



## **Modes of Delivery in Services**

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# Modes of Delivery in Services \*

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## Abstract

We develop a new analytical framework for both cross-border services trade and services trade through foreign affiliates, based on heterogeneous firms operating under oligopoly. This leads to direct predictions about choice of services delivery (mode of delivery) at the firm level, and about the pattern of bilateral trade at the industry level. We examine the industry-level predictions, working with a panel of U.S. data. Unlike the recent literature that works with FDI as a proxy for affiliate services sales, we work directly with data on bilateral U.S. trade through affiliates. These data feature more sector detail than in the recent literature. We also directly compare observed patterns of services trade and affiliate sales with the corresponding indicators of patterns of cross-border and affiliate sales for manufacturing sectors. In contrast to mixed results in manufacturing, in services overseas multinational activities consistently increase relative to direct exports the further away are host countries. Language and the presence of manufacturing FDI are also important. The impact of factors like corporate tax rates and relative stocks of human capital on modes of service delivery varies across sectors. The evidence on interdependence across modes and the importance of local affiliates implies that the impact of policy in any one mode is likely to depend on the mix of domestic regulation and policy across all modes of supply.

*Keywords:* International Trade in Services, Modes of Supply, FDI, Foreign Affiliates Trade, GATS

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# 1 Introduction

Because services are a flow and not a stock, direct proximity and interaction between user and supplier are more important for trade in services than for trade in goods. Historically, this has hampered growth in international services trade relative to commodities trade. However, because of technical change, the proximity burden has progressively weakened in recent decades for some (but not all) service activities. This has led both to dramatic growth in services trade and foreign investment, and to a nascent empirical and theoretical literature on trade in services (Francois and Hoekman, 2010). In this paper, we develop an analytical framework for both cross-border services trade and services trade through foreign affiliates, based on heterogeneous firms operating under oligopoly. This leads to direct predictions about choice of services delivery at the firm level, and about the pattern of bilateral trade at the industry level. We then examine the industry-level predictions with a panel of U.S. data on affiliate sales and cross border sales. Our data on affiliate sales allows more sector detail than found in the recent literature, which relies instead on FDI as a proxy for affiliate sales. In addition, and again in contrast to the recent literature, we also directly compare observed patterns of services trade and affiliate sales with the corresponding indicators of patterns of cross-border and affiliate sales for manufacturing sectors.

Proximity and jointness in production has important implications for the normative and positive aspects of trade and foreign investment in services. Bhagwati (1984) emphasized the implications of a decline in the cost of distance, highlighting mechanisms through which services are "disembodied" or "splintered" from goods or people as "carriers." Trade in services may then expand as a result of the incentive to "splinter" the production chain geographically, not just in terms of tangible inputs but also services. The subsequent literature has called this process fragmentation. In both goods and service sectors, fragmentation can lead to basic changes in the structure and pattern of trade, as low-wage activities can be sliced away and outsourced (Francois, 1990; Baldwin and Robert-Nicoud, 2007). However, the significance of underlying proximity constraints for service transactions to be feasible means that "trade" may require a heavier dose of local presence of suppliers in the mix of cross-border and local supplied services than is the case with goods.<sup>1</sup> The local

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<sup>1</sup>Horn and Shy (1996) argue that once account is taken of the fact that many services are also bundled with goods, and that the associated services-input bundle is non-tradable in the sense it must be provided locally, in direct proximity to the consumer/buyer of the goods, the impact of liberalization of trade in goods can be limited because of differences in

presence component of services trade may be foreign or domestic. In general, services provision will often have an element of jointness in production, in the sense that complementary inputs - including other services - are needed to allow effective exchange (trade) of a service to occur. This is recognized in the policy community, where the cross-border and local presence (or commercial establishment) components of international service transactions are referred to as modes of supply (Francois and Hoekman, 2010).

Questions raised in the recent literature on services trade and investment are closely related to the large body of empirical evidence regarding determinants of multinational activity with respect to goods production and trade. In general, the literature on goods finds more support for horizontal FDI motives (Brainard, 1997; Carr et al., 2001; Bloningen et al., 2003), although some studies also find evidence for the vertically integrated multinational firm (Hanson et al., 2001). Due to data limitations, this literature is largely based on aggregate data<sup>2</sup>. The data issues are even more severe for services investment than for goods, placing even more constraints on scope for empirical analysis of services trade and FDI linkages. Indeed, because of data issues the recent literature along these lines uses FDI flows or stocks as a proxy for affiliate sales. For example, Grünfeld and Moxnes (2003) explore the determinants of services trade and foreign affiliate sales (they use FDI stocks as proxy for foreign affiliate sales) in a gravity model, finding that trade barriers and distance have a strong negative impact on exports and FDI (a proxy for foreign affiliate sales), while GDP and similar income levels have a significant positive impact. Kolstad and Villanger (2008) study the determinants of service FDI with panel analysis for the whole service sector and a small number of sub-sectors. They conclude that FDI in services tends to be more market seeking and find strong correlation between manufacturing FDI and FDI in producer services as well as an important impact of institutional quality and democracy on services FDI. Mirza and Nicoletti (2004) develop an extended gravity model and explore whether services trade differs from trade in goods, but they do not look at FDI and foreign affiliate sales. In addition, Kimura and Lee (2006) and Lennon (2008) explore the differences and complementarities between trade in goods and trade in services, whereby Lennon (2008) uses disaggregated data classified in four IMF BOPS sub-sectors. Fillat-Castejón et al. (2008) examine more service sectors, based

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the prices/costs of the ancillary local services that make up the "product bundle". For more on this see (Fillat-Castejón et al., 2008) and (Francois and Wooton, 2010)

<sup>2</sup>See for example Bloningen (2005) for a detailed literature review on FDI determinants. Also see Markusen and Strand (2009) for extension of the knowledge capital model to the case of business services

on more detailed IMF BOPS categories and stressing long-run linkages, but again using FDI as a proxy for affiliate sales.

Globalization in services has yielded a set of sectors dominated by multinational companies and high profile investments, as well as a governing institutional structure for service trade (the GATS) that emphasizes multiple delivery modes in the structure of trade negotiations and commitments. This in turn has given rise to emphasis in the empirical literature on the determinants and the relationship between trade and FDI in services. Analytically, the literature on FDI in services is largely guided by the body of empirical evidence and related theoretical literature on patterns of trade and FDI in goods. In some ways, the emphasis of the analytical literature is on factors that should apply to both goods and services sectors. However, given the greater role of proximity and coordination costs between provider and buyer, we can also expect important differences to emerge as the literature on services matures. Furthermore, given the heavy degree of industrial concentration in service industries (the top 8 firms in U.S. service sectors, for example, typically account for 60 to 80 percent of sales), the interaction of market power and regulation with openness is likely to prove quite important in future theoretical and empirical work in this area.

For service firms, there are parallels to the proximity mechanisms stressed in the literature for goods.<sup>3,4</sup> In particular, because of what we call the proximity burden, we can expect increased costs linked to the coordination between provider and customer as the distance increases from the firm to its customers. To the extent this holds true, increased distance may then provide increased incentive to engage in FDI instead of cross-border trade in services, much as transport costs may encourage FDI in goods. Similarly, to the extent such FDI involves fixed costs, large markets offer a better opportunity to spread fixed costs linked to FDI, so that size may play a role in the balance between cross-border and establishment based trade. At the same time, the knowledge capital model implies that, for some sectors, the choice between local establishment and direct trade may also be linked to risk of appropriation of firm-specific assets

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<sup>3</sup>This includes Horstmann and Markusen (1992); Brainard (1993); Helpman (1984); Helpman and Krugman (1985); Markusen et al. (1996); Markusen (1997, 2002).

<sup>4</sup>More recently, the theoretical literature on multinational firms has highlighted heterogeneity with respect to important characteristics such as productivity (Melitz, 2003; Helpman et al., 2004). According to the model by Helpman et al. (2004), the decision of firms to become multinational depends on their productivity. Thus, setting up an affiliate in foreign countries only pays for the most productive firms. Firms with intermediate levels of productivity serve foreign markets through exports, while low-productivity firms produce only for the home market. It is important to note that the coexistence of firms operating through different modes of delivery is not limited to models of cost heterogeneity. Markusen (2002), for example, demonstrates that a mixture of MNEs and exporting firms can coexist under imperfect competition without heterogeneity, depending on relative endowments and trade costs.

like business models (where the risk is linked to skill levels and institutional features of the market). In addition, if service firms are selling locally with a mix of locally produced and home produced inputs, FDI restrictions are also likely to affect the relative patterns of affiliate and direct sales.

We proceed in this paper as follows. In Section 2, we provide an overview of special characteristics of services and patterns of service trade and FDI. In Section 3 we develop a new theoretical model based on services trade and FDI involving Cournot competition between heterogeneous firms. We use this framework for mapping firm choice of modes of delivery to the bilateral patterns of direct trade and foreign affiliates sales observed in the data. The next section, Section 4, describes the data set in more detail and highlights the motives of becoming multinational. Bilateral data on foreign affiliate sales and unaffiliated and partly affiliated cross-border sales for services as well as manufacturing sectors come from the Bureau of Economic Analysis. We also work with the recent IIDE Trade in Services Database, which offers a panel of bilateral total trade flows by service sector from the 1990s to 2006. Taken together, these data allow us to recover affiliated (intra-firm) services trade by sector for several OECD source and destination markets. Trade data for total manufacturing and seven sub-sectors are drawn from the WITS database. Our estimation strategy and the estimation results for service sectors are also discussed in the empirical section on patterns of trade in Services. We focus in the empirics on the relative importance of direct cross-border trade and indirect sales through local establishments, developing and exploiting a data set that merges information from a number of sources on sector level U.S. inward and outward sales. We apply a mixture of estimation methods to explore the relationship between cross-border and FDI based modes, while avoiding simultaneity problems between affiliate and cross-border activity. A contrasting study on determinants in manufacturing sectors is presented in Section 5. Focusing on the U.S. as both a source and destination market provides insight into sector-level variation in modes of entry (foreign affiliate sales and cross-border), including the impact of standard measures of economic distance and relative stocks of human capital. Our results highlight sector-level variation in modes of entry (sales through foreign affiliate and cross-border sales). While manufacturing FDI and trade patterns are mixed, for services we find that overseas multinational activity consistently increases relative to direct exports as a function of distance. In addition, the relative importance of establishment trade increases with more liberal FDI regimes (i.e. with lower investment barriers) and with higher manufacturing FDI. Common language and market size are also significant factors. The impact of some

factors, like like corporate tax rates and relative stocks of human capital, also varies across sectors. This result highlights the heterogeneous nature of services across sectors, suggesting that the core factors to emphasize in developing a full analytical picture for trade and FDI in services may vary in important ways from the relevant set of factors for goods. Finally, given evidence of interdependence across modes and the importance of local affiliates, the impact of policy in any one mode is likely to depend on the mix of domestic regulation and policy across modes. We offer a brief summary and concluding remarks in Section 6. The appendix provides all details on data and estimation results.

## 2 Patterns of services trade and FDI

The WTO distinguishes four different modes of supply<sup>5</sup>, which have also been adopted for the General Agreement of Trade in Services (GATS):

- *Mode 1 - cross-border trade:* when suppliers of services in one country supply services to consumers in another country without either supplier or consumer moving into the territory of the other
- *Mode 2 - consumption abroad:* process by which a consumer resident in one country moves to another country to obtain a service
- *Mode 3 - commercial presence:* enterprises in an economy supply services internationally through the activities of their foreign affiliates abroad
- *Mode 4 - movement of natural persons:* process by which an individual moves to the country of the consumer in order to provide a service.

Multinationals are obviously important for Mode 3 trade. They are also important for Mode 4 (which includes movement of technical personnel), and Mode 1 (as MNEs also engage in direct exports). The significant role of multinational firms in trade in services is depicted in Table 1 and 2 and will be discussed more below. From Table 1 and 2 it is clear that local presence is an important dimension of trade in services. In recent years the majority of both U.S. international sales and purchases of services was through affiliates (see Figure 1). In contrast to the persistent deficit in goods trade, the United States runs surpluses in trade in services. Over the period 1999-2005, both U.S. cross-border exports and imports increased in all major service categories. The largest increase in cross-border exports and imports was in other private

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<sup>5</sup>This typology for modes was developed by Sampson and Snape (1985) and was largely adopted as a framework for the GATS.

services, mainly reflecting increases in business, professional and technical services.<sup>6</sup> However, the majority of U.S. international services transactions was through foreign affiliate sales, which marked strong sales growth over the period 1999-2005 (Figure 1). The largest increase for sales by U.S. multinationals through their foreign affiliates was attributable to affiliates in finance and insurance services and in "professional, scientific and technical services".<sup>7</sup> Sales by foreign multinationals through U.S. affiliates were largest in finance and professional, scientific and technical services, but have not experienced growth in insurance services. In PST services, the largest increase was attributable to affiliates in computer and information services, management and consulting services as well as in other PST services, including legal services, advertising services and architectural, engineering and other technical services.

Interestingly, in finance services the majority of sales of services is through foreign affiliates, rather than direct cross-border trade, although the availability of online financial services is rising rapidly. This prevailing role of foreign affiliate sales stresses the importance of location of production and proximity constraints regarding the supply of services through multinationals. Data on trade and foreign affiliate sales in insurance services reflect the effects of deregulation. Insurance services have experienced a tremendous increase in outward sales (sales by U.S. multinationals through foreign affiliates) and cross-border trade, while inward sales (sales by foreign multinationals through U.S. affiliates) decreased slightly over the period 1999-2005. However, the dominant role of supply through local establishments can also be seen in insurance services.

