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Export-supporting FDI

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Abstract

Wholesale and retail trade affiliates owned by parent firms in manufacturing account for a considerable fraction of overall affiliate sales. Although quantitatively important, this Export-Supporting FDI (ESFDI) activity has received little attention in the literature. This paper includes ESFDI into a model of trade and horizontal FDI with heterogeneous firms. ESFDI is characterized by export-supporting distribution and service activities in the foreign market while production remains in the home country. This introduces some complementarity between trade and FDI. In the model falling trade costs lead to an increase in both overall trade and overall FDI activity. This provides a possible explanation for the simultaneous rise in trade and FDI in the data. An empirical analysis using German firm level FDI data confirms the quantitative importance of ESFDI. The data also support crucial implications of the theoretical model. Parents choosing ESFDI are smaller than firms choosing to produce in the foreign market. And the importance of ESFDI relative to horizontal FDI is strongest when variable trade costs are low.

JEL: *F12, F23*

Keywords: *exports, horizontal FDI, multinational companies, wholesale trade*

Non-technical summary

Wholesale and retail trade affiliates owned by manufacturing multinationals account for a considerable fraction of overall affiliate sales. Although quantitatively important, such Export-Supporting FDI (ESFDI) activities have received little attention in the literature. This paper provides a theoretical and empirical analysis of this quantitatively important type of FDI.

In the theoretical section ESFDI is introduced into a model of trade and FDI along the lines of Helpman, Melitz and Yeaple (2004). Firms with an ESFDI affiliate in a foreign market can use this affiliate to carry out distribution and importing activities at a lower cost compared to organizing these tasks from the headquarters. The two alternative modes of serving the foreign market are 'classic' exporting and horizontal FDI (HFDI). In the former case both production and distribution for the foreign market take place at home. In the latter, both activities are located directly in the destination market.

In the equilibrium of the model firms self select according to their productivity levels: the most productive firms choose HFDI and less productive firms choose 'classic' exporting. Firms with intermediate productivity levels choose ESFDI.

While 'classic' exporting and HFDI are substitutes, ESFDI involves both trade and FDI activity. It thus introduces some degree of complementarity between trade and FDI, which is in line with the empirical evidence.

The model also provides a possible mechanism for the conjecture of Neary (2009) that a fall in variable trade costs might have caused the simultaneous increase in trade and FDI over the 1990s. It is shown that a fall in variable trade costs leads to an unambiguous increase in ESFDI activity. In line with the data, this implies a simultaneous increase in trade and FDI activity.

The empirical section uses the MiDi data from the Deutsche Bundesbank to outline the importance of ESFDI in the FDI activity of German multinationals. It is shown that ESFDI is indeed a quantitatively important way of serving foreign markets: in many sectors there are more ESFDI affiliates than HFDI affiliates and in some sectors sales of ESFDI affiliates are even higher than sales of HFDI affiliates.

The data are also used to test two central implications of the model. To test the productivity ranking of parent firms, the six major destination markets of German FDI (France, Italy, US, Great Britain, Japan and Spain) are considered separately. Using parent size as proxy for productivity, the evidence is clearly supporting the ranking implied by the model.

The second implication of the model that is confirmed by the data is the impact of variable trade costs (proxied by geographical distance) on the relative importance of ESFDI. In line with the model it is shown that the fraction of ESFDI in overall FDI is the higher the closer the destination market is to Germany.

Nicht-technische Zusammenfassung

Ein beträchtlicher Anteil der Umsätze multinationaler Unternehmen im produzierenden Gewerbe wird von Tochterfirmen im Bereich des Gross- und Einzelhandels erzielt. Obgleich quantitativ bedeutsam, hat diese Form von 'export-unterstützenden' Direktinvestitionen (ESFDI) wenig Aufmerksamkeit in der Literatur erfahren. In diesem Aufsatz wird dieses Phänomen sowohl theoretisch als auch empirisch untersucht.

In der theoretischen Analyse wird ESFDI in ein Modell von internationalem Handel und ausländischen Direktinvestitionen (FDI) mit heterogenen Firmen nach dem Vorbild von Helpman, Melitz und Yeaple (2004) integriert. Unternehmen mit einer ESFDI-Niederlassung können diese nutzen, um Import- und Vertriebsaktivitäten zu geringeren Kosten durchzuführen als Firmen, die ihre Exportaktivitäten vom Unternehmenssitz aus organisieren. Alternativ zu ESFDI können Firmen den ausländischen Markt durch 'klassisches' Exportieren und horizontale Direktinvestitionen (HFDI) bedienen. Während im ersten Fall Produktion und Vertrieb im Heimatland lokalisiert sind, werden im letzteren beide Aktivitäten direkt im Zielland ausgeführt.

Das Modell impliziert eine Selbstselektion der Firmen nach ihren Produktivitätsniveaus: Die produktivsten Firmen wählen HFDI und weniger produktive Firmen wählen das 'klassische' Exportieren. Firmen mit mittleren Produktivitätsniveaus wählen ESFDI.

Die Analyse wirft ein neues Licht auf die Frage, ob Exporte und Direktinvestitionen Komplemente oder Substitute sind. Während 'klassisches' Exportieren und HFDI Substitute sind, beinhaltet ESFDI beide Aktivitäten und führt so ein Element der Komplementarität in das Modell ein. Diese Komplementarität ist in Übereinstimmung mit existierenden empirischen Resultaten.

