreign affiliates may well compete with each other, the UK provides such a small part of their total market that any competition effect within Britain is more than swamped by the efficiency-enhancing effects of being in relatively close proximity to other highly research-active enterprises, both foreign and domestic. In other words, physical proximity matters. Driffield and Love (2005) particularly highlight the importance of the links between EU firms, suggesting that a significant determinant of the location of EU affiliates in the UK is learning or agglomeration effects; by contrast, Japanese firms are motivated principally by market seeking. Further, in a detailed study of technology transfer between MNE parents, their affiliates and local firms in Italy, Driffield et al (2010) find that the two-way technology transfer effects are greater for EU firms than for US firms, while Japanese firms are significantly less likely than average to engage in technology sourcing. This lends support to the view that learning effects are stronger within regions than across regions, at least in the EU context, and extends the work of Qian et al (2008) who find that the relationship between regional diversification and performance is non-linear, and as such argue that this provides evidence of regional internationalisation rather than globalisation.

This leads to the next hypothesis, suggesting that reverse productivity spillovers are likely to be regionally bounded:

H2: Reverse spillovers and foreign-foreign spillovers occur principally within 'triad' regions.

Our final set of hypotheses concerns the precise nature of technology sourcing, and from whom who foreign affiliates are most likely to derive productivity spillovers. This stresses the importance of location – not merely the location of R&D, but the location of core activities. As Dunning (1979, 1998) stresses, firms locate activities where the combinations of goods markets, factor markets and technological development suggest it will be most profitable or productive to do so. While R&D in general is becoming more dispersed, firms typically still retain core activities at home. In a review of the evidence, Dunning and Lundan (2009) argue that much of a firm's truly innovative activity still takes place in the home country, even where more prosaic R&D is outsourced or moved abroad. This suggests that firms in general tend to retain their core activities, and more pertinently the development of their core resources (technology, human capital, product development), at home. This in turn suggests that for technology sourcing to be most effective it has to be targeted at the home country of those firms on or near the technology frontier, and thus targeted at the location of the core technological and productive assets of these firms. Since the enterprises most likely to be at or near the technological frontier are typically themselves multinational enterprises, technology sourcing will be most effective when targeted at the home country of other MNEs: in other words, the greatest source of productivity spillovers to foreign affiliates are not simply domestic enterprises or other foreign affiliates operating in the host economy, but rather the MNEs which are headquartered in a given country.

Building on the analysis above, within this context the region will also be important. Hypothesis 2 suggests that reverse spillovers generally occur predominantly within triad regions, an effect which we also expect to find with respect to reverse spillovers originating from MNE headquarters. The above analysis leads to the next two hypotheses:

H3a: Reverse spillovers from host-country MNEs are greater than those from other host-country firms or from other foreign affiliates.

H3b: Reverse spillovers from host-country MNEs occur principally within 'triad' regions.

Our final hypothesis relates to the relative likelihood of obtaining reverse spillovers from MNEs headquartered within different regions. A recent literature has developed suggesting that in contrast to the standard analysis of MNEs from the EU and North America, MNEs from Asia are developing principally not on the basis of technological advantage, but through economies of scale at home. There is now a literature developing on emerging market MNEs and FDI from emerging and transition countries. Meyer and Peng (2005) and Bhaumik et al (2010), for example, highlight the different motivations for firms from emerging and transition economies to engage in FDI, focussing on technology acquisition and the use of cashflow generated at home to facilitate this. Extending this, Meyer et al (2011), Sauvant et al (2009) and Guillén and García-Cana (2009) all focus on the importance of different theoretical approaches to emerging market MNEs. They highlight both the desire to acquire new technology through the acquisition of Western firms, but also the fact that in contrast to Western MNEs, which develop firm-specific advantages in the form of new technology or knowledge, Asian and other emerging market MNEs have developed advantages based principally on economies of scale, and the ability to deliver relatively standard products at very low cost[1]. This suggests that Asian MNEs are less likely to be the source of reverse productivity spillovers than their North American or European counterparts.

American firms are also generally regarded as being closer, on average, to the technology frontier than firms operating in Europe (Griffith et al. 2006); in addition, according to the National Science Foundation (2012) the US accounts for over $400bn of R&D, some $100bn more than the EU, with China and Japan totalling $154bn and $138bn respectively. This report also highlights the even larger relative differences when one considers 'basic' (that is scientific) research, where the proportion of such research is much higher for the US than for any other country. This suggests that not only will regionalisation matter with respect to reverse spillovers, but the type of region will also matter, with US MNEs being the most likely source of technology spillovers, followed by European MNEs, and finally Asian MNEs:

[1] For further discussion of this in the context of a notable example of this (Ranbaxy) see Kedron and Bagchi-Sen (2012).