Regarding the share of unaffiliated and affiliated trade the dominant role of affiliated trade in business, professional and technical services is apparent. The share of affiliated trade for this sectoral category is much greater than the shares of affiliate trade for other service classes, which illustrates the importance of intra-firm trade in this service category. Trade within multinational companies (affiliate trade) accounted for 25.9 percent of U.S. exports of private services in 2005 and for 22 percent of U.S. imports of private services. In contrast, affiliated trade in business, professional and technical services accounted for 50.1 percent of total exports and for 69.6 percent of total imports in 2005. In addition, data

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<sup>6</sup>Other private services include education, financial services, insurance, telecommunications, "business, professional and technical services" and "other services". "Business, professional and technical services" (BPT) consist of a variety of services, such as computer and information services, management and consulting services, research and development and testing services, operational leasing and "other BPT services" (for instance legal services, advertising services, accounting services and architectural, engineering and other technical services).

<sup>7</sup>Data on foreign affiliate sales are collected separately by BEA, which explains different names. However, "professional, scientific and technical services" (PST) cover the same service industries as in "business, professional and technical services" and are comparable.



on U.S. cross-border trade and commercial presence support a complementary relationship between local establishments and direct cross-border trade. For the industries included, trade flows and affiliate sales show a positive correlation in both directions, but the correlation is much stronger for outward activities and exports (67.71 percent) than for inward activities and imports (39.71 percent). Over the last decade, both cross-border exports and imports as well as foreign affiliate sales increased significantly and suggest a clear interdependence across modes. Depending on the mix of domestic regulations and FDI policies U.S. multinationals tend to supply foreign markets through local establishments and via cross-border trade. The determinants of entry modes (commercial presence versus cross-border trade) and patterns of service delivery will be examined more below.

### **3 Distance, Market Potential and Modes of Delivery**

In this section, we develop a theoretical framework mapping firm choice of modes of delivery to the bilateral patterns of direct trade and foreign affiliate sales observed in the data. We start by a characterization of market structure. Like manufacturing, individual service sectors are typically characterized by a handful of large firms representing a relatively large share of the market. This point can be lost when looking at the full population of firms across all service sectors collectively. However, when one focused on individual sectors, the importance of concentration in the services landscape is striking. For example, in the United States, the largest 8 software publishers accounted for 46 percent of receipts in 2002, the 8 largest largest theater chains accounted for 60 percent of receipts, the eight largest wireless telecommunications carriers accounted for 82 percent of receipts, the eight largest music publishers accounted for 72 percent of receipts, and the eight largest wired communications carriers accounted for 81 percent of receipts. In financial services, the top 8 consumer lenders accounted for 75 percent of receipts, the top 4 international trade financing companies accounted for 70 percent of receipts, the top 8 securities firms accounted for 50 percent of receipts, the top four direct life insurance carriers accounted for 81 percent of receipts, the top 8 commodity brokers accounted for 45 percent of receipts, and the top 8 commercial banks accounted for 42 percent of receipts. There are sectors where the combined market shares of the top firms are relatively small – including mortgage brokers – but this is the exception and not the rule. Even in the pawn shop sector, the top four firms accounted for 21 percent of receipts. The general pattern in the service sectors is one of concentration, with large firms playing a dominant role. They are also clearly

the most efficient firms, with their importance in terms of output (revenues) outweighing their importance in employment. In international trade, the pattern is one of even greater concentration. This is clear on inspection of the U.S. FATS data for service firms. Data points are frequently suppressed in published data because they represent the data of a single firm, and as such the data reveal confidential business information. Indeed, the importance of larger firms, limited competition, and variations in oligopoly behavior characterizes service industries from banking to telecommunications and transport in a broad range of countries (Francois and Hoekman, 2010).

Given our characterization of the market structure of service sectors, we model service markets as oligopolistic. In a representative service sector, we represent each country  $b \in B$  as having a set of heterogeneous domestic service producers  $i$  characterized by the cost vectors (impacting both fixed and marginal costs)  $\gamma_i^b \in \Gamma^b$ . Foreign service providers in country  $b$  may also sell services in destination market  $d$ . They have two options. One is arms-length (cross-border) transactions with production in country  $b$  and sales in country  $d$ . The other is exporting through a foreign affiliate based in country  $d$ , so that cross-border transactions takes place within the firm. An important factor in the cost of delivery is the proximity burden. We represent this here as a transaction cost that is increasing in the international distance between the service provider and the customer. Referring back to (Hill, 1997), these costs are because of the challenge of meeting potential problems with coordination between provider and client. This leads to a rising marginal cost  $\tau_x$  that interacts with the distance between the home market  $b$  and the destination market  $d$ . Representing distance from  $b$  to  $d$  as  $\delta_{b,d}$  the marginal cost of a country  $b$  service exporter when selling in country  $d$  is then  $(\gamma_x^{b,d} \tau_x \delta_{b,d})$ . We also assume some establishment costs  $(\gamma_x^{b,d} f_x^d)$  have to be paid as well, to manage sales, communications, and contracting for arms-length exporters. The second option is for the country  $b$  firm to establish a full-scale affiliate office in country  $d$  at cost  $(\gamma_x^{b,d} f_m^d)$  where  $f_m^d > f_x^d$ . In this case, the advantages is that they can export services through the affiliate rather than at arms length, which we assume saves on coordination costs linked to distance because the cross-border transactions are internal to the firm, while the affiliate office is assumed to facilitate better real time coordination between provider and customer. This means distance costs are  $\tau_m < \tau_x$ . In total, marginal costs for a country  $b$  services MNE operating in country  $d$  are then  $(\gamma_m^{b,d} \tau_m \delta_{b,d})$ .

Under a Cournot-Nash equilibrium, for country  $b$  service exporting firms market share in country  $d$  is a function of price and marginal cost. From the first order conditions for profit maximization, we have

$$\theta_x^{b,d} = \max \left[ -\epsilon \left( P^d - \gamma_x^{b,d} \tau_x \delta_{b,d} \right) / P^d, 0 \right] \quad (1)$$

where  $\epsilon$  is the elasticity of demand. Firms will only export if it is profitable, which means we also have the following export condition that holds for all exporting firms.

$$P^d \Big|_{\theta_x^{b,d} > 0} \geq \gamma_x^{b,d} \tau_x \delta_{b,d} + \gamma_x^{b,d} f_x^d \left( \theta_x^d Q^d \right)^{-1} \quad (2)$$

We have a similar set of conditions for services MNEs.

$$\theta_m^d = \max \left[ -\epsilon \left( P^d - \gamma_m^{b,d} \tau_m \delta_{b,d} \right) / P^d, 0 \right] \quad (3)$$

$$P^d \Big|_{\theta_m^{b,d} > 0} \geq \gamma_m^{b,d} \tau_m \delta_{b,d} + \gamma_m^{b,d} f_m^d \left( \theta_m^d Q^d \right)^{-1} \quad (4)$$

We can rearrange equations (2) and (4), yielding the following necessary conditions for the export and MNE decision. This involves substitution of our definitions of  $\theta_m^d$  and  $\theta_x^d$ . For exporters, we have the condition in equation (5):

$$\begin{aligned} P^d - \gamma_x^{b,d} \tau_x \delta_{b,d} &\geq \gamma_x^{b,d} f_x^d \left( \theta_x^d Q^d \right)^{-1} \\ P^d - \gamma_x^{b,d} \tau_x \delta_{b,d} &\geq -\gamma_x^{b,d} P^d f_x^d \left( P^d - \gamma_x^{b,d} \tau_x \delta_{b,d} \right)^{-1} \left( \epsilon Q^d \right)^{-1} \\ Q^d P^d &\geq - \left( \frac{\gamma_x^{b,d} f_x^d}{\epsilon} \right) \left[ \frac{P^d}{\left( P^d - \gamma_x^{b,d} \tau_x \delta_{b,d} \right)} \right]^2 \end{aligned} \quad (5)$$

A similar condition holds for multinational firms.

$$Q^d P^d \geq - \left( \frac{\gamma_m^{b,d} f_m^d}{\epsilon} \right) \left[ \frac{P^d}{\left( P^d - \gamma_m^{b,d} \tau_m \delta_{b,d} \right)} \right]^2 \quad (6)$$

Equations (5) and (6) lead directly to the following propositions.

**Proposition 1** *In larger markets, we will observe more firms meet the cutoff conditions for cross-border exporters and MNEs.*

**Proposition 2** *In more distant markets, we will observe fewer firms that can meet the cutoff conditions for cross-border exporters and MNEs.*

Propositions 1 and 2 follow from the left hand side of both equations (5) and (6), as in both cases this increase the range of distance and marginal costs where trade is profitable. The relative efficiency ranking of MNE and service exporters, however, is more complex. It depends on the ranking of  $f_m^d > f_x^d$  and also  $\tau_m < \tau_x$ . It is the case that because fixed costs are higher for MNEs, they need to have sufficient market share to cover the fixed costs involved. This is more easily met when marginal costs are lower, so that like the export decision there is a strict ranking of firm efficiency and cutoff in the option to be an MNE. There will be cases where firms that find acting as an MNE profitable will also find direct exporting profitable. Which business model they follow depends on relative profits from both modes. To sort out this aspect of the decision process, we first need to define profits as follows:

$$\begin{aligned}\pi_m &= \left(P^d - \gamma_m^{b,d} \tau_m \delta_{b,d}\right) \theta_m^d Q^d - \gamma_m^{b,d} f_m^d \\ &= -\epsilon Q^d \left(P^d - \gamma_m^{b,d} \tau_m \delta_{b,d}\right) \left(P^d - \gamma_m^{b,d} \tau_m \delta_{b,d}\right) / P^d - \gamma_m^{b,d} f_m^d\end{aligned}\quad (7)$$

$$\begin{aligned}\pi_x &= \left(P^d - \gamma_x^{b,d} \tau_x \delta_{b,d}\right) \theta_x^d Q^d - \gamma_x^{b,d} f_x^d \\ &= -\epsilon Q^d \left(P^d - \gamma_x^{b,d} \tau_x \delta_{b,d}\right) \left(P^d - \gamma_x^{b,d} \tau_x \delta_{b,d}\right) / P^d - \gamma_x^{b,d} f_x^d\end{aligned}\quad (8)$$

The choice of mode follows from the condition that firms choose establishment when  $\pi_m - \pi_x > 0$ .

$$\begin{aligned}\pi_m - \pi_x &= \gamma_j^{b,d} \left(f_x^d - f_m^d\right) - \epsilon \frac{Q^d}{P^d} \left[\left(P^d - \gamma_j^{b,d} \tau_m \delta_{b,d}\right)^2 - \left(P^d - \gamma_j^{b,d} \tau_x \delta_{b,d}\right)^2\right] \\ &= \gamma_j^{b,d} \left(f_x^d - f_m^d\right) - \epsilon E^d \left[\mu_{m,j}^2 - \mu_{x,j}^2\right]\end{aligned}\quad (9)$$

In the first version of equation (9), the last term on the right hand side is increasing in the distance coefficient  $\delta_{b,d}$ . This follows from as long as  $\tau_x > \tau_m$ . It is also increasing in the firm cost coefficient  $\gamma_i$ . This means we can characterize the aggregate pattern of trade across modes (aggregated across firms), though at the firm level there is a level of ambiguity. At the same time, market size will drive a move to establishment trade, as the second term on the right hand side is clearly increasing in market size. In the second version of equation (9),  $E^d = P^d Q^d$  is the total size of the market  $d$  in terms of expenditure. Expressed this way, the revenues from higher markups need to be enough to cover higher fixed costs.

The conditions expressed in equations (2), (4), and (9) can be manipulated to relate entry conditions to the choice of modes. With some manipulation, equations (2) and (4) can be re-written as follows.

$$k_x^d = -\epsilon E^d \left[ \frac{(P^d - \gamma_x^{b,d} \tau_x \delta_{b,d})}{P^d} \right]^2 - \gamma_x^{b,d} f_x^d \geq 0 \quad (10)$$

$$k_m^d = -\epsilon E^d \left[ \frac{(P^d - \gamma_m^{b,d} \tau_m \delta_{b,d})}{P^d} \right]^2 - \gamma_m^{b,d} f_m^d \geq 0 \quad (11)$$

From (10) and (11), we can re-write equation (9) in terms of the new entry conditions  $k_x$  and  $k_m$ .

$$\begin{aligned} z_j^d &= \pi_m - \pi_x = \gamma_j^{b,d} (f_x^d - f_m^d) \\ &\quad - \epsilon E^d \left[ \left( \frac{P^d - \gamma_j^{b,d} \tau_m \delta_{b,d}}{P^d} \right)^2 - \left( \frac{P^d - \gamma_j^{b,d} \tau_x \delta_{b,d}}{P^d} \right)^2 \right] \\ &= k_m^d - k_x^d \end{aligned} \quad (12)$$

From inspection of equations (10) and (11), the zero ( $k = 0$ ) for establishment trade is at a lower cost parameter  $\gamma$  than is the case for direct trade. This means only the most efficient firms will be able to opt for establishment trade for sufficiently high fixed cost differences. However, the location of the zeros also means  $k_x > k_m$  in the region of threshold condition for establishment trade. When will firms opt for establishment trade? From equation (12), for firms to choose establishment it has to be the case that  $k_x < k_m$ . Differentiation of equation (12) yields the following:

$$\frac{\partial z_j^d}{\partial \gamma_j} = (f_x^d - f_m^d) - 2\epsilon E^d \delta_{b,d} \left[ (\tau_x - \tau_m) - (\tau_m^2 - \tau_x^2) \frac{\gamma_j}{P^d} \right] \quad (13)$$

From equation (13), the distance between  $k_m$  and  $k_x$  falls with increasing values of  $\gamma$ .

We illustrate the two entry conditions with a numeric example in Figure 2.<sup>8</sup> For sufficiently high fixed cost differences, the cut-off cost coefficient parameter is lower for establishment trade than it is for direct trade.<sup>9</sup> However, at the same time, from equation (13), at lower value of  $\gamma$ , the  $k_m$  curve will eventually cut

<sup>8</sup>For the example in the figure the coefficients are  $\tau_x=0.13$   $\tau_m=0.06$ ,  $f_x=2$ ,  $f_m=80$ ,  $\epsilon=-2.0$ ,  $E^d=2000$ ,  $P^d=2$ , and  $\delta_{b,d}=1$ .