Auch für die Vermutung von Neary (2009), dass sinkende variable Handelskosten in den 1990er Jahren zu einem simultanen Anstieg von Handel und Direktinvestitionen geführt haben, liefert das Modell eine mögliche Erklärung. Die Analyse zeigt, dass sinkende Handelskosten zu einem unzweideutigen Anstieg der ESFDI-Aktivitäten führen, was zu einem simultanen Anstieg von Handel und ausländischen Direktinvestitionen führt.

Im empirischen Teil der Analyse werden die MiDi Daten der Deutschen Bundesbank verwendet, um die quantitative Bedeutung von ESFDI für deutsche multinationale Unternehmen zu belegen. Es wird gezeigt, dass ESFDI in der Tat quantitativ wichtig ist: In vielen Sektoren gibt es mehr ESFDI-Töchter als HFDI-Töchter und in einigen Sektoren haben diese sogar höhere Umsätze als die HFDI-Töchter.

Die Daten werden darüber hinaus verwendet, um zwei wichtige Vorhersagen des Modells zu testen. Das Model impliziert, dass produktivere Firmen tendenziell HFDI wählen sollten. Diese Vorhersage wird für die sechs wichtigsten Zielländer (Frankreich, Italien, Vereinigte Staaten, Großbritannien, Japan und Spanien) separat überprüft und erfolgreich bestätigt. Die zweite getestete Vorhersage des Modells bezieht sich auf den Einfluss variabler Handelskosten (approximiert durch geographische Distanz) auf die Bedeutung von ESFDI relativ zu HFDI. Wie vom Model vorhergesagt, ist der Anteil von ESFDI in den gesamten FDI-Aktivitäten umso höher, je näher die Zielmärkte an Deutschland liegen.

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1 Introduction

The literature on the Foreign Direct Investment (FDI) activity focuses almost exclusively on production activities in foreign countries.[1] Despite their quantitative importance, FDI activities that focus on distribution of goods imported from the parent have been widely ignored by the literature.[2] I label this type of activities 'Export-Supporting' FDI (ESFDI).

To see the quantitative importance of ESFDI, consider the sales of wholesale and retail affiliates owned by *manufacturing* parents as a proxy for ESFDI. Taking the German example, Table 1 displays sales of foreign affiliates owned by parents in the manufacturing sector in 2001.[3] The sales volume is reported by sector of the parent and by sector of the affiliate. Two clear patterns stand out. First, the largest part of foreign sales is accounted for by affiliates that belong to the same manufacturing sector as the parent firm (the diagonal), while the off-diagonal elements are rather small. Second, the only column with high volumes is column 'Who/Ret', which represents sales of affiliates in the wholesale and retail sector. The last column displays the ratio of sales by wholesale affiliates over the sales of affiliates that are in the same manufacturing sector as their parent. Ratios tend to be roughly between 0.3 and 1. This shows that serving foreign markets via wholesale affiliates is indeed a quantitatively important strategy for German multinational companies (MNCs) in the manufacturing sector.[4]

Most of the theoretical and empirical literature on FDI focuses on the location decision of *production*. The pattern in the table suggests, however, that FDI in 'export-supporting' activities plays an important role for the investment strategy of manufacturing parents. The aim of this paper is to analyze this phenomenon both theoretically and empirically.

In the model developed in section 3, the process of providing consumers with a final good re-

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[1] See e.g. Markusen and Maskus (2003) for a survey of the literature.

[2] An important exception is work by Head and Ries (2001). Their paper and other related articles will be discussed below.

[3] The data will be described below, it is taken from a confidential firm-level data set of the Deutsche Bundesbank, which contains the universe of German outward FDI (above a reporting threshold).

[4] Using data from the US Bureau of Economic Analysis, Hanson, Mataloni, and Slaughter (2001) find a very similar pattern for sales of affiliates owned by US manufacturing parents.

Sales of foreign affiliates by sector of the parent and by sector of the affiliate in 2001

sector	affiliate												
parent	DA	DB/DC	DE	DG	DH	DI	DJ	DK	DL	DM	DN	Who/Ret	ratio
Food DA	**3685**			*	*							**2829**	0.77
Textiles DB/DC		**2656**			*		*		*		117	**12437**	4.68
Paper DE			**3541**	*	*		*					**1977**	0.56
Chemicals DG				**63723**	209	*		277	382	*		**18983**	0.30
Plastic DH	*	16	36	*	**8508**		43	10	49	1747	*	**1940**	0.23
Minerals DI		143	*	*	80	**5040**	*	38	*		*	**736**	0.15
Metal DJ		*		*	179	*	**8723**	158	8	655	*	**3599**	0.41
Machinery DK			7	2897	465	*	879	**17550**	850	1420		**18350**	1.05
Electr. Equip. DL		*		*	20	*	41	3342	**35444**	6961		**14714**	0.42
Transp. Equip. DM		*			30	*	142	167	364	**163521**	293	**126118**	0.77
Other Mfg. DN						*	*				**527**	**891**	1.69

Table 1: Sales of foreign affiliates by sector of the German manufacturing parent and by sector of the foreign affiliate in 2001 (in million Euro). Sectors DA-DN are manufacturing sectors (for full description see, Table 2 in the appendix) sector Who/Ret is wholesale and retail. The vast majority of sales is reported either by affiliates in the same manufacturing sector as the parent or by affiliates in wholesale and retail. Under 'ratio' the ratio of affiliate sales in the wholesale and retail sector (column 'Who/Ret') to affiliate sales in the parent sector (diagonal) is reported. The stars represent (small) positive entries that are omitted to assure anonymity of the firms.

quires both production and distribution related tasks, which may be carried out in separate locations. Firms can choose to carry out production and distribution for the foreign market in the headquarters. I label this case 'classic' exporting. Alternatively, firms can choose to keep production at home but shift tasks like importing and distributing goods to an ESFDI affiliate in the foreign market. This ESFDI investment comes at an additional fixed cost but reduces the variable distribution cost abroad to the level of local firms. An important feature of ESFDI is that parents choose this alternative not to substitute exports but, on the contrary, to export *more*. Finally, firms can choose to open an HFDI affiliate which carries out production and distribution abroad. This alternative is the most costly in terms of fixed cost but reduces both the variable trade cost and the distribution cost to the level of the local firms.