H3c: Intra-regional spillovers within North America are greater than those within Europe, which in turn are greater than those within Asia.

3. Empirical model and data

3.1 Model

Our objective is to determine the existence and nature of reverse spillovers, running from host-economy firms to foreign affiliates in a number of settings. We therefore adopt a relatively standard approach from the literature, linking the productivity of affiliates to the productivity of the domestic sector (Driffield and Love 2005). The rationale for this is that total factor productivity captures the ability of the firm to combine a given set of inputs in order to generate outputs. Holding capital and labour constant, this is explained merely in terms of knowledge and technology. Equally, if the quality of either input increases, this will increase the returns to that input, and in turn increase total factor productivity. Technology is therefore seen to be embedded in total factor productivity, indeed Driffield (2001) demonstrates in the context of spillovers from FDI, that total factor productivity by the inward investor is an important determinant of technology transfer to the domestic sector. We therefore begin by calculating the total factor productivity from the following equation[2]:

$$Outputs_{it} = \beta_1 Capital_{it} + \beta_2 Labour_{it} + TFP_{it} \quad (1)$$

Where the key variable are $Outputs_{it}$, the total revenue of firm *i* in year t, and $Capital_{it}$, the total fixed capital of firm i in the same year, and $Labour_{it}$ is the number of workforces. TFP_{it} is our particular interest which is the total factor productivity of firm *i* in year t. Next, we specify a simple model of the total factor productivity of the foreign affiliate, explained in terms of a vector of variables X, and the total factor productivity of the relevant sector of the host economy:

$$TFP_{it}^{f} = \beta_1 TFP_{csy}^{D} + \beta_2 X_{it} + \alpha_i + \gamma_t + e_{it} \quad (2)$$

[2] We also re-calculated the total factor productivity of each firm by including intermediate inputs (Levinsohn and Petrin 2003) into Eq. 1, and re-ran our estimations. However, data on intermediate inputs are not available for the full sample of foreign firms (they are available for less than half). We find very robust results, suggesting there is no bias arising from the TFP estimation approach. The Lev-Pet estimates from the reduced sample is available on request.

where the key variables are TFP_{it}^{f}, the total factor productivity of foreign firm i in year t, and TFP_{csy}^{D}, the average total factor productivity of host firms in each cell of the relevant country/sector (2 digit) level and year. TFP_{csy}^{D} represents the domestic host sector firms, but as we discuss in detail below, the host country sector can be defined or stratified in a number of ways, focussing on all firms, host country MNEs, or other inward investors for example. The equation also includes other control variables (X_{it}), namely the capital per worker and firm age of foreign firm (again measured in logs), and different combinations of fixed effects, including industries and countries, and year effects (γ_t). The specifications also control for foreign firm fixed effects (α_i).The key parameter is β_1, which indicates the elasticity of foreign affiliate productivity with respect to domestic productivity.

To test for spillovers within the foreign-owned sector (i.e. that foreign firms learn from each other in a host economy), we slightly modify equation 2 as follows:

$$TFP_{it}^{f} = \beta_1 TFP_{csy}^{F} + \beta_2 X_{it} + \alpha_i + \gamma_t + e_{it} \qquad (3)$$

where TFP_{csy}^{F} is the average total factor productivity of other foreign firms (excluding firm i itself) in each cell of the relevant country/sector (2 digit level) and year.

Finally, to test for the existence of reverse spillovers from MNEs headquartered in the host economy, we estimate:

$$TFP_{it}^{f} = \beta_1 TFP_{csy}^{M} + \beta_2 X_{it} + \alpha_i + \gamma_t + e_{it} \qquad (4)$$

where TFP_{csy}^{M} is the average total factor productivity of host-economy multinationals in each cell of the relevant country/sector (2 digit level) and year.