<sup>9</sup>Without this condition, firms would never choose direct trade, and all firms would choose establishment trade, with the  $k_m$  curve lying strictly above the  $k_x$  curve.

above the  $k_x$  curve. Firms to the left of the intersection find both establishment and export trade profitable, but will choose establishment trade. Firms to the right of the intersection will choose direct exporting, even if they would also find establishment trade profitable. Also, controlling for both distance and the revenue size of the market, less competitive markets with higher prices also move both curves to the right while moving the intersection to the right. We illustrate the relationship of larger equilibrium market size to the observed pattern of modes of delivery in Figure 3, using the numeric value from Figure 2 but with a 10 percent increase in total market revenues. What can be seen is that both  $z$  curves move to the right, along with a shift in the cutoff point. Basically, we expect to see more firms operating in larger markets, while at the same time a larger number of firms will opt for establishment based trade (with the  $z_m$  curve lying above the  $z_x$  curve). Finally, in Figure 4 we use the same numeric values to highlight the impact of rising distance and so distance-related costs (17.5 percent increased distance in the figure), again leading to a shift in the relevant  $z_m$  and  $z_x$  curves. The intersection of the two curves shifts increasingly close to the horizontal axis as distance rises, eventually crossing, at which point establishment dominates as the only viable option, and so direct (unaffiliated) trade vanishes. All these observations follow from the properties of equation (9). We summarize them formally in the following propositions.

**Proposition 3** *At the firm level, for sufficiently high fixed costs linked to establishment, only the most efficient firms will choose establishment. Firms with intermediate levels of efficiency will choose direct exports, while the least efficient firms will not export.*

**Proposition 4** *At the firm level, there is a range of costs where firms would find establishment trade profitable, but would still engage in direct trade.*

At the industry level, increasing market size in terms of revenue moves both curves to the right, while moving the intersection to the right as well. This means the incentive to engage in FDI instead of unaffiliated sales increases with the size of the destination market  $Q^d$  for all firms. Therefore we will have an unambiguous shift from observed direct cross border sales to affiliate sales in aggregate, as a function of size of the destination market.

**Proposition 5** *Increasing size of the destination market will lead to an unambiguous shift from observed direct cross border sales to affiliate sales in aggregate.*

At the industry level, increasing distance moves both curves in Figure 4 down, but also moves the intersection to the right. The incentive to engage in FDI

instead of unaffiliated sales increases with distance to the destination market  $Q^d$  for all firms. This implies an unambiguous shift from observed direct cross border sales to affiliate sales in aggregate, as a function of distance.<sup>10</sup> This leads us to Proposition 6.

**Proposition 6** *The incentive to engage in FDI instead of unaffiliated sales increases with discrete changes in distance to the destination market  $Q^d$ .*

At the industry level, higher price in a market moves both curves to the right, while moving the intersection to the right as well. The incentive to engage in FDI instead of unaffiliated sales increases with price levels in the destination market  $Q^d$  for all firms. This implies an unambiguous shift from observed direct cross border sales to affiliate sales in aggregate, as a function of prices. This leads us to Proposition 7.

**Proposition 7** *The incentive to engage in FDI instead of unaffiliated sales increases with price levels in the destination market  $Q^d$  for all firms.*

Next we offer some observations on the role of distance in total bilateral trade and establishment trade. From equation (3), market share of firms already operating as multinationals is declining with distance. However, from Proposition 5 we have a shift from trade to multinational operations with rising distance. This implies a potential ambiguity for the impact of distance on observed MNE activity. For direct trade, Proposition 5 means some share of firms shift out of exporting, either into establishment trade or out of the market entirely. For remaining firms, equation (1) means they will have falling market share and we will have falling direct trade volumes. We summarize these points as follows.

**Proposition 8** *At the industry level, greater distance means an unambiguous fall in total direct cross-border bilateral sales.*

**Proposition 9** *At the industry level, greater distance means an ambiguous change in total bilateral establishment sales. If the switching of firms from cross-border sales to establishment sales is minimal (i.e. if their market share is sufficiently small) total bilateral establishment sales are declining with distance.*

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<sup>10</sup>While Proposition 6 holds strictly for large changes in distance, there is a second order effect for marginal firms with low market shares that follows from the squeezing out of both types of providers. In the region of marginal firms (those close to the threshold of dropping out) there may be a shift from establishment back to direct exporting because of declining market size. Because these are those with the smallest market share, these firms drop out entirely for discrete (non-marginal) increases in distance. As such, we should still expect the total share of establishment sales to rise at industry level. We can offer numeric examples of such effects on request.

Finally, we are also interested in the impact of policies restricting foreign investment that increase fixed costs on total bilateral trade and establishment trade. From equation (12), increasing the fixed costs of entry is qualitatively the same as a fall in market size in the destination market.

$$\partial z_j^d = \gamma_x^{b,d} \left( \partial f_x^d - \partial f_m^d \right) \quad (14)$$

Where we have an  $x\%$  increase in fixed costs, then as long as establishment related fixed costs are greater than cross-border related fixed costs, limits on FDI will induce some firms to shift from establishment trade to cross-border trade.<sup>11</sup> From equations (3) and (1), market share of remaining firms selling through establishment will fall, while the sales of existing firms selling through direct exports will also fall. Unless the switch of firms from establishment to cross-border trade dominates, we should therefore also see a complementarity between cross-border and establishment-based sales in the face of policies that raise fixed costs for both modes. We summarize these points as follows:

**Proposition 10** *At the industry level, policies that raise fixed costs in similar proportions for establishment and cross-border trade will induce a shift by some firms out of establishment trade and into cross-border trade.*

**Proposition 11** *Policies that raise fixed costs in similar proportions for establishment and cross-border trade will lead to lower observed market shares for all individual firms.*

**Proposition 12** *There is scope for complementarity in aggregate, where bilateral cross-border and establishment trade rise and fall together in the face of policy-induced cost increases, even as individual firms substitute between modes. However, a substantive shift in firm population from establishment to cross-border trade can lead to apparent substitution in aggregate flows across modes, even as market shares for all firms and total sales in the destination market fall.*

Basically, we have a clean ranking of the aggregate pattern of modes, in terms of market size or potential, degrees of competition, and distance. We may also have firms that export directly to some markets, and sell through affiliates in others. At the same time, among the subset of potential MNE firms, the least efficient of these firms may be the ones that engage in establishment based trade. In the empirics that follow, we focus on bilateral patterns at the industry level, following directly from Propositions 1,2,5,6,7,8, 9, and 12.

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<sup>11</sup>In terms of Figure 3, this is analogous to changes in destination market size, with both  $z$  curves move to the right, along with a shift in the cutoff point.



## 4 Empirics - Patterns of Trade in Services

We now turn to empirics. In order to give a better understanding of the interactions between various modes we focus on the linkages between cross-border trade and local sales of services through affiliates at a sectoral level - distinguishing between 13 major service categories. The choice of the estimating framework is guided by our propositions in Section 3. Our empirical results provide insight into sector-level variation in modes of entry (foreign affiliate sales and cross-border). We employ a mixture of GLM models, three-stage least squares methods and seemingly unrelated equations to explore the relationship between cross-border and FDI based modes. In order to avoid simultaneity problems between affiliate activity and cross-border trade we use shares of affiliate sales and cross-border sales in total foreign sales as dependent variables. Distinguishing between inward and outward activities our empirical analysis is based on the following two shares first introduced by Brainard (1993, 1997):

- *Outward affiliate sales share*: Share of outward affiliate sales in total outward sales
- *Inward affiliate sales share*: Share of inward affiliate sales in total inward sales

### 4.1 Data

For the purpose of this paper we work with a multi-sourced data set on sector level U.S. exports and imports. These are summarized in Table 3. Bilateral data on foreign affiliate sales as well as unaffiliated and partly affiliated cross-border sales come from the Bureau of Economic Analysis. Cross-border transactions include both affiliated and unaffiliated transactions between U.S. companies and foreign residents. Affiliated cross-border trade indicates intra-firm trade within multinational companies and consists of trade between U.S. parent companies and their foreign affiliates and transactions between U.S. affiliates and their foreign parent groups. In order to describe Mode 3, commercial presence, we make use of U.S. Foreign Affiliates Trade Statistics (FATS) published by BEA, which illustrates the importance of services in affiliate activities. These data are drawn from benchmark and annual sample surveys of U.S. direct investment abroad and of foreign investment in the United States. By using the FATS data we gather information on sales of services by majority-owned foreign affiliates and on sales of majority-owned U.S. affiliates. One advantage of this data is that it has been classified by destination of sales through

affiliates. However, data on sales through affiliates are published by primary industry of the affiliate and not by type of service which asks for reclassification. Our dataset on foreign affiliates sales finally covers 13 service sectors over the years 1997 to 2005. In addition, we also work with the recent IIDE Trade in Services Database, which offers a panel of bilateral total trade flows by sector from the 1990s to 2006. Taken together, these data allow us to recover affiliated (intra-firm) services trade by sector for several OECD source and destination markets. Data on foreign affiliate sales in manufacturing sectors are also taken from the BEA's publications. Additionally, trade data for total manufacturing and seven sub-sectors are drawn from the WITS database. The final dataset includes bilateral U.S. trade and foreign affiliate sales for 10 partner countries in total. They include: Australia, Brazil, Canada, France, Germany, Japan, Mexico, The Netherlands, Switzerland and the United Kingdom.

To identify the determinants of entry modes we use several explanatory variables suggested by the recent theoretical and empirical literature. The size of the host country markets are captured through GDP (measured in billions of current U.S. dollars). According to previous literature, market size is expected to have a positive impact on services trade and foreign affiliate sales. GDP, income and population data are taken from the IMF and World Development Indicators database respectively. In addition, we employ a similarity index for per capita income to proxy for skill and human capital differences. The similarity index ranges from 0 to 1, whereby a higher score means a higher degree of per-capita income similarity, implying a similar per capita stock of skills and human capital. The similarity index is used to help identify whether multinational activity is motivated by horizontal FDI strategies (trading partner are more similar) or vertical FDI strategies (trading partner are dissimilar in their factor endowments and factor prices). Hence, a positive coefficient on the similarity index can be interpreted in favor of horizontal FDI motives. In addition, per capita income inequalities can also be used to test for the convergence hypothesis (Markusen, 1995; Markusen and Venables, 1998) which suggests that multinational firms become more important relative to domestic firms the more similar are countries in size and endowments. Next, to reflect the proximity burden, we include geographic distance<sup>12</sup> between the United States and the respective partner countries as a proxy for transportation costs (variable distance costs). Hence, we expect a positive coefficient on geographic distance if local establishment sales and cross-border trade act as substitutes (supporting the horizontal FDI model), since variable distance cost make cross-border

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<sup>12</sup>Geographic distance is calculated following the great circle formula, which uses latitudes and longitudes of the relevant capital cities.

trade more expensive so that affiliates in the host country could pay for firms. A negative coefficient on distance indicates a complementary relationship between trade and foreign affiliate sales and supports the vertical FDI model. In order to capture some cultural influences we include a language dummy, which indicates if home and host country share a common language familiarity and generally share the same cultural heritage. Since a common language plays an important role in services trade we expect a positive coefficient on language, fostering the establishment of affiliates in the host market to a greater extent than cross-border trade. Geographic distance, together with data on cultural familiarity are taken from Mayer and Zignago (2006)<sup>13</sup>.

All determinants of affiliate activity described so far, such as market size, geographic distance to trade partners, and to a lesser extent economic development and education levels, are beyond the influence of trade policy. Nevertheless, economic and trade policies are used to influence the activities of multinational firms through various channels (Blomström and Kokko, 2003), and so these need to be accounted for in the economic analysis. To capture the impact of FDI and trade policies on multinational activity we include several indices designed to quantify the underlying trade and investment climate of host and source markets. We include the measures of the OECD’s FDI Regulatory Restrictiveness Index<sup>14</sup>. The index captures deviations from national treatment in order to identify discrimination against foreign investment and is measured on a 0-to-1 scale, with 0 representing full openness and 1 prohibition. Hence, we expect a negative coefficient on the FDI regulatory restrictiveness index. The advantage of the OECD’s FDI restrictiveness index is that it displays sector-specific levels of restrictiveness and covers important main sectors and several sub-sectors. In addition, we make use of the Heritage Foundation index of economic freedom which comprises 10 components of economic freedom, such as trade freedom and investment freedom as well as an averaged overall score. The indices are scaled from 0 to 100, with 100 indicating the highest level of freedom. Hence, we expect a positive coefficient on this variable. The Heritage Foundation index does not account for sectoral freedom differences and is therefore only used for sensitivity analysis<sup>15</sup>. In addition to indices displaying the investment and trade climate, we include the destination-market corporate income tax rate for obvious reasons regarding location decisions according to tax rate advantages. Central and sub-central corporate income tax

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<sup>13</sup><http://www.cepii.com/anglaisgraph/bdd/distances.htm>

<sup>14</sup><http://www.oecd.org/dataoecd/1/40/40476272.pdf>

<sup>15</sup>Results using the Heritage Foundation index can be obtained upon request from the authors.

rates are taken from the OECD’s tax database<sup>16</sup> and KPMG’s Corporate and Indirect tax rate Survey 2007<sup>17</sup>. The establishment of local affiliates should be preferred towards cross-border trade the lower is the corporate tax rate in the destination market relative to the home market, since affiliate profits are taxed at the foreign tax rate while cross-border trade profits are taxed at the home-market rate. Furthermore, to address the discussion on fragmentation and the increased importance of traded services in the fragmentation process we include manufacturing FDI<sup>18</sup> in our empirical analysis. This allows us to study the role of services as inputs in the manufacturing process and accounts for indirect exports of services. Thus, we expect a positive relationship between manufacturing FDI and affiliate activity. In addition, given the linkage between manufacturing and services trade, both FDI streams are influenced by investment regulation and policies across modes which needs to be considered in the actual policy environment.