These three alternatives of serving the foreign market are included into a model of trade and FDI with heterogeneous firms along the lines of Helpman, Melitz, and Yeaple (2004).[5] Under appropriate assumptions on the cost structure, the equilibrium is characterized by a productivity ranking similar to the one in their model: the most productive firms do HFDI, the least productive firms (that are still productive enough to serve the foreign market) choose 'classic' exporting. The novel option, ESFDI, is chosen by parents with intermediate productivity levels. These parents are productive enough to pay the fixed cost necessary to open an ESFDI affiliate in the foreign market, but their sales volume does not justify a replication of their production facilities abroad.

The focus of the theoretical analysis is on the tradeoff between the three strategies of serving the foreign market. It turns out that a fall in variable trade costs makes ESFDI more attractive to both 'classic' exporters and HFDI firms. ESFDI thus gains on both possible margins when variable trade costs fall: on the one hand, the incentive to avoid variable trade costs by pro-

[5]Technically, the modeling is also closely related to Chaney (2008) and Melitz (2003).

ducing in the destination market (HFDI) decreases which leads more of the productive firms to switch to ESFDI (*proximity-concentration effect*). On the other hand, the volume of exports per exporter expands. The larger volume makes it profitable for some firms that were doing 'classic' exporting before, to pay the higher fixed cost of doing ESFDI in order to improve their export-efficiency (*expansion effect*). So the number of parents choosing ESFDI unambiguously increases when variable trade costs fall.

Since ESFDI involves trade and FDI at the same time, a fall in variable trade costs leads to a simultaneous increase in overall export *and* overall FDI activity. This holds true for both the number of affiliates and their sales volumes as measures of FDI activity.

The model thus opens a new perspective on the issue whether FDI and exports are complements or substitutes. While standard proximity-concentration models of trade and FDI imply that the two are substitutes, most empirical studies find the opposite (see e.g. Blonigen (2001) for a survey). Along these lines Neary (2009) argues that the implication of substitutability is clearly at odds with the data: contrary to the predictions of proximity-concentration models, the 1990s have been characterized by substantial falls in trade cost and a *simultaneous increase* in both trade and FDI activity.[6] From within a fairly standard monopolistic competition, proximity-concentration framework, the model of ESFDI provides a natural rational for this pattern: when variable trade costs fall, more firms choose ESFDI which implies that trade and FDI activity increase *simultaneously*.[7]

Broadening the analysis of an earlier version (Krautheim (2007)), this paper uses the MiDi firm-level database from the Deutsche Bundesbank to analyze different aspects of ESFDI and its relation to HFDI. The dataset I use contains the universe of German FDI activity from 1989 to 2005. The great advantage of the MiDi database is that for outward FDI it contains information on the sector of both the parent and the affiliate. It allows thus to distinguish between ESFDI and HFDI.

The analysis reveals that ESFDI (measured by the number of affiliates and affiliate sales) plays indeed a quantitatively important role in the FDI activity of German manufacturing firms. The evolution of ESFDI and HFDI are analyzed as well as the particular importance ESFDI plays for German investment in Western European markets.

[6] He conjectures that falling trade costs were the driving force behind these patterns and proposes two directions of research to address this positive correlation over time: export-platform FDI and oligopolistic competition with takeovers.

[7] An alternative way of generating complementarity is to assume that HFDI requires some trade in intermediate products (see Pontes (2007), Kleinert and Toubal (2008), Bombarda (2007) and Irarrazabal, Moxnes, and Opromolla (2009)). I view the two mechanisms as complementary: both, trade in intermediate products and ESFDI are observed in the data and intermediate goods trade could be easily added to the model of ESFDI without altering the main results and tradeoffs. To focus the analysis on ESFDI, I restrict the model to the case without trade in intermediate inputs.

An important testable implication of the model is the clear productivity ranking between HFDI and ESFDI parents. In a given market (and everything else equal) parents choosing HFDI should be more productive than firms choosing ESFDI. I consider the six major destination markets of German FDI (France, Italy, US, Great Britain, Japan and Spain). Using parent size as proxy for productivity, the evidence is clearly supporting the ranking implied by the model.

The second important testable implication of the model is the impact of a fall in variable trade costs on the tradeoff between ESFDI and HFDI. The model implies that lower variable trade costs should lead to an increase in ESFDI and a decrease in HFDI. Using distance as a proxy for variable trade costs, it is not possible to estimate two separate gravity-type equations for ESFDI and HFDI (country fixed effects would have to be introduced, which would be perfectly collinear with distance). I thus use the model to derive predictions of the impact of distance on the importance of ESFDI *relative* to overall FDI activity. It turns out that this ratio only depends on the different trade costs and is independent of any other destination market characteristics. The empirical analysis shows that in line with the model, the share of ESFDI activity in overall FDI activity (here: ESFDI + HFDI) decreases in distance. So the closer markets are (e.g. in Western Europe) the higher is the share of ESFDI in overall FDI activity.