Within this framework the crucial methodological problem is to identify the causal relationship between domestic TFP and that of the foreign affiliate, and deal with the potential problem of endogeneity between these variables. This could arise, for example, from common productivity shocks affecting both the domestic and foreign sector, and which could result in a spurious correlation between the productivity of both sectors. In addition, to some extent better performing multinationals may self-select their preferred locations for their overseas investments. In order to solve or at least alleviate this endogeneity issues and therefore to identify the causal relationship in our estimations, we employ the panel data generalized method of moments instrumental variables estimator (GMM-IV) that instruments

for current period average TFP of host countries' firms and its interaction term related to regional dummies using the average sector sales, capital, and their interactions with regional dummies. At the same time, we also control for firm fixed effects and year effects. Average sector sales refers to average of sales within country/sector (2 digits) for the current period year. In our each GMM-IV estimation, the Sargan test of over-identification and tests of weak-identification and under-identification indicate that the instruments are valid.

Control variables

Total factor productivity is the portion of outputs which is not explained by the amount of inputs used in the production. In order to establish a vector of other control variables, we rely here on the efficiency literature that seeks to establish measures of productivity differences across firms, and subsequently to explain them. The key variable over which firms have control is the ratio of inputs, specifically capital to labour. This variable then captures the efficient input choice of a given firm, and also any frictions that the firm may have in moving towards the efficiency frontier (see for example Fare et al 1994). While the estimation and explanation of differences in total factor productivity is a discipline in itself, the common set of control variables in the literature are for example labour quality, intangibles, and debt. However, while these are not available for the full sample of firms, they are available for just over half. Inclusion of these however generates significant collinearity, without adding to the explanatory power of the model[3]. We therefore include only capital per worker to maximise sample size and country coverage without compromising econometric efficiency.

3.2 Data and descriptives

Our analysis draws on Orbis, an accounting dataset with detailed accounting and financial information published by Bureau van Dijck. Crucially this dataset includes ownership data and allows the linking of parents and subsidiaries[4]. The records of each company include information on its overseas subsidiaries or affiliates, defined as firms where the parent

[3] In order to test this, we ran various factor loadings and parametric regressions using a vector of variables, including intangible assets, capital and debt structures, investment ratios, average earnings (as a proxy of labour quality) and free cash flow as different indicators or measures of firm heterogeneity. After dealing with the essential problem of collinearity, we established that capital / labour ratios capture most of the unexplained heterogeneity, without recourse to other variables, for which coverage is not as great. We therefore include only the capital labour ratio to capture unexplained differences in firms, in the spirit of the large efficiency literature, based on frontiers, see for example Fare et al (1994). The results from these procedures are available on request

[4] The extensive benefits of these data, for both the link between parents and subsidiaries, and also the use in the modelling of location are discussed in detail in Ribeiro et al (2010), who also highlight the advantages of these data over official data.

company has an ownership stake corresponding to a minimum of 25.01% . These affiliates are identified by company name and country. As information on the link between the affiliate and the parent is only available for the last year in which the parent appears in the data, we assume that the two firms were linked during all years in which their information is available (the same assumption is made by Budd et al. (2005), who use the European version of these data, Amadeus). Moreover, we consider only firms that have information available on sales, capital and employment levels. After the data linking, and some attrition resulting from missing data, we have 1,822 multinational parents and their 4,505 foreign subsidiaries in our data set across 47 countries, and 3,289 out of 4,505 foreign subsidiaries are located in the same continent (region) as their multinational parents.

Now turning to our interest of host countries firms, there are 47,697 domestic firms (without one foreign subsidiary) and 15,947 domestic multinational (with at least one foreign subsidiary) in our data set. On average, there are 67 domestic firms, 27 domestic multinationals, and 19 foreign firms in each cell of the country/sector (2 digits) level and year where each foreign firm was based. Table 1 presents the key summary statistics. As we expect, we find that foreign firms are larger than domestic firms in terms of sales generation (€582million vs. €363million), average level of capital (€171million vs. €165million), average workforces (2272 vs. 1311), while their firm size are smaller than domestic multinationals. Foreign firm TFP on average is 6.55 and domestic firm TFP is 6.20 and domestic multinationals is 6.45. Domestic multinationals are older (38 vs. 29 years) than foreign firms. Monetary values were converted into Euros using exchange rates retrieved from the IMF. The data cover the period from 1996 to 2007, and are centred around 2003, with a small standard dispersion (2.7 years). Each foreign firm appears on average 4.74 times (standard deviation of 2.8), which facilitates a longitudinal analysis thereby controlling for time-invariant (observed and unobserved) heterogeneity.