## 4.2 Preliminaries

Before we turn to the relationship between trade across the border and producing abroad, we discuss the patterns of cross-border and affiliate sales using a gravity type approach. From Propositions 1, 2, 8, and 9, both market size and distance should be important for total observed trade. In its original formulation, the gravity model originally predicted bilateral trade flows as a function of distance between any two countries and their size. The approach has been widely applied in international trade literature. Recently, the original model specification (Tinbergen, 1962) has been augmented by the inclusion of additional variables which are thought to effect trade flows, such as dummy variables for language familiarities, trade barriers or historical linkages between the countries. In addition, better controls have been introduced for country-specific factors in the standard model of bilateral flows (Baldwin and Taglioni, 2006; Feenstra, 2002). Since trade flows between countries change over time, the empirical estimation of gravity models is increasingly conducted using panel data specifications which is also used in this paper. In formal terms, we use an augmented standard gravity model, which can be written as

$$\ln Trade_{it}^j = \alpha_0 + \beta_1 \mathbf{X}_{it} + \beta_2 \mathbf{X}_i + \beta_3 \mathbf{X}_{ij} + \varepsilon_{it}^j, \quad (15)$$

<sup>16</sup><http://www.oecd.org/ctp/taxdatabase>

<sup>17</sup><http://www.kpmg.com/SiteCollectionDocuments/2007CorporateandIndirectTaxRateSurvey.pdf>

<sup>18</sup>Data on manufacturing FDI are taken from the Bureau of Economic Analysis and comprise FDI in the United States and U.S. direct investment positions abroad.

where  $i$ ,  $t$  and  $j$  index countries, time and service sectors. The dependent variable  $Trade_{it}^j$  represents either direct cross-border trade volumes (exports or imports) or affiliate sales (outward or inward affiliate sales). While vector  $\mathbf{X}_{it}$  represents time-varying explanatory variables for country  $i$  (GDP, similarity index, tax rates, freedom indices, etc.), vector  $\mathbf{X}_i$  comprises time invariant explanatory variables for country  $i$  (distance, common language). Vector  $\mathbf{X}_{ij}$  displays sector-varying explanatory variables for country  $i$ , like the FDI restrictiveness index. Concerning the interpretation of the results it is important to note that the gravity equations for outward flows and inward flows differ. While the outward gravity equation depicts how characteristics of the host markets effect the volume of trade flows, given that the home market is the United States, the inward equations display how characteristics of the source country influence the volume of trade, given that the destination market is the United States. We apply a system of simultaneous system estimations, in which exports and affiliate sales are treated as endogenous. Table 4 reports the patterns for levels of outward affiliate sales and cross-border exports, applying three-stage least squares (3SLS) methods. As hypothesized in Proposition 6 before, increased distance between suppliers and consumers makes exports less attractive and leads to more affiliate activity, while exports decrease with increasing variable distance cost. The coefficient of the restrictiveness index has the predicted negative sign for affiliate sales. Affiliate activity decreases the higher are FDI flow restrictions and U.S. multinationals serve foreign markets through exports if discriminatory barriers are high. Moreover, the United States tend to export more the bigger are host markets. Interestingly, the impact of the endogenous variables affiliate sales and exports are both positive, indicating a complementary relationship between cross-border exports and commercial presence. From Proposition 12 above, this means that the drop in sales across firms in both modes dominates any switching that takes place between modes. In addition, our results suggest a positive relationship between manufacturing FDI and affiliate sales for some service sectors. Moreover, a common language just seems to be important for some service sectors, like telecommunication, finance, insurance and R&D services. The other gravity variables such as the corporate tax rate or the similarity index vary across sectors, indicating the heterogenous nature of services.

Turning to the inward gravity equations we consider that patterns of cross-border imports and affiliate sales depict the characteristics of the home market. Table 5 reports the gravity estimation results applying 3SLS estimation procedures. We find a less consistent impact of the distance variable on inward

side, which varies by sector. Since our setup just allows us to control for home market characteristics, the results on the inward side are in general less consistent than what we have seen before on the outward side. Common language familiarities seem to have an important impact on inward affiliate sales and imports to the United States. Moreover, our gravity pattern suggest that inward affiliate sales increase the bigger is the home market (except for insurance and financial services), indicating that bigger home markets tend to import more to the United States. However, no clear conclusion can be drawn from the restrictiveness index. The coefficient on manufacturing FDI is not reporting any significant linkages between investment in manufacturing and service sectors in almost all sectors, apart from business services.

The basic gravity type patterns of cross-border and affiliate sales highlight the importance of factors like distance, market size, manufacturing FDI and discriminatory barriers for affiliate sales. Since direct cross-border trade and affiliates sales may act as alternative modes of foreign market penetration, we examine the impact of distance, FDI restrictions, language familiarity, skill and human capital differences, FDI in manufacturing and additional factors in determining the motive of overseas production relative to direct cross-border sales.

### 4.3 Outward Shares

Given that the United States is always the home market, outward shares analyze how characteristics of the destination markets determine the choice between exporting and affiliate sales. The baseline econometric model can be written as

$$OUTSH_{it}^j = \alpha_0 + \beta_1 \mathbf{X}_{it} + \beta_2 \mathbf{X}_i + \beta_3 \mathbf{X}_{ij} + v_{it}^j, \quad (16)$$

where  $i$ ,  $t$  and  $j$  index countries, time and service sectors. While vector  $\mathbf{X}_{it}$  represents time-varying explanatory variables for country  $i$  (GDP, similarity index, tax rates, freedom indices, etc.), vector  $\mathbf{X}_i$  comprises time invariant explanatory variables for country  $i$  (distance, common language). Vector  $\mathbf{X}_{ij}$  displays sector-varying explanatory variables for country  $i$ , like the FDI restrictiveness index.  $v_{it}^j$  represents the respective error term. As proposed by Papke and Wooldridge (1996) we use GLM-based estimators as preferred econometric approach. As a measure of robustness of the results we also use the share of exports in total outward sales as dependent variable. Table 6 reports the results using OUTSH, the share of outward affiliates sales in total outward sales, as dependent variable applying GLM estimation approaches. We find a very consistent positive impact of distance on the likelihood of U.S. firms to establish

affiliates in foreign countries across all service categories. The results suggest that proximity between consumers and suppliers of services is still needed or desired, so that multinational activity relative to exports increases the further away are destination markets (see Proposition 6). The impact of FDI restrictions on the share of outward affiliate sales is consistently negative, indicating that discriminatory barriers have a strong interfering aspect on affiliate sales except for legal services. The coefficient of the common language variable shows generally the expected sign, although our results support sector level differences. In addition, regarding characteristics between the United States as the home market and various destination markets the coefficients on the similarity index show up differences between sectors. While we stated above that vertical FDI mainly takes place between countries which are dissimilar in their factor endowments and horizontal FDI takes place between similar countries, the results are ambiguous and once again point out that services differ across sectors.

In a first step, we estimated equation (16) alone using GLM specifications. In a second step, we also test for linkages between total outward sales (affiliate sales+cross border sales) and the outward affiliate sales share. Consequently, we estimate both influencing variables jointly using the seemingly unrelated regression (SUR) procedure. Since both variables - total sales and FDI intensity - are influenced by the same determinants, the residuals of both single equations might contain some information of omitted variables. By imposing a joint variance covariance structure SUR takes contemporaneous correlations into account. Table 7 reports results from the baseline equation using SUR estimation. Applying SUR supports the results found in the base equation and related literature and improves the results and significance levels for the basic results. Again, our results show a consistent strong impact of distance, discriminatory barriers and language familiarities on total sales and affiliate sales. Moreover, the coefficient on manufacturing FDI supports the previous findings in related literature that manufacturing FDI is intertwined with trade in services, since services are used as inputs in the manufacturing process.

#### 4.4 Inward Shares

Turning to imports and foreign multinational activity in the United States it is important to note that equation regarding the inward share is not equivalent to the equation depicting the outward share. In particular, while the outward equation explains how characteristics of the host markets determine the choice between exporting and local presence abroad, given that the home market is the United States, the inward equation displays how characteristics of the source

country influence the mode of entry, given that the destination market is the United States. The baseline econometric model can be written as

$$INSH_{it}^j = \alpha_0 + \beta_1 \mathbf{X}_{it} + \beta_2 \mathbf{X}_i + \beta_3 \mathbf{X}_{ij} + \psi_{it}^j, \quad (17)$$

where  $i$ ,  $t$  and  $j$  index countries, time and service sectors. While vector  $\mathbf{X}_{it}$  represents time-varying explanatory variables for country  $i$  (GDP, similarity index, tax rates, freedom indices, etc.), vector  $\mathbf{X}_i$  comprises time invariant explanatory variables for country  $i$  (distance, common language). Vector  $\mathbf{X}_{ij}$  displays sector-varying explanatory variables for country  $i$ , like the FDI restrictiveness index.  $\psi_{it}^j$  represents the respective error term. Similar to the outward equation we apply GLM estimation procedures and use the share of imports as alternative in order to check for the robustness of the results. Estimates on the share of inward affiliate sales in total inward sales are reported in Table 8. The impact of distance on the share of inward affiliate sales is ambiguous and varies by sector. While some sectors, such as financial, information and R&D services, show a significant positive effect, the FDI intensity decreases with increasing distance in other sectors, like insurance and computer services. We find a consistent positive impact of the language dummy, indicating the enhancing impact of a common cultural heritage on affiliate sales except for insurance services. Moreover, it seems that bigger markets and manufacturing FDI offer a better opportunity to undertake FDI in services in the United States, though the impact differs by sector. The impact of the restrictiveness index on affiliate sales remains ambiguous. In the same way, our results on the impact of tax rate differences as well as the similarity index do not allow a clear interpretation of the results.

Going one step further we reestimate the base equation (17) together with total inward sales (affiliate sales+cross border sales) in a SUR system to account for linkages between total inward sales and the inward affiliate sales share. The results on the SUR estimation are presented in Table 9. We find similar results as in the baseline estimation, indicating the importance of distance, FDI restrictions, manufacturing FDI and language familiarities for affiliate activity.

## 5 Empirics - Comparison to Manufacturing

Fragmentation of production processes in order to increase efficiency and profits has accelerated in manufacturing sectors over the last decade. Technological changes as well as trade and investment liberalization foster this fragmentation process, which is characterized by increasing complexity and international ori-



entation. Since services are increasingly used in manufacturing processes - as intermediate inputs but also as stand-alone production components - the intertwined linkage between services trade and manufacturing is apparent. Including manufacturing FDI in our regressions, we find a positive effect of manufacturing FDI on affiliate activity for some service sectors in inward and outward sales. Our results support the results on manufacturing and services linkages previously found in the economic literature (Francois and Woerz, 2008; Gage and Leshner, 2005). Going one step further, we aim at identifying whether motives for investing abroad are similar between manufacturing and service sectors. Although there exists a growing literature analyzing the determinants of FDI empirically, mainly based on aggregate data, but there also some studies focusing on the determinants of services FDI, little attention is paid to the issue of contrasting manufacturing and service sectors. Riedl (2008) contrasts the dynamic patterns of manufacturing and service FDI in transition countries using the data from the WIIW database on Foreign Direct Investment. She finds that investment in services adjust much faster to its desired level than manufacturing FDI.

Our analysis here addresses the open question by examining the motives for going abroad in total manufacturing, as well as seven sub-sectors. By applying the same econometric specifications we will then compare our results on the determinants in manufacturing sectors to our results on the motives for affiliate activity in service sectors, which are discussed in Section 4. Accordingly to the unique characteristics of services, which require the proximity between supplier and consumer, we find a consistent positive impact of distance on inward and outward affiliate sales. In contrast, we expect manufacturing FDI to take place between countries located next to each other, in order to guarantee proximity to large markets and to exploit agglomeration advantages. Moreover, manufacturing services are likely to be affected by efficiency motives, rather than market-seeking motives hypothesized for FDI in service sectors.

In order to examine the motives for affiliate activity in manufacturing sectors we perform similar estimation procedures as discussed above. Hence, we use the share of outward affiliate sales in total outward sales and the share of inward affiliate sales in total inward sales and apply GLM specifications. The estimation results for the outward affiliate sales share in manufacturing sectors based on equation (16) are presented in Table 10. Table 10 shows the reversed impact of distance on affiliate activity and cross-border trade in manufacturing services. In contrast to our results found in service sectors, affiliate sales decrease the further away are host countries, while direct exports increase with

distance. These results are consistent across all manufacturing sectors with significant impacts of the distance variable, except for machinery and the food sub-sector. But it's significantly negative for the transport equipment sector, which is mainly dominated by trade in automotive parts. In the case of market size, proxied by GDP, we observe a significant positive impact on affiliate activity of the proximity to large markets hypothesis. Our results support the idea and also previous findings, that manufacturing FDI is positively and significantly affected by market size. To test whether manufacturing FDI is driven by horizontal FDI motives or vertical FDI motives, we find a consistent negative impact on manufacturing FDI. Thus, we find evidence in favor of vertical FDI motives for manufacturing sectors. Furthermore, the estimation results for the share of outward affiliate sales in manufacturing sectors suggest a positive impact of language familiarity on affiliate activity, indicating that a common language heritage fosters affiliate activity significantly in 5 out of 8 manufacturing sectors. The impact of FDI restrictions shows the predicted negative sign. However, manufacturing sectors are relatively less restricted. Using the Heritage Foundation index instead, we find a significantly positive impact of the investment climate on affiliate sales<sup>19</sup>.

Turning to the inward side it is important to note that specifications regarding the inward shares are not equivalent to the specification for the outward shares. The inward shares display the characteristics of the home market, given that the United States is the destination market. Table 11 reports the estimation results, based on equation (17) applying GLM specifications. The estimation results for the inward share shows similar decisive motives for affiliate activities, as found for the outward share. Looking at the distance variable, the importance of proximity to host countries is apparent. Thus, affiliate activity decreases the further away are the United States as host market, except for total manufacturing. Moreover, affiliate activity is more likely the larger is the market size of the home country. Moreover, we find a strong negative impact of FDI restrictions in the respective home country on foreign direct investment in the United States. Again, we use the Heritage Foundation index and the coefficient on the investment freedom index of the home market suggests that a less restricted investment climate allows more affiliate activity in the United States<sup>20</sup>.