The rest of the paper is structured as follows. The next section reviews the related literature. Section 3 presents the model and its equilibrium, Section 4 derives and discusses the main theoretical results. Sections 5, 6 and 7 contain the empirical analysis.

2 Related Literature

Very few empirical studies in the literature focus explicitly on the analysis of 'export-supporting' FDI activities. Two notable exceptions on the empirical side are Yamawaki (1991) and Head and Ries (2001), who use data on Japanese MNCs that includes information on the sector of the foreign affiliate to determine the impact of different FDI types on a firm's exports. In line with the predictions of the model of ESFDI, they find that the presence of distribution affiliates tends to increase aggregate exports from Japan into the destination market.

Evidence of the quantitative importance of ESFDI activity can also be found in some empirical works which do not address ESFDI explicitly. An early study for the US is Zeile (1997). Using the benchmark survey of the Bureau of Economic Analysis (BEA) on foreign direct investment in the US, he delivers a set of stylized facts about US intrafirm trade. He finds that about one fifth of overall US imports goes via a wholesale affiliate of the exporting foreign firm. In a later study, Zeile (2003) provides more details about these flows: the intrafirm imports of wholesale affiliates mainly consist of heterogeneous manufactured products. In most years, the imports from the parent groups account for more than three-fourth of the total imports by wholesale affiliates. He also points out that more than 96% of the imports of US wholesale affiliates from their foreign parent groups were goods for resale.

Hanson, Mataloni, and Slaughter (2001) use the BEA data to provide additional information on the structure of US FDI. Looking at majority-owned, non-bank affiliates of U.S.-headquartered corporations, they find the same pattern for the US as Table 1 displays for Germany: the largest part of affiliate sales is by affiliates in the same sector as the parent company. But the share of wholesale trade affiliates in total affiliate sales in manufacturing is considerable and reaches from 9.7% for transport equipment, over 28% in electrical equipment up to 38% in industrial machinery (see Table 9 in their paper).

Using the MiDi data, Buch, Kleinert, Lipponer, and Toubal (2005) provide some evidence for the relevance of ESFDI for German manufacturers. Their Table 3 plots the number of affiliates (summed from 1989-2001) in the same way as Table 1 plots sales for 2001: almost all affiliates are either in the same industry as the parent firm or in wholesale and retail trade.

Additional insights from the MiDi data about wholesale FDI in German manufacturing can be found in Kleinert and Toubal (2005) and Kleinert and Toubal (2006). These papers focus on the trade-off between trade and horizontal FDI along the lines of Helpman, Melitz, and Yeaple (2004). Since the MiDi data do not contain information on trade volumes, the sales of wholesale affiliates are used as a proxy for trade. They thereby provide several insights on the particularities of wholesale FDI, that also support the model of ESFDI proposed in this paper. Kleinert and Toubal (2006) find that wholesale affiliates have systematically lower sales than manufacturing affiliates. Kleinert and Toubal (2005) provide evidence for the proximity-concentration forces between horizontal and wholesale FDI. They find that the probability of a parent firm to do production FDI instead of wholesale FDI increases in distance and decreases in a (size adjusted) measure of average sectoral fixed costs. Both findings are in line with the model proposed in this paper. In addition they find that the wage differential and market size also matter.[8]

On the theoretical side recent work by Felbermayr and Jung (2008) includes wholesale FDI in the analysis. Motivated by a strand of the business literature, that underlines the importance of trade intermediaries, they introduce an additional way of exporting into the Melitz (2003) model: exporting in co-operation with a general importer. They interpret the fixed cost of exporting in the Melitz-model as the cost of setting up a wholesale affiliate and then analyze the trade-off between the two modes of serving the foreign market. They do not consider the possibility of production FDI and do not address any issues related to trade-offs between different types of

[8]In ongoing revision of Kleinert and Toubal (2005), the authors confirm their empirical results with more recent data. In addition, they develop a simplified partial equilibrium version of the model of ESFDI with quasi-linear preferences à la Melitz and Ottaviano (2008). Such a partial equilibrium structure and the quasi-linear preferences can be used to take into account wage differences and to determine the effect of the ‘toughness’ of competition on the probability to choose wholesale instead of production FDI.

FDI which are the focus of this paper.[9]

While export-supporting forms of FDI have not found much attention in the literature, the issue of complementarity and substitutability between trade and FDI and its apparent contradiction to proximity-concentration models has interested many authors. Blonigen (2001) gives an overview over the large literature, which (quite in line with the model of ESFDI) finds strong evidence for complementarity on the aggregate level. Blonigen (2001) (and in the same spirit Swenson (2004)) shows that these findings are caused by aggregation. Going to the product level, they find evidence for substitutability between exporting and *producing* abroad. These findings are exactly in line with the predictions of the model of ESFDI: in the presence of ESFDI, one should find complementarity between trade and FDI on the aggregate level, while on the product level exporting and production abroad remain substitutes.

3 The Model

3.1 The Economy

Basic structure: The world economy consists of N countries with L_n denoting the population in country n. There are $H+1$ sectors, H of which are producing differentiated products, while sector zero produces a homogeneous good with a constant returns to scale technology. The homogeneous good is freely traded and is used as the numeraire with its price normalized to one. Only equilibria are considered where all countries produce the homogeneous good implying that wages are equalized across countries and can be normalized to one. Labor is the only input in the production process. Each worker holds a share of a perfectly diversified portfolio of all firms in the world.