Table 2 presents the country distribution of firms, separately for foreign subsidiaries, domestic firms and domestic multinationals, along with the most important variables used in our analysis, including average TFP, average number of workforce, and sales and capital. Our data cover 47 countries. Foreign subsidiaries are concentrated Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, the Netherlands, Poland, Romania, Spain, Sweden, the U.K. and the U.S., which account for 78.6% of all foreign subsidiaries.

4. Results

In order to address our three basic hypotheses we start by addressing the fundamental question, does location matter for technology sourcing? In order to do this, we begin by relating the performance of the multinational affiliate to the performance of the host sector in which its affiliate is based. In doing this, we distinguish between the performance of domestic firms in the host country, and foreign affiliates in that country. This involves an estimation of the baseline model, with the respective reference group of host country firms. We then augment this by testing for 'intra-regional' differences, that is adding a dummy term for where the foreign affiliates' home country is in the same regional block as the host country, more specifically Europe, Asia or North and Central America.

We subsequently examine the details of technology sourcing behaviour in more detail. In line with hypothesis 3, we seek to link the performance of foreign affiliates to the performance of host country MNEs. Building on the baseline model, we begin with a baseline regression, and then augment this with a regional term, as discussed in relation to Table 3. We then extend this by looking at the three regions separately, to examine whether technology sourcing from host country MNEs by foreign affiliates is more effective in each of the three 'triad' regions.

The main results are presented in Tables 3 and 4. Table 3 presents the results that distinguish between reverse technology spillovers from host country (domestically owned) firms, and spillovers arising from other foreign affiliates in the host country. The baseline models (columns 1 and 3) highlight the importance of technology sourcing, in that the average productivity of the reference group of firms is positively related to the productivity of the inward investors. These clearly show that host country firms' total factor productivity is related to the total factor productivity of the foreign affiliates. This holds both in terms of the impact of the performance of the domestic sector, and the performance of other foreign affiliates operating in the domestic economy. This suggests strong support for both elements of H1: there is systematic evidence of reverse productivity spillovers from host country enterprises to foreign affiliates, and these effects comprise both domestic-foreign spillovers and spillovers within the foreign-owned sector.

Columns 2 and 4 of Table 3 augment the basic finding with the addition of variables to capture the importance of investment within the 'triad' region. This includes a dummy variable for the MNE investing in its own region interacted with the performance of the

reference group. In both cases this interaction term is found to be significant and positive, while the baseline TFP coefficient now has an insignificant coefficient, suggesting that productivity spillovers from domestic firms to foreign affiliates and between foreign affiliates occur exclusively within regions. This suggests support for H2: technology sourcing is more effective when carried out within rather than across regions.

Turning now to Table 4, the focus switches to the relationship between the productivity of foreign affiliates and that of host country MNEs. This provides a more specific test of the technology sourcing hypotheses, in that it links the performance of the foreign affiliate with the performance of the most productive, and potentially most innovative ,sector of the host economy. We start with the baseline model presented in column 1, which again provides significant evidence of technology sourcing. In addition, the size of the spillover coefficient on this baseline model (0.136) is substantially greater than those of the baseline models in Table 3 (0.066 and 0.090 respectively), indicating support for H3a: reverse spillovers from host-country MNEs are greater than those from other host-country firms or from other foreign affiliates. The second column of Table 4 introduces the 'same region' interaction term discussed above, and with the same effect, providing support for H3b: reverse spillovers from host-country MNEs occur principally within 'triad' regions.

In the remaining columns of Table 4 we investigate the nature of this effect in more detail, by distinguishing between the location of the region. Specifically, we test separately for the existence of spillovers from (host) MNEs to foreign affiliates whose parent companies are located within different reference regions. We test for differences between the three main regional blocks, by the same baseline and augmented model: in this case the interaction terms relates specifically to EU affiliates operating in Europe, North American affiliates operating in North America, and Asian affiliates operating in Asia. The results are revealing. In the cases of EU and North American affiliates, there is evidence of productivity spillovers from host-county MNEs, and in both cases this is strongly regional in nature: thus EU affiliates gain principally from host-country MNEs located in Europe, and North American affiliates gain principally from host-country MNEs located in North America. By contrast, there is no evidence of productivity spillovers involving Asian affiliates, regardless of their regional location. In addition, the strength of the intra-regional effect is much greater in the case of North American affiliates than for their EU counterparts, suggesting support for H3c: intra-regional spillovers within North America are greater than those within Europe, which in

turn are greater than those within Asia. Overall, the results of Table 4 suggest that technology sourcing from host-economy MNEs is effective in Europe and North America, but not in Asia. This highlights not only the importance of regionalism, but also differences between regions in terms of the benefits to be gained from technology sourcing and reverse spillovers[5].