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<sup>19</sup>Results using the Heritage Foundation index can be obtained upon request from the authors.

<sup>20</sup>Results using the Heritage Foundation index can be obtained upon request from the authors.

## 6 Conclusions

In this paper we focus on the relationship between direct cross-border trade and indirect sales through affiliates as alternative modes of services delivery. We offer a parsimonious analytical framework for the choice of mode. This is based on a model of heterogenous service firms operating under oligopoly. The framework yields predictions about the choice of service delivery at the firm level, and about the pattern of bilateral trade and MNE activity at the industry level. While we then focus on industry-level predictions in the empirical section of this paper, the analytical model developed here could also be applied to firm level data as well. At the industry level, the importance of proximity between supplier and consumer, what we call the proximity burden, appears empirically robust in explaining increased affiliate activity relative to cross-border sales with increased distance. Multinational activity in services increases relative to direct exports the further away are host countries, the lower are investment barriers and the higher is manufacturing FDI. Common language familiarities and bigger markets also foster affiliate activity. The impact of factors like corporate tax rates and relative stocks of human capital on modes of service delivery varies across sectors. For manufacturing firms, the impact of the key factors identified here differ in important ways from our results for service sectors, mainly with respect to distance and the underlying proximity burden for services trade. The empirical results suggesting that core factors to emphasize in developing a full analytical picture for trade and FDI in services may vary in important ways from the relevant set of factors for goods. In addition, the impact of any particular policy on one mode of services delivery is likely to interact with the broad mix of domestic regulation and policy across all modes of supply.

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## A Appendix

Table 1: Sales through Affiliates

Sales of services			
to foreign persons by U.S. MNCs through their foreign affiliates			
	1999	2005	
All countries		1999	2005
Total private services	353,207		528,481
Education	n.a.		n.a.
Financial services	31,641		42,912
Insurance services	52,855		94,438
Telecommunications	n.a.		21,483
Professional, scientific and technical services	63,898		95,412
Computer and information services	14,708		n.a.
Management and consulting services	n.a.		12,405
Research and development	n.a.		3,600
Architectural, engineering and other technical services	11,939		12,059
Legal services	821		2,402
Advertising	n.a.		10,080
to U.S. persons by foreign MNCs through their U.S. affiliates			
	1999	2005	
All countries		1999	2005
Total private services	293,485		389,030
Education	355		403
Financial services	15,318		24,916
Insurance services	78,479		77,168
Telecommunications	13,095		n.a.
Professional, scientific and technical services	15,421		48,590
Computer and information services	4,022		8,815
Management and consulting services	585		2,079
Research and development	658		882
Architectural, engineering and other technical services	3,880		6,175
Legal services	21		n.a.
Advertising	5,219		20,327

n.a. Not available.

Professional, scientific and technical services are comparable to business, professional and technical services.

All data are in millions of US Dollars.

Table 2: U.S. Cross-border Trade

	Cross-border trade - Exports		Cross-border trade - Imports	
	1999	2005	1999	2005
All countries				
Total private services	265,106	367,813	183,034	281,607
unaffiliated	203,081	272,724	147,137	219,688
affiliated	62,025	95,088	35,897	61,920
Education	9,616	14,076	1,808	3,962
unaffiliated	9,616	14,076	1,808	3,962
affiliated	n.a.	n.a.	n.a.	n.a.
Financial services	17,410	7,787	9,418	12,620
unaffiliated	13,410	7,787	3,418	6,720
affiliated	4,000	n.a.	6,000	5,900
Insurance services	3,053	7,787	9,389	28,540
unaffiliated	3,053	7,787	9,389	28,540
affiliated	n.a.	n.a.	n.a.	n.a.
Telecommunications	4,549	5,231	6,602	4,527
unaffiliated	4,549	5,231	6,602	4,527
affiliated	n.a.	n.a.	n.a.	n.a.
BPT	53,517	83,990	27,635	48,765
unaffiliated	27,700	41,874	8,588	14,824
affiliated	25,817	42,116	19,047	33,941
Computer&information services	6,643	9,782	4,494	9,048
unaffiliated	5,443	7,482	1,494	2,748
affiliated	1,200	2,300	3,000	6,300
Management&consulting services	n.a.	6,864	n.a.	6,070
unaffiliated	1,832	2,564	842	1,870
affiliated	n.a.	4,300	n.a.	4,200
Research&development	n.a.	10,191	n.a.	6,744
unaffiliated	994	1,291	749	2,244
affiliated	n.a.	8,900	n.a.	4,500
AET	n.a.	n.a.	n.a.	n.a.
unaffiliated	2,620	3,430	19	181
affiliated	n.a.	n.a.	n.a.	n.a.
Legal services	n.a.	n.a.	n.a.	n.a.
unaffiliated	2,465	4,274	742	897
affiliated	n.a.	n.a.	n.a.	n.a.
Advertising	n.a.	n.a.	n.a.	n.a.
unaffiliated	481	574	881	982
affiliated	n.a.	n.a.	n.a.	n.a.

n.a. Not available.

BPT - Business, professional and technical services.

AET - Architectural, engineering and other technical services.

All data are in millions of US Dollars.



Figure 1: U.S. International sales and purchases of services of Private Services, 1987-2005

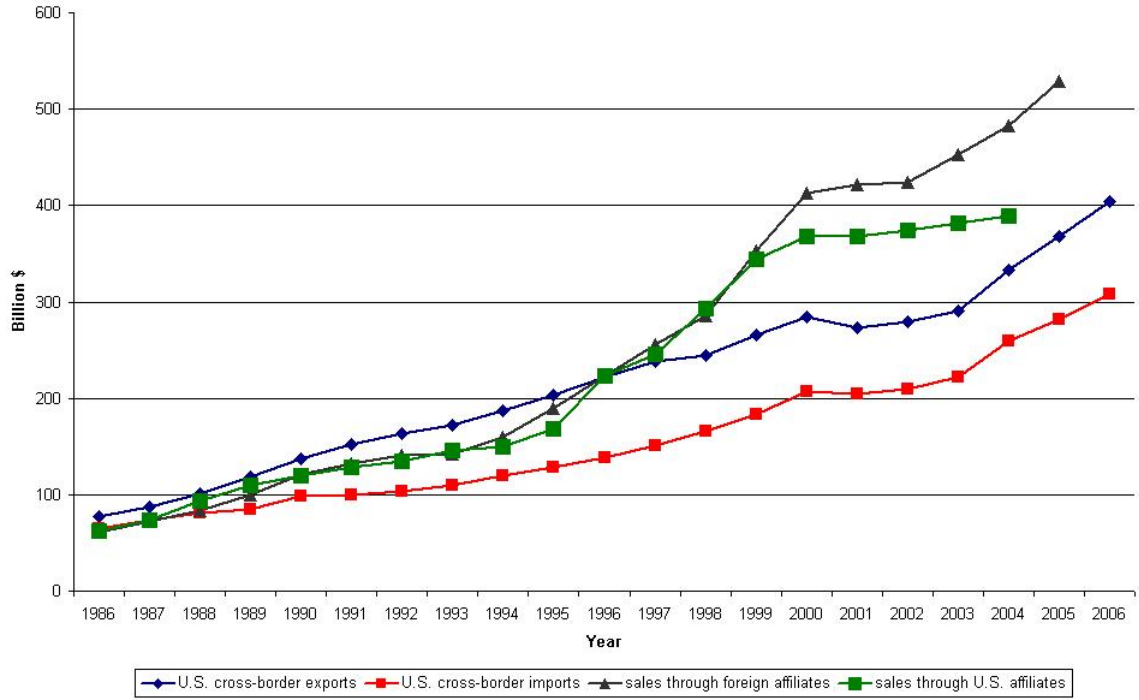


Table 3: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Outsh	559	0.7044478	0.2575423	0	0.9938525
Insh	538	0.4262909	0.3845714	0	0.9986651
Manufacturing outsh	456	0.5316677	0.444042	0	0.9987003
Manufacturing insh	415	0.4685912	0.4496828	0	0.9997787
Log distance	1590	8.577451	0.854291	6.306995	9.680893
Log GDP	1590	6.871722	0.8164167	5.522241	8.448654
Language	1590	0.4	0.4900521	0	1
Similarity index	1590	0.6186601	0.3077173	0	0.9991627
Restrictiveness Index	1300	0.1218231	0.1034626	0.011	0.56
Log outward manufacturing FDI	1270	9.864045	0.6884036	8.138272	11.33833
Log inward manufacturing FDI	1446	9.993362	1.554714	4.624973	11.35117
Corporate tax rate	1558	35.35746	7.122973	21.3	57.5
EU Dummy	1590	0.4	0.4900521	0	1
NAFTA Dummy	1590	0.2	0.4001258	0	1
Log outward affiliate sales	647	6.192992	1.735329	0	10.10316
Log inward affiliate sales	492	5.183279	2.707609	0	10.31088
Log exports	1407	5.291403	1.551603	1.098612	9.671997
Log imports	1346	4.275433	1.874804	0	9.192685
Log total outward sales	559	6.770904	1.316524	3.78419	10.29008
Log total inward sales	538	5.379661	2.322071	0	10.31454