Preferences: The workers are all identical. They share the same preferences over consumption of the goods produced in the $H+1$ sectors:

$$U = q_0^{\mu_0} \prod_{h=1}^{H} \left(\int_{X_h} (q_h^x)^{\frac{\sigma_h - 1}{\sigma_h}} dx \right)^{\frac{\sigma_h}{\sigma_h - 1}\mu_h}$$

where q_h^x is the quantity of variety x of good (sector) h, q_0 is the quantity of the homogeneous good consumed, $\mu_0 + \sum_{h=1}^{H} \mu_h = 1$ and $\sigma_h > 1$ is the elasticity of substitution between varieties of sector h. In the subsequent analysis, sectoral indices will be dropped where this causes no confusion.

Firms: The number of firms in each sector is assumed to be fixed and proportional to country size. No firm entry and exit takes place on the national level. Production in the differentiated

[9] Their approach could in fact be used to develop a micro foundation for the cost difference between 'classic' exporting and ESFDI assumed in this paper.

good sectors takes place according to a standard increasing returns to scale technology. The cost for a firm with productivity φ in country i of producing q units of output and to sell q units in the local market is given by $c(q) = \frac{q}{\varphi} + f_{ii}$.

Firms differ in their productivity levels which are assumed to be drawn from a Pareto distribution with parameter γ i.e. $P(\tilde{\varphi} < \varphi) = F(\varphi) = 1 - \varphi^{-\gamma}$. Without loss of generality the minimum productivity level is normalized to one ($\varphi_{min} \equiv 1$). Furthermore, we have to impose $\gamma > (\sigma - 1)$. This assumption assures that in equilibrium the mean of the firm size distribution is finite.

Tasks, location choices and the cost structure: The business of a firm consists of two tasks: production and distribution. To serve a foreign market, firms have three different location choices for performing these tasks. Firms choosing 'classic' exporting have to pay a fixed cost of exporting f_{ij}^x and a variable iceberg trade cost: τ_{ij} units need to be shipped to have one unit arriving at the border of the destination country. As standard, $\tau_{ij} > 1 \ \forall\ j \neq i$ and $\tau_{ii} = 1$. In addition, 'classic' exporters face a variable distribution cost δ_{ij} which is also of the iceberg type ($\delta_{ii} = 1$ and $\delta_{ij} > 1 \ \forall\ j \neq i$).[10]

When firms choose ESFDI they face a fixed cost of setting up a service affiliate in the destination country f_{ij}^d. The firm can transfer the distribution activities to this ESFDI affiliate and then faces the same distribution cost as the local firms, $\delta_{jj} = 1$.

The third alternative is to opt for horizontal FDI (HFDI) transferring both production and distribution for the foreign market into the foreign country. This requires a fixed cost f_{ij}^f of 'replicating' the firm's activities in the foreign market. These firms then face the same distribution and variable trade costs as local firms: $\delta_{jj} = 1$ and $\tau_{jj} = 1$. Thus, a firm in country i with productivity φ faces the following alternative costs of selling quantity q in country j:

$$c_x(q) = q\ \frac{\tau_{ij}\delta_{ij}}{\varphi} + f_{ij}^x \qquad c_d(q) = q\ \frac{\tau_{ij}}{\varphi} + f_{ij}^d \qquad c_f(q) = q\ \frac{1}{\varphi} + f_{ij}^f$$

The indices stand for 'classic' exporting (x), transferring distribution management to an ESFDI affiliate (d) and HFDI where both tasks are carried out in the foreign market (f).

To determine what type of firms will choose which strategy to serve the foreign market, the structure of fixed and variable cost plays a crucial role. Following Helpman, Melitz, and Yeaple (2004), I will focus on cost structures which allow the three alternative ways to coexist in equilibrium. I impose the following condition which is a generalization of their equation (1):

$$f_{ij}^x\ \tau_{ij}^{\sigma-1}\ \delta_{ij}^{\sigma-1} < \tau_{ij}^{\sigma-1}\ \frac{f_{ij}^d - f_{ij}^x}{1 - \delta_{ij}^{1-\sigma}} < \frac{f_{ij}^f - f_{ij}^d}{1 - \tau_{ij}^{1-\sigma}} \tag{1}$$

[10] To keep the model as parsimonious as possible an iceberg distribution cost is assumed. It would be possible to provide a micro foundation of this cost along the lines of Felbermayr and Jung (2008) who explicitly model a distribution sector where the producer has to share its profits with a local distributor.

Since this condition might seem a bit arbitrary, it is important to note that for the main results of the paper to hold (in particular the productivity ranking discussed in section 3.2) it is sufficient to assume $f_{ij}^x < f_{ij}^d < f_{ij}^f$.[11] In this case it would be possible, however, that some modes of serving the foreign market are not chosen by any firm. Condition (1) assures that all three modes coexist, which is what we observe in the data. This condition thus allows to focus on the empirically relevant case. All other cases (e.g. no trade, no ESFDI, only HFDI) could be easily addressed in this framework but appear less relevant.

Demand: With the wages in all countries normalized to one, the total labor income in j is given by L_j. Since firms make positive profits the second component of income consists of dividends paid on the shares of the global fund holding all firms. Dividends received by workers in country j are given by $(L_j/L)\Pi$ where Π are world profits and L stands for world population. Demand in j for a given variety imported from i is given by

$$q_{ij} = A_j \; p_{ij}(\varphi)^{-\sigma} \qquad \text{with} \qquad A_j = \mu \left(1 + \frac{\Pi}{L}\right) L_j \, (P_j)^{\sigma-1}$$

where P_j is the welfare based price index.