5. Conclusions

The purpose of this paper is to examine the importance of technology sourcing activity within the context of the debate on regionalism. We find strong support for the hypotheses that reverse productivity spillovers are predominantly regional in nature, and that they accrue principally from the home base of MNEs. A key contribution of the paper is to extend the analysis of technology sourcing in a number of ways. Firstly, we identify the key sources of knowledge and/or technology to which inward investors seek to link, illustrating that while both the solely domestic sector and the stock of inward investors do provide spillovers, the significantly greater effect is provided by the stock of host country MNEs. Our results suggest that, in line with analysis of global production and technology flows, while MNEs continue to internationalise R&D, many core competences remain at home. To the best of our knowledge, this distinction has never been tested previously, and extends the work of Griffith et al (2006) and Driffield and Love (2005) by extending the analysis beyond a single country setting. The essential hypothesis holds for a large sample of firms covering almost fifty countries.

We further extend the analysis by linking to the importance of regionalism. The region remains an important dimension in the study of both international technology transfer, and of technology sourcing. Based on our estimates, the technology sourcing effects within regions are on average some 15.7% greater than the more general effect, with the impact of EU-EU links being some 18.2% greater again, and the North America effect being some 31.8% higher again. These findings are consistent not only with the literature on the importance of regions, and of distance within international business, but also with the wider work on global technology frontiers. For firms to engage with global technology frontiers, it is not sufficient

[5] Even with this large sample one could argue that our sample of foreign subsidiaries is still not precisely representative of the country distribution of foreign direct investment in the world, and this could distort our findings. To shed light on this matter, we reran the all model but weighting each observation using the levels of inward FDI flows to the host country (using data from UNCTAD and WDI from the World Bank). We find very robust results, suggesting there is no bias arising from the global pattern of FDI flows.

merely to engage in FDI, in the manner suggested by the large literature on internationalisation and performance, but more focussed investment into the home countries of leading firms is required. The results concerning the Asian sample bear this out, in that while Asian firms effectively engage in technology sourcing in Europe and North America, there is very little technology sourcing within Asia.

In addition to highlighting the importance of regionalism, the findings also offer some extensions to the multinationality-performance (MP) literature. One weakness of the wider MP literature is that it fails to take into account either the motivation for firms to internationalise, or to consider the location of the international activity. Our results show here that while technology sourcing is significant, one has to consider the importance of the region, suggesting that intra-regional expansion is more likely to lead to performance increases than expansion across regions.

This also highlights the importance of both institutional and physical distance for studies on technology sourcing, an issue that warrants further investigation. We briefly discuss in this paper the relatively broad literature on the importance of distance, and highlight the limits that this suggests for the MP relationship. This literature highlights the transactions costs associated with distance, both in terms of cultural and psychic distance, as well as institutional differences. The results presented here are focussed on the importance of international technology transfer, which places the emphasis on intellectual property rights protection. The fact that technology sourcing is effective, but also mitigated by distance, would suggest that firms retain core technology at home under the protection of familiar institutions. This, however, is worthy of further investigation.

This provides an interesting challenge for policy makers. Transatlantic FDI, in both directions, has been seen by policy makers as an important source of technology transfer into the host economy. Equally, many local and national development agencies within the West are turning their attention to Asia and other emerging countries to provide investment flows, as investment from the traditional sources stagnates. The results presented here suggest that FDI is not typically associated with frontier technology, and that inter-regional investment has less of an impact on technology transfer than its intra-regional counterpart. Further, many policymakers in the EU and North America have viewed outward FDI from their country with suspicion, associating it with relocation of employment to low-cost locations. While we

do not test this directly, our results suggest, in the manner indicated for the UK by Driffield et al (2009), that outward FDI can generate productivity growth at home when targeted at key technology abroad.

The findings here present a number of avenues for further research. Perhaps the main one is why we should find such strong effects. Distance in this context, or regionalism, has a number of dimensions, including level of technology or development, institutional quality, patent protection, financial systems and trade blocks, as well as physical distance. It is clear that on many of these measures Asia is more disparate than either the EU or North America, so perhaps it is not surprising that the estimated effects within Asia are smaller than the European or North American effects. Equally, these results may be considered in terms of the growing literature on MNEs from emerging markets, and their focus on technology sourcing, not within their own region, but through acquisition of brands and technologies in the West. Finally, one may consider what this means for IB theory in general, in the context of the call for this edition. Within the confines of technology sourcing we have shown that regionalism is important, but this could be extended to consider the importance for location theory more generally, and the extent to which the region, and interaction within the region, may be seen as an additional level of location advantage within IB.