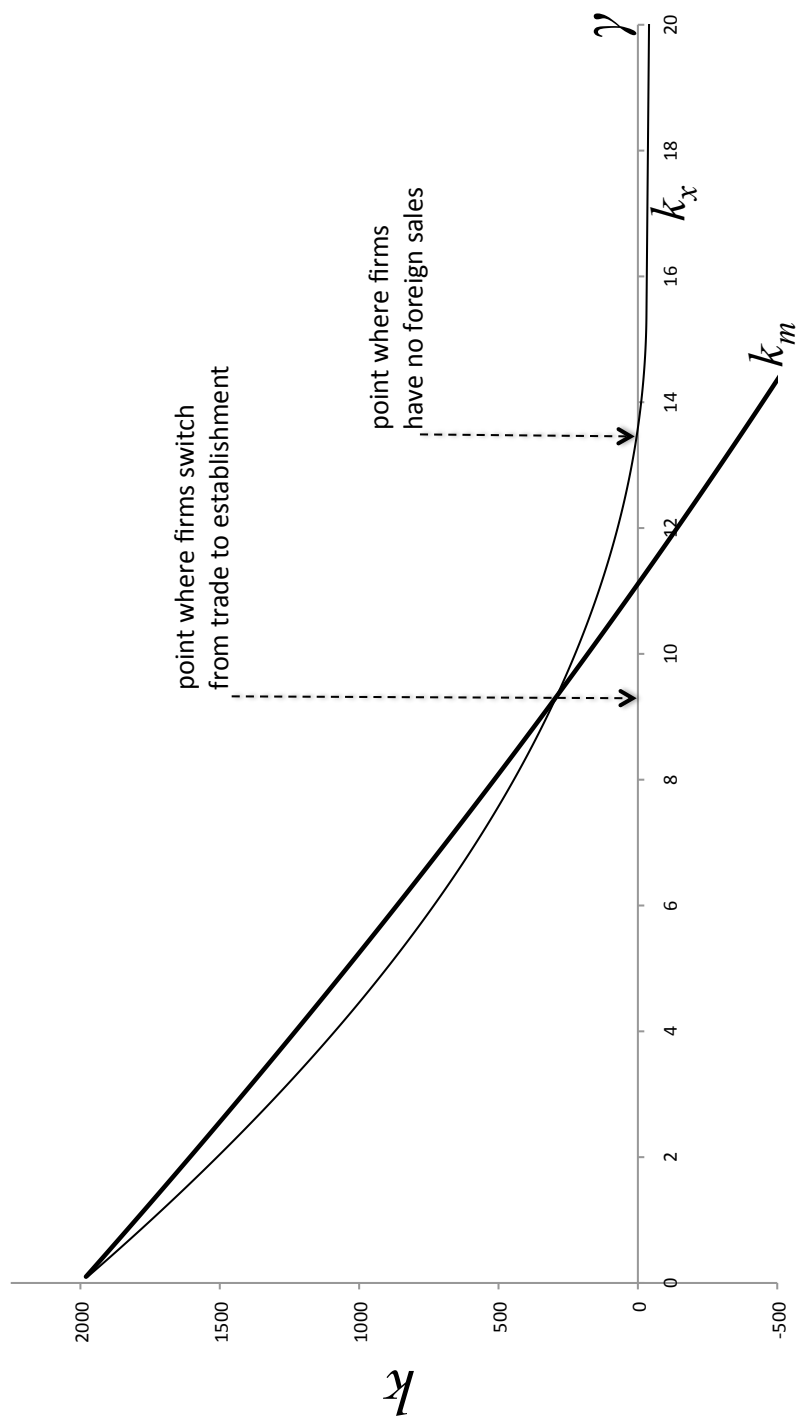


Figure 2: Threshold levels for establishment and direct trade

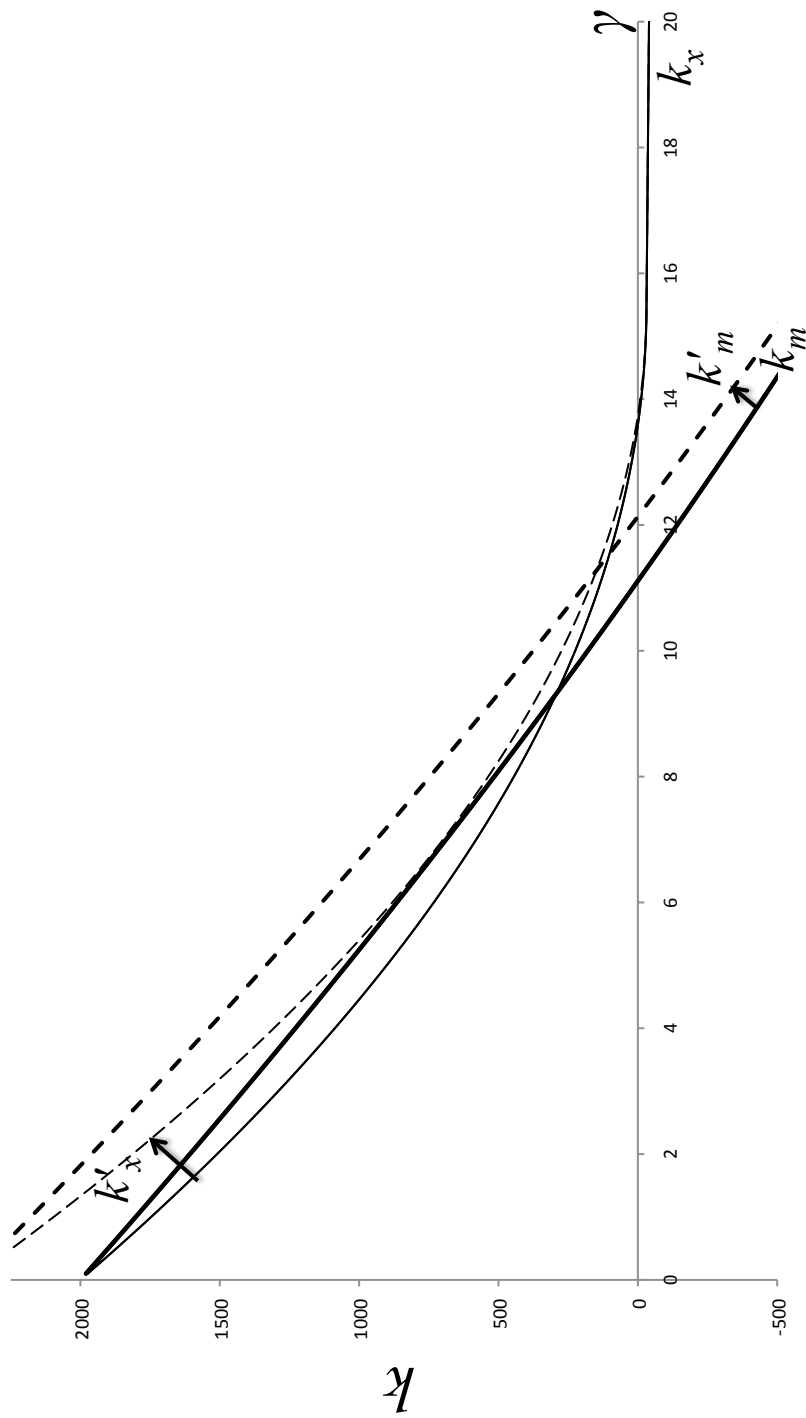


Figure 3: Increasing size and the threshold levels for establishment and direct trade

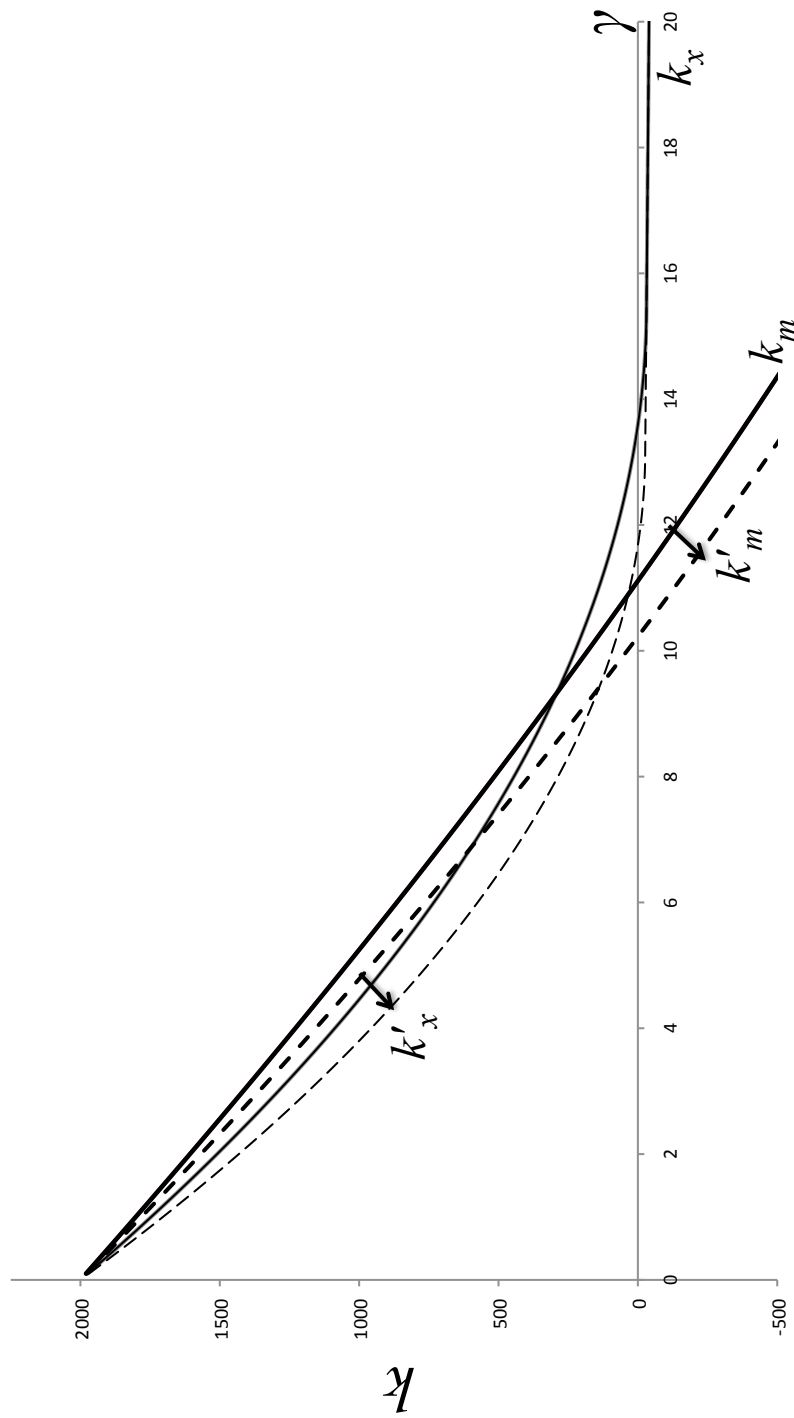


Figure 4: Increasing distance and the threshold levels for establishment and direct trade

Table 4: Regression results: 3SLS outward sales

	(1) exports	(2) affiliate sales	(1) exports	(2) affiliate sales	(1) exports	(2) affiliate sales	(1) exports	(2) affiliate sales
	Log Distance		Language		Restrictiveness Index		Log FDI Manufacturing	
Education	-0.283*** (-3.504)	0.130 (0.470)	0.045 (0.280)	0.097 (0.257)	7.586*** (4.875)	-14.463*** (-7.580)	0.329*** (3.485)	0.125 (0.378)
Telecommunication	-0.351*** (-5.495)	0.842*** (5.358)	0.721*** (3.252)	0.217 (0.620)	0.645 (1.147)	-1.655** (-2.200)	0.273*** (3.145)	1.120*** (3.799)
Insurance	-0.348*** (-5.273)	-0.145 (-0.885)	1.013*** (3.425)	1.580*** (6.057)	0.131 (0.120)	-5.797*** (-5.678)	0.218* (1.682)	-0.044 (-0.193)
Financial services	-0.307*** (-5.347)	0.245** (1.963)	-0.001 (-0.00358)	1.790*** (7.206)	-1.038 (-0.964)	-4.998*** (-3.904)	0.332*** (3.348)	-0.165 (-0.738)
Computer&Information	-0.137 (-1.340)	0.248 (1.023)	-0.250 (-0.591)	0.179 (0.279)	4.646 (1.583)	-5.065 (-1.024)	0.364** (2.283)	0.281 (0.678)
Computer	-0.011 (-0.0117)	-0.415 (-0.282)	1.189 (1.228)	-1.040 (-0.780)	1.051 (0.107)	-10.032 (-0.724)	0.444** (2.302)	0.349 (0.325)
Information	-0.757 (-0.923)	0.218 (0.144)	0.170 (0.146)	2.220 (1.524)	-4.228 (-0.713)	-5.870 (-0.425)	0.350 (1.079)	-1.204 (-0.998)
Operational leasing	-0.502** (-2.350)	-0.162 (-0.393)	-0.079 (-0.327)	-0.141 (-0.398)	-0.069 (-0.0330)	-1.198 (-0.400)	0.234 (0.880)	0.192 (0.321)
Business services	-0.353*** (-3.372)	0.454** (2.211)	0.155 (0.794)	-0.166 (-0.535)	0.545 (0.356)	-1.252 (-0.587)	0.497*** (3.315)	0.407* (1.767)
Legal services	-0.402*** (-6.767)	1.168*** (6.727)	-0.000 (-0.000304)	-0.712*** (-2.918)	-1.791** (-2.394)	0.371 (0.354)	0.126** (1.981)	1.706*** (6.479)
Consulting	-0.253*** (-4.428)	0.026 (0.224)	0.531*** (4.195)	0.177 (0.768)	-3.042*** (-3.293)	-1.550 (-0.979)	0.441*** (5.097)	0.020 (0.110)
Advertising	-0.647*** (-9.765)	0.377** (2.048)	-0.199 (-1.436)	-0.005 (-0.0210)	4.664*** (3.451)	-6.749*** (-4.353)	0.431*** (3.759)	0.541** (2.297)
R&D	-0.546*** (-7.358)	0.385* (1.730)	-0.651*** (-3.945)	1.118*** (3.509)	3.681*** (3.368)	-6.253*** (-3.262)	0.689*** (8.297)	-0.234 (-0.718)
	Log GDP		Similarity Index		Corporate tax		Log Exports	
Education	1.011*** (7.813)	-1.262*** (-2.904)	0.626 (1.123)	0.379 (0.521)	0.032* (1.812)	-0.007 (-0.256)	1.136*** (3.427)	554 R-squared
Telecommunication	0.346*** (2.797)	0.031 (0.180)	0.230 (0.858)	-1.038*** (-2.996)	0.001 (0.0373)	-0.034 (-1.601)	0.356** (1.725)	0.996
Insurance	1.009*** (4.213)	1.328*** (6.404)	0.911*** (2.831)	-1.796*** (-5.799)	-0.048*** (-4.083)	0.048*** (3.058)	0.304** (2.426)	
Financial services	0.371*** (3.346)	0.295* (1.716)	0.178 (0.448)	-1.826*** (-4.072)	-0.057*** (-5.469)	0.043** (2.282)	0.873*** (3.538)	
Computer&Information	0.022 (0.140)	-0.052 (-0.256)	0.576** (2.041)	-0.295 (-0.579)	0.058* (1.895)	-0.080* (-1.778)	1.344*** (3.003)	
Computer	0.321 (0.513)	0.193 (0.234)	2.618* (1.677)	-5.646*** (-3.601)	-0.006 (-0.125)	-0.014 (-0.251)	1.065*** (2.222)	
Information	0.520 (1.225)	-0.055 (-0.0648)	1.312 (1.110)	-1.756 (-0.872)	-0.022 (-0.464)	0.031 (0.525)	0.572 (0.735)	
Operational leasing	0.427*** (2.818)	-0.204 (-0.944)	-0.741 (-1.071)	2.080*** (3.470)	-0.140*** (-0.342)	-0.018 (-0.342)	0.290 (1.158)	
Business services	0.352*** (2.591)	-0.162 (-0.727)	-0.871*** (-2.738)	1.766*** (6.861)	-0.032*** (-2.599)	0.021 (1.139)	0.992*** (3.836)	
Legal services	0.571*** (3.080)	1.279*** (4.390)	1.220* (1.901)	-4.563*** (-6.677)	-0.030** (-2.153)	-0.091*** (-0.975)	0.136 (0.569)	
Consulting	-0.030 (-0.372)	0.272*** (2.720)	0.473*** (2.610)	0.596*** (2.759)	-0.036*** (-3.552)	-0.056*** (-4.752)	0.333*** (4.981)	
Advertising	0.762*** (7.303)	-0.105 (-0.593)	0.629 (1.145)	-2.220*** (-3.867)	-0.034*** (-2.757)	-0.033** (-2.275)	0.545*** (4.638)	
R&D	0.220* (1.955)	0.223 (1.018)	-0.775 (-1.271)	1.568** (2.147)	-0.032** (-2.459)	0.017 (1.007)	0.795*** (5.058)	

Estimations based on equation (14). Dependent variables are log of exports and log of outward affiliate sales.

Estimation method: 3SLS. z statistics in parentheses.

Sector dummy variables are included in the regression, but are not reported in the table.

\*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level respectively.