Prices, profits and productivity cutoffs: Facing isoelastic demand curves, firms charge a constant mark-up over marginal costs in each market they choose to serve: $p_{ij}(\varphi) = \frac{\sigma}{\sigma-1} \, mc(\varphi)$. Marginal costs are given by $\frac{1}{\varphi}$ for serving the domestic market, and by $\frac{\tau_{ij}\delta_{ij}}{\varphi}$, $\frac{\tau_{ij}}{\varphi}$ and $\frac{1}{\varphi}$ for the respective strategies x, d, and f of serving the foreign market. A firm serving the domestic market only generates profits of $\pi_{ii}(\varphi) = B_i \; \varphi^{\sigma-1} - f_{ii}$. With $B_i = \frac{A_i}{\sigma} \left(\frac{\sigma-1}{\sigma}\right)^{\sigma-1}$. In addition to this, firms can make profits by serving one or more foreign markets (j):

$$\begin{aligned} \pi_{ij}^x(\varphi) &= B_j \left(\frac{\varphi}{\tau_{ij}\delta_{ij}}\right)^{\sigma-1} - f_{ij}^x \\ \pi_{ij}^d(\varphi) &= B_j \left(\frac{\varphi}{\tau_{ij}}\right)^{\sigma-1} - f_{ij}^d \\ \pi_{ij}^f(\varphi) &= B_j \; \varphi^{\sigma-1} - f_{ij}^f \end{aligned}$$

The profitability of the different options can be easily compared using Figure 1. The profits implied by the three different strategies are plotted as a function of the productivity ($\varphi^{\sigma-1}$) of the firms. The functions have a slope of $\left(\frac{B_j}{\tau_{ij}\delta_{ij}}\right)$, $\left(\frac{B_j}{\tau_{ij}}\right)$ and B_j respectively. Like in Helpman, Melitz, and Yeaple (2004) the model implies a productivity ranking, where the most productive firms choose HFDI and the less productive firms choose 'classic' exporting. New is the intro-

[11] This assumption can be easily justified. For example assume that f_{ij}^x represents some basic information acquisition cost. f_{ij}^d includes this information cost plus a fixed cost of opening a sales office and f_{ij}^f includes both costs plus the cost of setting up production capacity.

duction of ESFDI which is chosen by firms with intermediate productivity levels. The cutoff productivity levels of the different ways of serving the foreign market are denoted by $\bar{\varphi}^x_{ij}$, $\bar{\varphi}^d_{ij}$ and $\bar{\varphi}^f_{ij}$ respectively.[12]

3.2 Equilibrium

In order to derive the central equilibrium objects of the model, the equilibrium price index P_j and aggregate world profits Π are needed.[13] Later in the analysis it will turn out that aggregate world profits only depend on exogenous parameters of the model, Π will thus be treated as a constant from now on, which later on will turn out to be justified. Under the assumption that firm productivities are distributed Pareto, a closed form expression for the price index can be derived:[14]

$$P_j = E_j \theta_j. \tag{2}$$

Where θ_j is to be interpreted as an index of aggregate remoteness of country j and E_j collects constant terms. It is - along with all the other terms collecting constants in the following equations - reported in the appendix.

The profit functions for firms choosing different strategies to serve the foreign market that were spelled out above can be used together with (2) to derive the equilibrium cutoff productivity levels associated with the three possible strategies:

$$\begin{aligned}
\bar{\varphi}^x_{ij} &= G_j \; \theta_j^{-1} \; \tau_{ij} \; \delta_{ij} \; \left(f^x_{ij}\right)^{\frac{1}{\sigma-1}} && (3)\\
\bar{\varphi}^d_{ij} &= G_j \; \theta_j^{-1} \; \tau_{ij} \; \left(\frac{f^d_{ij} - f^x_{ij}}{1-\delta_{ij}^{1-\sigma}}\right)^{\frac{1}{\sigma-1}} && (4)\\
\bar{\varphi}^f_{ij} &= G_j \; \theta_j^{-1} \; \left(\frac{f^f_{ij} - f^d_{ij}}{1-\tau_{ij}^{1-\sigma}}\right)^{\frac{1}{\sigma-1}} . && (5)
\end{aligned}$$

[12] Figure 1 can be used to illustrate the role of condition (1). The simple fixed cost ranking $f^x_{ij} < f^d_{ij} < f^f_{ij}$ implies the intercepts of the profit functions. By construction, the slopes of the functions are steeper for the modes with higher fixed costs. It could be that the slopes are such that e.g. only ESFDI and HFDI are chosen. But already the simple ranking of the fixed costs assures that conditioned on the modes being chosen by some firms the more productive firms chose HFDI. The more complex condition (1) just assures that we are in the (realistic) case where all three modes coexist.