Table 1: Descriptive statistics of 68,176 firms (47,697domestic firms, 15,974 domestic multinationals and 4,505 foreign firms)

Variables	Mean	Std. Dev.	Obs
All Firms			
Total factor productivity	6.296	1.054	340808
Sales	581.958	5950.044	340808
Capital	235.747	3767.165	340808
Employment	4426.613	1116234	340808
Firm Age	30.476	29.670	340808
Survey year	2002.517	2.696	340808
Foreign firms			
Total factor productivity	6.548	1.022	26733
Sales	581.640	3321.828	26733
Capital	171.291	1322.955	26733
Employment	2271.622	10630.42	26733
Firm Age	28.809	27.875	26733
Survey year	2002.115	2.696	26733
Same Region (parent and affiliate are in same region)	0.738	0.440	26733
Europe-Europe	0.724	0.447	26733
North America-North America	0.006	0.080	26733
Asia-Asia	0.007	0.084	26733
Domestic firms (no overseas subsidiaries)			
Total factor productivity	6.203	1.104	223103
Sales	362.578	6412.877	223103
Capital	164.578	4356.387	223103
Employment	1311.473	7055.03	223103
Firm Age	27.558	26.310	223103
Survey year	2002.621	2.666	223103
Domestic multinationals			
Total factor productivity	6.448	0.898	90972
Sales	1120.067	5303.212	90972
Capital	429.227	2461.269	90972
Employment	12699.560	2160461	90972
Firm Age	38.122	35.942	90972
Survey year	2002.380	2.751	90972

Notes: All monetary variables are in millions of Euros. Same region is a dummy equal to one if parent and affiliate are in same regions. The analysis groups countries into European, North American, or Asian regions. ` Europe-Europe' is a dummy equal to one if parent and affiliate both are in Europe. ` NA-NA' is a dummy equal to one if parent and affiliate both in North America. ` Asia-Asia' is a dummy equal to one if parent and affiliate both are in Asia.