Table 5: Regression results: 3SLS inward sales

	(1) imports	(2) affiliate sales	(1) imports	(2) affiliate sales	(1) imports	(2) affiliate sales	(1) imports	(2) affiliate sales	(1) imports	(2) affiliate sales
	Log Distance		Language		Restrictiveness Index		Log affiliate sales		Log FDI Manufacturing	
Education	1.795*** (3.025)	1.565** (1.989)	0.243 (0.482)	0.432 (0.445)	9.299 (1.275)	11.987 (1.153)	-1.171*** (-3.897)	-0.571 (-1.262)	396	396
Telecommunication	-0.465*** (-3.921)	-1.170*** (-3.267)	1.255*** (5.042)	2.202*** (4.023)	-1.279* (-1.768)	-6.611*** (-3.889)	-0.244*** (-2.683)	-0.960*** (-2.596)	0.995	0.984
Insurance	1.113*** (5.422)	0.104 (1.921***)	1.612*** (6.950)	-0.177 (-0.320)	18.637*** (7.733)	1.768 (0.292)	0.778*** (8.235)	0.265 (2.277)		
Financial services	0.421 (1.364)	1.921*** (3.190)	1.577*** (5.293)	1.466 (1.475)	-0.275 (-0.0851)	21.473*** (3.481)	0.136 (1.291)	0.265 (0.541)		
Computer&Information	-2.641*** (-8.446)	-1.810 (-0.687)	-1.936** (-2.067)	4.675 (1.580)	13.231 (1.544)	43.320** (2.574)	-0.069 (-0.484)	0.265 (0.781)		
Computer	-29.390** (-2.022)	16.499 (0.232)	-25.145* (-1.737)	16.949 (0.273)	-41.4.937* (-1.940)	235.647 (0.233)	0.096 (0.111)	0.031 (0.484)		
Information	7.175** (1.994)	16.235*** (2.945)	2.586* (1.854)	6.800*** (3.858)	-63.925** (-2.369)	-121.511** (-2.573)	-0.075 (-0.390)	0.366 (0.447)		
Operational leasing	2.638*** (3.796)	4.946** (2.027)	5.209*** (3.206)	9.338*** (4.686)	25.744*** (4.398)	30.680 (1.348)	-0.491** (-2.102)	-2.206 (-0.344)		
Business services	-0.609*** (-9.194)	-1.507*** (-5.312)	1.161*** (9.604)	2.603*** (3.783)	-2.063** (-2.266)	-5.331** (-2.137)	-0.021 (-0.584)	1.151*** (4.544)		
Legal services	-0.546 (-0.336)	-9.950 (-0.234)	0.000 (-0.330)	-198.599 (-0.330)	0.000 (-0.330)	0.000 (-0.330)	0.312 (0.203)	0.128 (0.262)		
Consulting	-0.627*** (-5.039)	-0.026 (-0.0737)	1.099*** (6.212)	0.640 (1.165)	-6.533*** (-3.946)	-11.662** (-2.437)	-0.037 (-0.656)	0.529 (1.277)		
Advertising	5.216** (2.572)	-16.272*** (-5.474)	7.454*** (3.024)	-20.493*** (-5.080)	77.377** (2.500)	-245.726*** (-5.089)	0.207* (1.646)	-0.105 (-0.165)		
R&D	-1.484*** (-7.485)	1.528** (2.377)	0.322 (1.313)	2.528*** (5.598)	-16.604*** (-7.053)	29.223*** (4.879)	0.026 (0.522)	0.128 (0.233)		
	Log GDP		Similarity Index		Corporate tax		Log Imports		Observations	
Education	1.361* (1.655)	1.537 (1.399)	-1.473 (-0.717)	-2.408 (-0.637)	-0.025 (-0.965)	0.007 (0.125)	-0.571 (-1.262)	396	396	
Telecommunication	0.922*** (4.361)	2.427*** (6.902)	-0.971 (-1.296)	-2.063 (-1.273)	0.038* (1.778)	0.080 (1.515)	-0.960*** (-2.596)	0.995	0.984	
Insurance	1.061*** (7.627)	-1.079*** (-4.471)	3.084*** (4.648)	-2.307** (-2.222)	-0.046*** (-4.081)	0.028 (1.159)	0.265 (2.277)			
Financial services	0.435*** (3.123)	-0.915*** (-3.415)	-0.029 (-0.0531)	-0.286 (-0.252)	-0.036*** (-3.086)	0.051** (1.987)	0.265 (0.541)			
Computer&Information	2.515 (1.251)	9.850** (2.061)	1.778 (0.499)	-11.776 (-1.492)	-3.422*** (-3.411)	-0.518 (-0.989)	-0.561 (-0.662)			
Computer	7.115** (2.462)	-2.307 (-0.134)	-7.938*** (-2.607)	3.343 (0.175)	0.350** (2.004)	-0.127 (-0.149)	0.031 (0.0138)			
Information	-0.345 (1.028)	-0.950 (-1.244)	-1.454 (-0.833)	3.928 (0.997)	0.006 (0.193)	-0.078 (-1.493)	-0.171 (-0.285)			
Operational leasing	1.308*** (3.007)	1.372 (0.884)	-0.803 (-0.497)	-0.387 (-0.110)	0.201*** (2.616)	0.335*** (2.610)	-1.447 (-1.408)			
Business services	0.726*** (8.956)	1.869*** (5.358)	0.698 (1.573)	1.195 (1.228)	-0.020*** (-2.417)	-0.064*** (-3.304)	-1.768*** (-3.699)			
Legal services	2.470 (0.185)	43.188 (0.280)	-2.626 (-0.169)	-81.119 (-0.274)	-0.065 (-0.0832)	-0.846 (-0.175)	-14.890 (-0.246)			
Consulting	0.613*** (4.313)	-0.141 (-0.403)	0.046 (0.0722)	0.329 (0.246)	-0.043*** (-3.736)	-0.085*** (-0.107)	-0.259 (-0.929)			
Advertising	1.127*** (4.247)	-0.956 (-1.081)	-0.359 (-0.307)	1.076 (0.378)	0.045* (1.810)	-0.130*** (-2.861)	0.866 (1.617)			
R&D	0.905*** (7.445)	0.449 (1.201)	1.993*** (3.482)	0.171 (0.122)	-0.072*** (-6.798)	0.026 (0.885)	0.123 (0.426)			

Estimations based on equation (14). Dependent variable is log of imports and log of inward affiliate sales.

Estimation method: 3SLS, z statistics in parentheses.

Sector dummy variables are included in the regression, but are not reported in the table.

\*, \*\*, and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level respectively.

Table 6: Regression results: outward affiliate sales share

	Log Distance	Language	Restrictiveness Index	Log FDI Manufacturing
Education	0.356* (1.822)	-0.189 (-0.401)	-10.246*** (-3.607)	0.560 (1.554)
Telecommunication	0.757*** (3.997)	0.027 (0.0461)	-2.155* (-1.791)	0.585 (1.580)
Insurance	0.401** (2.219)	0.443 (1.956)	-3.821*** (-3.927)	0.491* (1.715)
Financial services	0.221* (1.650)	1.773*** (9.351)	-5.064*** (-5.792)	-0.258 (-1.092)
Computer&Information	0.229 (1.144)	0.014 (0.0262)	-3.024 (-0.741)	0.383 (1.025)
Computer	-0.590 (-0.465)	-0.696 (-0.729)	-12.577 (-1.030)	0.051 (0.0746)
Information	0.656 (0.946)	1.668*** (4.452)	-1.808 (-0.278)	-0.846 (-1.394)
Operational leasing	-0.225 (-0.818)	0.296 (1.264)	-2.902 (-1.555)	-0.666* (-1.725)
Business services	0.491*** (4.701)	-0.241 (-1.459)	-0.893 (-0.731)	0.488*** (3.761)
Legal services	1.495*** (6.023)	-0.643** (-2.455)	5.688*** (4.083)	2.006*** (4.895)
Consulting	0.242** (2.022)	-0.207 (-0.906)	1.502 (0.896)	0.161 (0.757)
Advertising	0.937*** (8.478)	-0.306 (-1.121)	-4.927*** (-3.540)	1.054*** (4.865)
R&D	0.666*** (3.889)	0.675** (2.349)	-3.648** (-2.294)	0.262 (1.217)
	Log GDP	Similarity Index	Corporate tax	Observations
Education	-1.192*** (-8.129)	1.115 (1.292)	-0.007 (-0.248)	559
Telecommunication	-0.212 (-1.169)	-0.268 (-0.307)	-0.017 (-0.508)	
Insurance	0.128 (0.921)	-2.168*** (-5.951)	0.080*** (3.866)	
Financial services	0.197 (1.486)	-1.912*** (-5.530)	0.047** (2.516)	
Computer&Information	-0.137 (-0.812)	0.041 (0.216)	-0.054* (-1.922)	
Computer	0.242 (0.366)	-5.904*** (-5.876)	-0.008 (-0.172)	
Information	-0.364 (-0.985)	-1.813 (-1.538)	0.038 (1.381)	
Operational leasing	-0.368** (-2.304)	2.634*** (6.118)	0.056 (1.567)	
Business services	-0.197*** (-2.842)	1.793*** (10.35)	0.022** (2.348)	
Legal services	1.085*** (4.518)	-5.798*** (-6.732)	-0.076*** (-3.444)	
Consulting	0.184 (1.316)	0.232 (1.002)	-0.056*** (-3.485)	
Advertising	-0.654*** (-4.527)	-1.671*** (-2.807)	-0.013 (-1.168)	
R&D	-0.074 (-0.714)	1.516** (2.194)	0.020 (0.995)	

Estimations based on equation (15). Dependent variable is share of outward affiliate sales in total outward sales.

Estimation method: GLM model. Robust z statistics in parentheses.

Sector dummy variables are included in the regression, but are not reported in the table.

\*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level respectively.

Table 7: Regression results: SUR outward sales

	(1)		(2)		(1)		(2)	
	total sales	affiliate sales	total sales	affiliate sales	total sales	affiliate sales	total sales	affiliate sales
	Log Distance							
Education	-0.513*** (-4.343)	0.099 (0.563)	0.555** (2.378)	0.075 (0.214)	Restrictiveness Index -13.675*** (-0.985)	Log FDI Manufacturing -0.307 (-1.493)	554	0.179 (0.581)
Telecommunication	0.562*** (4.505)	0.816*** (4.373)	0.579*** (2.256)	-0.134 (-0.349)	-2.190** (-1.983)	1.122*** (5.204)	0.682** (2.116)	0.938
Insurance	-0.290** (-2.431)	0.258 (1.448)	1.973*** (13.95)	0.517** (2.446)	-4.599*** (-7.411)	-0.069 (-0.382)	0.170 (0.626)	
Financial services	0.015 (0.154)	0.202 (1.377)	1.787*** (11.06)	1.778*** (7.367)	-5.942*** (-6.581)	0.083 (0.514)	-0.321 (-1.323)	
Computer&Information	0.031 (0.164)	0.210 (0.750)	-0.246 (-0.496)	0.065 (0.0880)	2.555 (0.736)	0.384 (1.161)	0.338 (0.685)	
Computer	-0.014 (-0.1119)	0.533 (0.311)	0.400 (0.428)	-0.933 (-0.668)	-7.580 (-0.694)	1.353* (1.832)	0.272 (0.247)	
Information	-0.542 (-0.528)	0.689 (0.449)	2.437*** (2.850)	1.675 (1.310)	-10.354 (-1.114)	-1.329 (-1.551)	-0.854 (-0.667)	
Operational leasing	-0.215 (-0.658)	-0.164 (-0.336)	-0.249 (-0.920)	0.156 (0.384)	-0.358 (-0.153)	0.397 (0.867)	-0.519 (-0.758)	
Business services	-0.101 (-0.766)	0.494** (2.512)	0.450** (2.024)	-0.230 (-0.693)	-3.303** (-2.076)	0.260 (1.412)	0.482* (1.750)	
Legal services	-0.130 (-1.091)	1.512*** (8.471)	-0.268 (-1.388)	-0.800*** (-2.778)	2.096* (1.876)	0.420** (2.000)	1.755*** (5.589)	
Consulting	-0.200** (-2.312)	0.246* (1.896)	0.675*** (4.133)	-0.322 (-1.319)	-4.622*** (-4.038)	-0.051 (-0.344)	0.170 (0.771)	
Advertising	-0.188* (-1.917)	1.036*** (7.066)	0.153 (0.804)	-0.535* (-1.887)	-6.864*** (-5.756)	0.320* (1.852)	1.187*** (4.593)	
R&D	-0.716*** (-6.527)	0.697*** (4.252)	1.702*** (8.210)	0.731** (2.358)	-9.030*** (-6.997)	-1.262*** (-6.758)	0.249 (0.892)	
	Log GDP							
Education	0.659*** (4.613)	-1.148*** (-5.374)	1.353** (2.464)	0.582 (0.710)	Corporate tax 0.058*** (3.523)	554	-0.000 (-0.00305)	
Telecommunication	0.198* (1.653)	-0.189 (-1.055)	-1.090*** (-4.034)	-0.904** (-2.239)	-0.030* (-1.847)	0.998	-0.022 (-0.898)	
Insurance	1.734*** (20.99)	0.323*** (2.616)	-1.456*** (-6.196)	-2.221*** (-6.324)	0.030*** (2.624)		0.082*** (4.770)	
Financial services	0.741*** (9.032)	0.249** (2.033)	-1.457*** (-4.171)	-1.888*** (-3.615)	-0.027*** (-2.658)		0.049*** (3.185)	
Computer&Information	-0.001 (-0.00530)	-0.048 (-0.202)	0.936*** (3.918)	0.020 (0.0561)	0.008 (-1.392)		-0.061 (-0.253)	
Computer	0.709 (1.126)	0.283 (0.300)	-3.291*** (-2.779)	-5.712*** (-3.228)	-0.030 (-0.690)		-0.016 (0.038)	
Information	0.440 (0.855)	-0.370 (-0.481)	-0.800 (-0.521)	-1.976 (-0.861)	0.011 (0.231)		0.038 (0.562)	
Operational leasing	-0.044 (-0.281)	-0.400* (-1.691)	1.284*** (2.817)	2.620*** (3.845)	-0.071** (-2.136)		0.060 (1.197)	
Business services	0.541*** (4.855)	-0.190 (-1.142)	0.996*** (4.963)	1.781*** (5.937)	-0.024** (-2.048)		0.020 (1.138)	
Legal services	0.873*** (5.426)	0.489** (2.032)	-0.039 (-0.0734)	-4.902*** (-6.207)	-0.063*** (-5.488)		-0.051*** (-2.951)	
Consulting	0.320*** (4.148)	0.188 (1.633)	1.084*** (7.197)	0.176 (0.784)	-0.041*** (-4.450)		-0.065*** (-4.767)	
Advertising	0.500*** (5.726)	-0.696*** (-5.331)	-2.382*** (-2.791)	-1.854*** (-2.791)	-0.062*** (-6.208)		-0.010 (-0.697)	
R&D	1.079*** (10.44)	-0.055 (-0.356)	1.562*** (2.777)	1.402* (1.668)	-0.014 (-1.073)		0.018 (0.924)	
	Observations							
	R-squared							

Estimations based on equation (15). Dependent variables are log of total outward sales and share of outward affiliate sales. Estimation method: SUR. z statistics in parentheses. Sector dummy variables are included in the regression, but are not reported in the table. \*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level respectively.