[13] The price index of varieties in a given sector in country j is defined as

$$P_j = \left(\sum_{k=1}^{N} L_k \left[\int_{\bar{\varphi}^x_{kj}}^{\bar{\varphi}^d_{kj}} \left(\frac{\sigma}{\sigma-1}\frac{\tau_{kj}\delta_{kj}}{\varphi}\right)^{1-\sigma} dF(\varphi) \;+\; \int_{\bar{\varphi}^d_{kj}}^{\bar{\varphi}^f_{kj}} \left(\frac{\sigma}{\sigma-1}\frac{\tau_{kj}}{\varphi}\right)^{1-\sigma} dF(\varphi) \;+\; \int_{\bar{\varphi}^f_{kj}}^{\infty} \left(\frac{\sigma}{\sigma-1}\frac{1}{\varphi}\right)^{1-\sigma} dF(\varphi) \right] \right)^{\frac{1}{1-\sigma}} .$$

[14] Where $\theta_j^{-\gamma} \equiv \sum_{k=1}^{N} L_k \left[\tau_{kj}^{-\gamma}\delta_{kj}^{-\gamma}\left(f^x_{kj}\right)^{-\frac{\gamma-(\sigma-1)}{\sigma-1}} \;+\; \tau_{kj}^{-\gamma}\left(1-\delta_{kj}^{1-\sigma}\right)^{\frac{\gamma}{\sigma-1}}\left(f^d_{kj}-f^x_{kj}\right)^{-\frac{\gamma-(\sigma-1)}{\sigma-1}} \;+\; \left(1-\tau_{kj}^{1-\sigma}\right)^{\frac{\gamma}{\sigma-1}}\left(f^f_{kj}-f^d_{kj}\right)^{-\frac{\gamma-(\sigma-1)}{\sigma-1}} \right].$

Under condition (1), one has $\bar{\varphi}_{ij}^{x} < \bar{\varphi}_{ij}^{d} < \bar{\varphi}_{ij}^{f}$ which assures that all three strategies of serving the foreign market are chosen by some firms.

With the equilibrium price index in (2) and the cutoff productivity levels, it is now possible to derive the relevant equilibrium objects of the analysis. Before, note that it is now also possible to derive equilibrium firm profits and to use these to derive an expression for equilibrium aggregate profits. This is done in appendix C. It turns out that aggregate world profits Π are indeed constant. We can thus state the following proposition:

Proposition 1 *Under the cost structure in* (1)*, firms self-select into their strategy of serving a foreign market according to their productivity levels. The most productive firms choose HFDI, firms with intermediate productivity levels choose ESFDI, firms with lower productivity export and the lowest productivity firms serve the domestic market only.*

Proof: This follows directly from equations (1) and (3) to (5). q.e.d.

The two most frequently used measures of FDI are the number of affiliates of firms from country i in country j and their sales. By construction, it will never be optimal for a firm to have two affiliates in the same country (i.e. to engage in ESFDI and HFDI at the same time. This is because the ESFDI activities are already included in the HFDI step). Thus the number of firms opting for some type of FDI maps one-to-one into the number of affiliates.[15]

The mass of firms choosing ESFDI to serve market j is given by: $n_{ij}^{d} = \int_{\bar{\varphi}_{ij}^{d}}^{\bar{\varphi}_{ij}^{f}} dF(\varphi)$. The mass of firms choosing the other modes is obtained analogously:

$$n_{ij}^{x} = K_j \, \theta_j^{\gamma} \, \tau_{ij}^{-\gamma} \left[\delta_{ij}^{-\gamma} \, \left(f_{ij}^{x}\right)^{-\frac{\gamma}{\sigma-1}} - \left(\frac{f_{ij}^{d} - f_{ij}^{x}}{1 - \delta_{ij}^{1-\sigma}} \right)^{-\frac{\gamma}{\sigma-1}} \right] \tag{6}$$

$$n_{ij}^{d} = K_j \, \theta_j^{\gamma} \left[\left(\tau^{\sigma-1} \left[\frac{f_{ij}^{d} - f_{ij}^{x}}{1 - \delta_{ij}^{1-\sigma}} \right] \right)^{-\frac{\gamma}{\sigma-1}} - \left(\frac{f_{ij}^{f} - f_{ij}^{d}}{1 - \tau_{ij}^{1-\sigma}} \right)^{-\frac{\gamma}{\sigma-1}} \right] \tag{7}$$

$$n_{ij}^{f} = K_j \, \theta_j^{\gamma} \left(\frac{f_{ij}^{f} - f_{ij}^{d}}{1 - \tau_{ij}^{1-\sigma}} \right)^{-\frac{\gamma}{\sigma-1}} . \tag{8}$$

Given the assumptions on the cost structure in (1) all these measures are positive i.e. in equilibrium each option to serve the foreign market is chosen by some firms.

Sales of a firm from country i with productivity φ in the foreign market j are given by $s_{ij}(\varphi) = p_{ij}(\varphi) \; q_{ij}(\varphi)$. The optimal price setting of the firm, the demand function and the

[15]In the MiDi data used in the empirical section affiliates only have to report their main activity (production or distribution). Many affiliates report production as their main activity but also carry out distribution activities. The assumption hat HFDI includes both production and distribution appears thus justified.

equilibrium price index in (2) can be used to find the equilibrium sales of a firm conditioned on the way it chooses to serve the foreign market:

$$s_{ij}^{x}(\varphi) = J_j \theta_j^{\sigma-1} \tau_{ij}^{1-\sigma} \delta_{ij}^{1-\sigma} \varphi^{\sigma-1} \qquad s_{ij}^{d}(\varphi) = J_j \theta_j^{\sigma-1} \tau_{ij}^{1-\sigma} \varphi^{\sigma-1} \qquad s_{ij}^{f}(\varphi) = J_j \theta_j^{\sigma-1} \varphi^{\sigma-1}$$