Table 2: List of Countries and main variables

Country	N.	TFP	Sale	Capital	Empl.	TFP	Sale	Capital	Empl.	TFP	Sale	Capital	Empl.
		Foreign firms				Domestic firms				Multinationals firms			
Australia	18	6.21	571.8	235.0	4708.4	6.22	279.9	119.1	1810.3	6.30	851.8	429.0	4623.5
Austria	65	6.62	222.9	48.8	1048.6	6.45	291.5	131.4	1370.6	6.43	683.2	379.8	2844.2
Belgium	195	7.03	505.0	56.3	1118.0	6.77	223.6	67.2	700.5	6.71	448.4	133.5	1757.7
Brazil	5	6.36	806.7	511.2	6439.1	5.88	819.9	1720.0	4651.0	5.44	681.8	964.2	6921.8
Bulgaria	32	4.75	61.4	28.2	1005.3	4.05	11.6	6.7	505.8	4.41	26.2	17.1	898.6
Canada	7	6.81	2656.9	1234.8	3631.4	5.95	855.6	767.9	8474.4	6.12	1057.9	945.7	6283.3
China	41	5.63	366.1	419.4	6889.5	5.24	184.0	117.7	3331.9	5.57	1075.1	793.0	12605.0
Czech Republic	171	5.73	124.0	49.0	940.7	5.43	50.0	24.9	729.7	5.45	204.6	257.7	2745.6
Denmark	132	6.65	191.3	33.2	772.7	6.36	150.6	61.7	627.8	6.33	375.6	131.6	2998.6
Estonia	80	5.14	24.1	8.8	417.5	4.76	14.5	8.3	369.8	5.22	52.8	61.9	715.6
Finland	118	6.56	169.1	32.3	664.3	6.32	122.8	42.5	519.7	6.33	553.7	256.8	2447.4
France	628	6.86	325.1	40.2	879.5	6.73	161.0	36.2	636.5	6.74	537.7	77.8	2024.4
Germany	332	7.20	977.2	209.7	2788.3	6.67	549.4	214.6	2241.1	6.80	2052.2	527.6	8768.3
Greece	66	6.41	117.2	21.3	420.2	5.79	54.0	25.4	389.9	5.84	184.6	140.9	914.5
Hong Kong	7	5.95	958.6	228.2	19269.5	5.31	507.6	630.7	6360.7	5.96	832.6	766.0	7974.1
Hungary	41	5.97	341.0	218.4	2216.3	5.62	82.0	33.0	873.0	5.92	242.1	111.0	1880.0
Iceland	1	6.58	255.5	113.9	504.5	5.70	41.6	17.4	251.5	5.96	224.8	78.1	1664.3
India	5	5.39	97.7	25.8	3203.2	5.15	455.3	186.2	10785.2	5.18	198.4	177.5	4076.3
Indonesia	9	5.64	374.0	248.9	6576.7	4.92	114.4	83.2	2830.7				
Ireland	30	7.46	2991.5	1185.8	1355.5	7.50	1454.3	383.0	989.7	6.76	1197.5	407.8	5322.5
Italy	378	6.80	306.9	45.4	811.1	6.55	151.0	56.3	550.3	6.41	267.1	156.2	50906.1
Japan	22	7.11	1085.8	177.1	970.4	6.81	326.9	112.2	836.6	6.82	2547.5	1043.9	8185.1
Latvia	51	5.04	16.5	3.9	251.7	4.60	15.3	10.8	490.5	5.14	37.0	16.6	901.6
Lithuania	41	5.04	40.9	27.5	766.8	4.57	14.9	9.2	361.0	4.82	20.5	12.3	495.7
Luxembourg	21	6.31	332.9	114.1	2245.4	6.05	147.2	78.1	3248.8	6.17	418.9	257.8	2769.1
Malaysia	11	6.15	303.1	119.3	2143.0	5.00	78.5	69.2	1237.3	5.30	288.2	247.6	5229.7
Mexico	4	5.77	184.8	147.1	2398.7	5.65	685.8	519.2	6569.1	6.11	2811.3	2175.2	24926.7
Netherland	200	7.04	1131.7	241.2	2877.7	6.86	606.0	178.3	2903.5	6.89	1185.5	282.2	4599.7
New Zealand	5	6.18	410.3	288.9	968.5	6.28	213.7	890.6	385.2	6.03	966.3	781.6	5176.1
Norway	80	6.68	281.4	68.9	681.6	6.61	123.3	43.8	468.3	6.46	719.4	385.9	2444.5
Philippines	2	5.12	64.8	9.8	1099.7	4.72	139.7	141.4	2052.8	4.97	280.4	168.7	4208.6
Poland	270	5.92	125.2	49.1	1020.2	5.63	78.3	39.4	1272.6	5.88	182.2	116.0	2634.7
Portugal	81	6.58	254.1	98.4	950.1	5.57	77.4	53.3	545.2	6.02	519.3	317.9	2649.1
Romania	132	4.95	276.3	49.1	1458.5	4.82	4288.6	2372.5	1063.6	4.86	175.5	97.8	5340.6
Russia	22	5.54	166.5	90.4	1620.6	5.35	125.1	96.4	2487.4	5.49	1256.5	1773.4	23753.7
Singapore	88	6.52	647.8	90.1	3117.2	5.73	120.7	47.7	804.6	5.73	418.4	292.4	5458.6
Slovenia	1	6.00	82.5	32.0	404.7	5.60	115.9	87.8	900.1	5.65	248.0	113.6	2576.7
South Africa	17	6.11	2366.5	564.8	9354.1	5.94	835.5	229.3	3365.3	6.04	727.5	361.4	8951.3
South Korea	68	6.57	168.0	56.7	530.2	6.06	102.8	63.7	481.4	6.29	316.2	125.3	792.8
Spain	244	6.86	522.2	230.2	1573.6	6.75	335.1	119.1	1391.3	6.70	720.2	350.5	2872.9
Sweden	153	6.70	324.8	84.2	1392.0	6.49	204.0	121.0	925.2	6.54	506.7	148.1	2875.7
Switzerland	17	6.58	741.6	153.8	6448.7	5.99	242.9	150.9	1463.0	6.37	2054.3	628.7	12062.3
Taiwan	6	5.18	17.7	9.2	202.6	5.29	117.8	135.6	803.4	5.60	275.8	165.1	2746.0
Thailand	16	5.55	147.8	60.9	1877.8	5.06	110.1	56.9	1643.9	5.87	1340.9	641.2	7145.9
Turkey	3	5.63	103.9	53.8	975.8	6.03	372.0	133.3	2135.5	6.51	1362.7	404.7	6209.9
UK	393	6.65	673.9	223.8	3286.4	6.53	319.6	127.5	1747.6	6.54	1107.2	497.8	6198.6
US	196	6.54	3146.9	1246.4	14266.3	6.46	1345.8	588.3	8073.8	6.61	2825.7	1004.5	15541.2

Notes: All monetary variables are in millions of Euros. 'N.' refers to number of firms. 'Empl.' refers to number of employees. Domestic firms are firms with no overseas affiliates.