Table 8: Regression results: inward affiliate sales share

	Log Distance	Language	Restrictiveness Index	Log FDI Manufacturing
Education	0.069 (0.156)	0.893 (1.315)	28.859*** (3.648)	0.568 (0.860)
Telecommunication	-0.536 (-1.173)	0.463 (1.092)	-6.054** (-2.336)	-0.096 (-0.147)
Insurance	-0.635** (-2.088)	-1.173*** (-4.439)	-14.430*** (-3.920)	-0.272 (-0.737)
Financial services	1.690*** (4.383)	0.476 (1.389)	19.057*** (4.612)	-0.683*** (-2.633)
Computer&Information	-0.189 (-0.260)	4.720*** (3.983)	40.711** (2.489)	-1.068 (-1.462)
Computer	-0.780*** (-3.148)	-0.816** (-2.534)	24.352*** (3.311)	0.214 (0.601)
Information	7.513*** (3.545)	5.104*** (7.650)	-43.845** (-2.374)	0.980 (1.282)
Operational leasing	0.524 (0.583)	5.439*** (10.95)	9.713 (1.385)	6.036** (2.063)
Business services	-0.007 (-0.0364)	-0.229 (-0.540)	-4.587 (-1.396)	0.657** (2.036)
Legal services	-0.084 (-0.0522)	28.221** (2.504)	18.951 (0.987)	2.238 (1.492)
Consulting	0.499 (1.413)	-0.062 (-0.103)	10.220* (1.936)	1.527*** (2.591)
Advertising	-0.084 (-0.181)	2.676*** (3.551)	13.420 (1.433)	0.829 (1.273)
R&D	2.327*** (4.111)	2.057*** (5.359)	33.744*** (5.384)	-0.373 (-0.279)
	Log GDP	Similarity Index	Corporate tax	Observations
Education	5.048*** (4.670)	-7.700** (-2.122)	0.156*** (4.637)	538
Telecommunication	1.136*** (3.024)	-3.230 (-1.306)	0.069 (0.826)	
Insurance	-1.266*** (-7.590)	-4.739*** (-4.560)	0.057*** (4.264)	
Financial services	-1.128*** (-5.072)	-0.421 (-0.585)	0.069*** (4.241)	
Computer&Information	13.582*** (3.690)	-25.770*** (-3.410)	-0.589** (-2.211)	
Computer	6.113*** (8.775)	2.889* (1.844)	-0.331*** (-8.992)	
Information	-1.275** (-2.137)	10.878** (2.464)	-0.046 (-1.108)	
Operational leasing	0.687 (0.851)	-0.559 (-0.594)	0.215*** (3.788)	
Business services	-0.218 (-0.842)	1.640 (1.201)	-0.005 (-0.212)	
Legal services	10.130 (1.185)	-14.221** (-2.242)	0.334 (0.692)	
Consulting	0.367 (0.800)	0.786 (0.386)	-0.037 (-0.934)	
Advertising	1.374*** (2.695)	-3.115 (-0.788)	-0.139*** (-2.880)	
R&D	-0.409 (-0.742)	0.671 (0.549)	0.076*** (2.825)	

Estimations based on equation (16). Dependent variable is share of inward affiliate sales in total inward sales.

Estimation method: GLM model. Robust z statistics in parentheses.

Sector dummy variables are included in the regression, but are not reported in the table.

\*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level respectively.

Table 9: Regression results: SUR inward sales

	(1)		(2)		(1)		(2)		(1)		(2)	
	total sales	affiliate sales	total sales	affiliate sales	total sales	affiliate sales	total sales	affiliate sales	total sales	affiliate sales	total sales	affiliate sales
	Log Distance											
Education	0.875 (1.631)	1.774* (1.934)	0.536 (0.870)	1.685 (1.600)	0.057 (0.0102)	34.131*** (3.555)	0.032 (0.0496)	-0.681 (-0.627)	Log FDI	0.994	396	0.856
Telecommunication	-0.454** (-2.093)	-0.280 (-0.757)	1.126*** (3.621)	0.590 (1.110)	-2.603** (-2.269)	-5.143*** (-2.623)	-0.211 (-0.847)	0.053 (0.124)	Manufacturing	0.994	396	0.856
Insurance	0.664** (2.354)	-0.838* (-1.739)	0.661** (2.022)	-1.382** (-2.473)	11.729*** (3.808)	-16.017*** (-3.043)	0.797*** (3.233)	-0.223 (-0.530)				
Financial services	1.956*** (6.254)	1.331** (2.491)	1.919*** (6.290)	0.138 (0.265)	20.955*** (5.704)	16.798*** (2.675)	0.422* (1.695)	-0.265 (-0.622)				
Computer&Information	-1.258 (-1.299)	2.280 (1.377)	2.986** (1.999)	8.346*** (3.269)	26.735*** (2.757)	26.651 (1.608)	0.818 (0.799)	1.304 (0.746)				
Computer	-11.094 (-0.455)	43.186 (1.036)	-7.529 (-0.323)	39.490 (0.993)	-140.433 (-0.390)	611.967 (0.994)	0.417 (0.456)	0.571 (0.365)				
Information	7.825*** (2.663)	9.518* (1.895)	4.278*** (4.906)	4.431*** (2.974)	-62.622** (-2.572)	-61.195 (-1.471)	0.579 (1.038)	0.217 (0.227)				
Operational leasing	1.919** (2.505)	-0.230 (-0.176)	6.283*** (9.249)	5.230*** (4.505)	16.602 (1.152)	10.521 (0.427)	2.813 (0.859)	8.019 (1.433)				
Business services	-0.600*** (-5.223)	-0.187 (-0.952)	0.421** (2.075)	-0.998*** (-2.880)	-3.096* (-1.818)	-4.598 (-1.580)	0.339** (2.113)	0.591** (2.152)				
Legal services	-0.682 (-0.356)	1.215 (0.371)	-14.754 (-0.172)	-44.610 (-0.305)	0.000 (0.000)	0.000 (0.000)	0.770 (0.278)	0.010 (0.00215)				
Consulting	-0.423* (-1.933)	0.650* (1.738)	0.541* (1.812)	-0.875* (-1.716)	-6.921** (-2.190)	-6.142 (-1.137)	0.268 (0.953)	0.292 (0.608)				
Advertising	-10.396*** (-5.790)	-16.633*** (-5.421)	-12.767*** (-5.663)	-21.090*** (-5.474)	-159.471*** (-5.348)	-251.137*** (-4.928)	-0.109 (-0.250)	-0.125 (-0.169)				
R&D	-0.686** (-2.386)	3.017*** (6.144)	1.056*** (3.463)	2.320*** (4.450)	-1.519 (-0.551)	42.684*** (9.063)	0.556 (1.603)	-0.557 (-0.940)				
	Log GDP											
Education	-0.112 (-0.177)	3.600*** (3.335)	2.469 (1.099)	-8.898** (-2.318)	-0.054** (-2.205)	0.167*** (4.009)	396	396	Observations			
Telecommunication	0.985*** (4.972)	1.369*** (4.041)	-1.874* (-1.730)	-0.267 (-0.144)	-0.004 (-0.123)	0.097 (1.579)	0.994	0.856	R-squared			
Insurance	-0.897*** (-5.487)	-1.222*** (-4.371)	-1.819*** (-2.067)	-3.971*** (-2.642)	0.010 (0.638)	0.047* (1.705)						
Financial services	-0.722*** (-4.132)	-1.029*** (-3.446)	-0.121 (-0.157)	-0.446 (-0.338)	0.034** (2.100)	0.066** (2.366)						
Computer&Information	6.193** (2.016)	6.853 (1.305)	-7.987 (-1.546)	-15.963* (-1.807)	-0.239 (-1.102)	0.111 (0.238)						
Computer	4.437 (0.788)	-8.913 (-0.926)	-3.280 (-0.519)	10.637 (0.985)	0.134 (0.478)	-0.452 (-0.944)						
Information	-0.145 (-0.287)	-0.543 (-0.631)	3.127 (1.189)	5.593 (1.245)	-0.073** (-2.061)	-0.092 (-1.532)						
Operational leasing	1.027 (0.970)	1.096 (0.606)	0.040 (0.0168)	0.465 (0.114)	0.240*** (2.841)	0.251* (1.744)						
Business services	0.859*** (7.374)	0.109 (0.547)	-0.738 (-1.156)	-0.397 (-3.956)	-0.051*** (-1.716)	-0.038* (-3.956)						
Legal services	3.065 (0.259)	2.964 (0.147)	-5.302 (-0.549)	-3.669 (-0.222)	-0.042 (-0.0616)	0.403 (0.345)						
Consulting	0.160 (0.754)	-0.867** (-2.389)	0.057 (0.0625)	0.266 (0.170)	-0.064*** (-3.670)	-0.043 (-1.416)						
Advertising	0.382 (0.912)	-1.118 (-1.560)	0.111 (0.0572)	1.153 (0.348)	-0.072** (-2.386)	-0.133** (-2.565)						
R&D	0.792*** (4.647)	-0.401 (-1.378)	3.766*** (4.510)	-1.930 (-1.353)	-0.019 (-1.232)	0.080*** (2.957)						

Estimations based on equation (16). Dependent variables are log of total inward sales and share of inward affiliate sales.

Estimation method: SUR. z statistics in parentheses.

Sector dummy variables are included in the regression, but are not reported in the table.

\*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level respectively.

Table 10: Regression results: Manufacturing outward affiliate sales share

	Log Distance	Language	Restrictiveness Index	
Total manufacturing	-0.170 (-1.231)	2.006*** (2.999)	-13.428*** (-2.691)	
Food	1.735*** (4.834)	9.857*** (4.658)	-42.955*** (-4.197)	
Chemicals	0.351 (1.397)	1.026 (1.520)	-4.128 (-0.863)	
Metals	-0.816*** (-3.403)	1.545** (2.373)	-23.640*** (-4.464)	
Machinery	0.462*** (2.958)	3.819*** (4.164)	-18.512*** (-2.671)	
Computer	-2.497 (-1.023)	-0.036 (-0.0450)	24.086 (1.552)	
Electrical equipment	-0.948** (-2.337)	-1.345* (-1.804)	7.859 (1.499)	
Transport equipment	-1.456*** (-2.818)	2.314*** (2.772)	13.785 (1.356)	
	Log GDP	Similarity Index	Corporate tax	Observations
Total manufacturing	0.759*** (3.356)	-7.281*** (-3.674)	-0.050 (-1.315)	456
Food	-6.141*** (-5.080)	6.382 (1.543)	0.413*** (4.186)	
Chemicals	2.353*** (3.885)	-15.037*** (-5.873)	-0.186*** (-3.199)	
Metals	0.212 (0.496)	-3.728 (-1.279)	0.010 (0.224)	
Machinery	0.151 (0.287)	-3.805 (-1.244)	-0.017 (-0.335)	
Computer	2.099*** (4.024)	2.756 (0.737)	-0.094 (-0.891)	
Electrical equipment	0.995 (1.472)	-0.817 (-0.245)	-0.148* (-1.666)	
Transport equipment	2.718*** (3.819)	-14.539*** (-4.729)	-0.138 (-1.556)	

Estimations based on equation (15). Dependent variable is share of outward affiliate sales in total outward sales.

Estimation method: GLM model. Robust z statistics in parentheses.

Sector dummy variables are included in the regression, but are not reported in the table.

\*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level respectively.

Table 11: Regression results: Manufacturing inward affiliate sales share

	Log Distance	Language	Restrictiveness Index	
Total manufacturing	0.165*** (2.759)	-0.103 (-0.516)	-18.285*** (-4.986)	
Food	-1.049 (-1.503)	-1.312 (-1.322)	14.314 (0.672)	
Chemicals	-0.717*** (-3.211)	-2.430*** (-5.227)	-20.771*** (-3.218)	
Metals	0.190 (0.659)	5.758*** (6.913)	-24.809*** (-2.690)	
Machinery	-1.217*** (-4.838)	-0.573 (-0.516)	-39.851*** (-7.420)	
Computer	-0.554 (-1.595)	-1.455* (-1.682)	-15.410 (-1.418)	
Electrical equipment	-0.175 (-0.556)	0.067 (0.0617)	-12.613*** (-2.675)	
Transport equipment	-1.676*** (-3.191)	-1.217 (-1.365)	-43.264*** (-5.632)	
	Log GDP	Similarity Index	Corporate tax	Observations
Total manufacturing	-0.701* (-1.798)	-0.192 (-0.169)	-0.050*** (-3.417)	415
Food	1.873 (1.338)	11.584** (2.315)	0.034 (0.595)	
Chemicals	-0.393 (-0.689)	2.958* (1.729)	-0.084** (-2.399)	
Metals	2.031*** (3.658)	-2.160 (-0.317)	0.152*** (4.448)	
Machinery	-1.005** (-2.345)	4.876 (1.197)	-0.010 (-0.238)	
Computer	0.588 (0.678)	-2.502 (-0.641)	-0.003 (-0.0407)	
Electrical equipment	0.078 (0.123)	-0.984 (-0.244)	-0.315** (-2.211)	
Transport equipment	3.110*** (5.144)	-23.413*** (-3.739)	-0.070 (-1.279)	

Estimations based on equation (16). Dependent variable is share of inward affiliate sales in total inward sales.  
 Estimation method: GLM model. Robust z statistics in parentheses.

Sector dummy variables are included in the regression, but are not reported in the table.

\*, \*\* and \*\*\* indicate statistical significance at the 10-percent level, 5-percent level, and 1-percent level respectively.