Table 3: foreign firms learn from firms in host country (IV+FE)

	Learning from all host country firms		Learning from other foreign firms in the host country	
TFP (average), firms in host countries	0.066***	-0.009	0.090***	0.030
	(0.022)	(0.033)	(0.016)	(0.031)
Firm Age, foreign firms	0.364***	0.360***	0.358***	0.356***
	(0.022)	(0.022)	(0.022)	(0.022)
Capital, foreign firms	0.282***	0.281***	0.280***	0.278***
	(0.016)	(0.016)	(0.016)	(0.016)
TFP (average), firms in host countries*Same region		0.099***		0.089**
		(0.036)		(0.039)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
No. observation	25140	25140	24236	24236
F statistics	486.755	452.863	479.158	445.400
R-squared	0.334	0.334	0.338	0.338
Under-identification test	535.919	366.563	833.702	737.479
P- value	0.000	0.000	0.000	0.000
Weak identification test	398.391	120.935	1388.634	305.475
Over identification test (Hansen J statistic)	2.924	3.212	1.097	1.258
P value	0.232	0.360	0.295	0.262

Notes: Dependent variable: TFP of foreign firms. Same region is a dummy equal to one if parent and affiliate are in same regions. The analysis groups countries into European, North American, or Asian regions. Values in parentheses are robust standard errors. Significance levels: *: 0.10; **: 0.05; ***: 0.01.

Table 4: foreign firms learn from domestic multinational firms (IV+FE)

	Overseas Affiliates in all countries		Overseas Affiliates in Europe		Overseas Affiliates in North America		Overseas Affiliates in Asia	
TFP (average), domestic multinationals	0.136***	0.009	0.152***	-0.005	0.089*	0.086	-0.061	-0.058
	(0.033)	(0.052)	(0.036)	(0.062)	(0.047)	(0.054)	(0.045)	(0.052)
Firm Age, foreign firms	0.310***	0.308***	0.298***	0.299***	0.411***	0.408***	0.406***	0.407***
	(0.023)	(0.023)	(0.024)	(0.024)	(0.096)	(0.098)	(0.101)	(0.101)
Capital, foreign firms	0.292***	0.291***	0.292***	0.291***	0.271***	0.260***	0.501***	0.501***
	(0.017)	(0.017)	(0.019)	(0.019)	(0.036)	(0.040)	(0.056)	(0.057)
TFP (average), domestic multinationals* Same region		0.157***						
		(0.050)						
TFP (average), domestic multinationals*Europe-Europe				0.182***				
				(0.059)				
TFP (average) domestic multinationals*NA-NA						0.318**		
						(0.133)		
TFP (average) domestic multinationals*Asia-Asia								-0.007
								(0.093)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. observation	22445	22445	20288	20288	1496	1496	615	615
F statistics	415.142	387.779	384.556	359.238	32.426	30.308	17.964	16.689
R-squared	0.327	0.326	0.332	0.332	0.271	0.268	0.394	0.394
Under-identification test	216.909	220.194	191.138	190.815	37.452	26.119	76.427	58.369
P value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Weak identification test	142.572	79.717	125.212	68.184	54.166	18.518	343.407	151.471
Over identification test (Hansen J statistic)	0.561	0.649	0.509	0.511	1.576	1.906	0.600	0.803
P value	0.454	0.723	0.476	0.774	0.665	0.592	0.439	0.669

Notes: Dependent variable: TFP of foreign firms. Same region is a dummy equal to one if parent and affiliate are in same regions. The analysis groups countries into European, North American, or Asian regions. ` Europe-Europe' is a dummy equal to one if parent and affiliate both are in Europe. ` NA-NA' is a dummy equal to one if parent and affiliate both in North America. ` Asia-Asia' is a dummy equal to one if parent and affiliate both are in Asia. Values in parentheses are robust standard errors. Significance levels: *: 0.10; **: 0.05; ***: 0.01.

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