Where J_j collects constants and is reported in the appendix. The aggregate sales volume of ESFDI affiliates in market j is given by $S_{ij}^{d} = \int_{\bar{\varphi}_{ij}^{d}}^{\bar{\varphi}_{ij}^{f}} s_{ij}^{d}(\varphi)\ dF(\varphi)$. Analogously for the other modes:

$$S_{ij}^{x} = M_j\ \theta_j^{\gamma}\ \tau_{ij}^{-\gamma}\ \delta^{1-\sigma} \left[\delta_{ij}^{\sigma-1-\gamma}\ \left(f_{ij}^{x}\right)^{\frac{\sigma-1-\gamma}{\sigma-1}} - \left(\frac{f_{ij}^{d} - f_{ij}^{x}}{1-\delta_{ij}^{1-\sigma}} \right)^{\frac{\sigma-1-\gamma}{\sigma-1}} \right] \tag{9}$$

$$S_{ij}^{d} = M_j\ \theta_j^{\gamma}\ \tau_{ij}^{1-\sigma} \left[\left(\tau^{\sigma-1} \left[\frac{f_{ij}^{d} - f_{ij}^{x}}{1-\delta_{ij}^{1-\sigma}} \right] \right)^{\frac{\sigma-1-\gamma}{\sigma-1}} - \left(\frac{f_{ij}^{f} - f_{ij}^{d}}{1-\tau_{ij}^{1-\sigma}} \right)^{\frac{\sigma-1-\gamma}{\sigma-1}} \right] \tag{10}$$

$$S_{ij}^{f} = M_j\ \theta_j^{\gamma} \left(\frac{f_{ij}^{f} - f_{ij}^{d}}{1-\tau_{ij}^{1-\sigma}} \right)^{\frac{\sigma-1-\gamma}{\sigma-1}}. \tag{11}$$

The constant M_j is reported in the appendix. By (1) aggregate sales of all three strategies are positive. These results allow to state the following proposition.

Proposition 2 *Under the cost structure in* (1),

(i) relative to their sales volumes classic exporters to market j are more numerous than ESFDI affiliates selling in market j, i.e. $\frac{n_{ij}^{x}}{n_{ij}^{d}} > \frac{S_{ij}^{x}}{S_{ij}^{d}}$ *and*

(ii) relative to their sales volumes ESFDI affiliates selling in j are more numerous than HFDI affiliates in j, i.e. $\frac{n_{ij}^{d}}{n_{ij}^{f}} > \frac{S_{ij}^{d}}{S_{ij}^{f}}$.

Proof: This follows directly from equations (6) to (11). q.e.d.

This proposition simply reflects the feature of the model that exporters have lower sales in market j than ESFDI firms, which have in turn lower sales in j than HFDI firms.[16] There are two reasons for this pattern. First, modes with lower fixed costs are chosen by firms with lower productivities which thus choose lower sales. Second, for a given productivity level when higher fixed costs need to be recovered, firms choose higher sales volumes. This can be easily seen considering e.g. firms at the cutoff between ESFDI and HFDI: they are indifferent between the two but when they choose HFDI they need higher sales to recover the higher fixed costs.[17]

[16] Kleinert and Toubal (2006) show that for production and wholesale affiliates this pattern can be found in the MiDi data.

[17] This result will be referred to several times in the empirical section when the effect of a reporting threshold on affiliate size is discussed. Since ESFDI affiliates tend to be smaller than HFDI affiliates, they are affected disproportionately by an increase in the reporting threshold.

3.3 The Role of Variable Trade Costs

This subsection presents three propositions which summarize the main theoretical results of the model. In particular, they determine to which extent and why trade and FDI are complements in the model and present testable implications.

The following proposition summarizes the impact of a fall in variable trade costs on the measure of firms self-selecting into the different strategies to serve the foreign market and their sales volume in the foreign market.[18]

Proposition 3 *Under the cost structure in* (1)*, a fall in variable trade costs between market* i *and market* j *implies for country* i

(i) an increase in the measure of 'classic' exporters to j*, an increase in the measure of firms choosing ESFDI to serve market* j *and a decrease in the measure of firms using HFDI to serve market* j*, i.e.* $\frac{\partial n_{ij}^x}{\partial \tau_{ij}} < 0$, $\frac{\partial n_{ij}^d}{\partial \tau_{ij}} < 0$ *and* $\frac{\partial n_{ij}^f}{\partial \tau_{ij}} > 0$.

(ii) an increase in the sales volume of 'classic' exporters in j*, an increase in the sales volume of ESFDI affiliates in* j *and a decrease of the sales volume of HFDI affiliates in* j*, i.e.* $\frac{\partial S_{ij}^x}{\partial \tau_{ij}} < 0$, $\frac{\partial S_{ij}^d}{\partial \tau_{ij}} < 0$ *and* $\frac{\partial S_{ij}^f}{\partial \tau_{ij}} > 0$

Proof: see appendix.[19]

It is an important feature of the model that ESFDI implies both trade and FDI activity at the same time. The following proposition summarizes the impact of variable trade costs on *overall* trade and *overall* FDI activity.

Proposition 4 *Under the cost structure in* (1)*, a fall in variable trade costs between market* i *and market* j *implies for overall exports and FDI activity originating in* i

(i) an increase in both the measure of firms exporting to country j *('classic' exporters and ESFDI parents) and the measure of firms with an affiliate in country* j *(ESFDI and HFDI parents), i.e* $\frac{\partial (n_{ij}^x + n_{ij}^d)}{\partial \tau_{ij}} < 0$ *and* $\frac{\partial (n_{ij}^d + n_{ij}^f)}{\partial \tau_{ij}} < 0$

(ii) an increase in both the volume of export sales in country j *(sales of 'classic' exporters and ESFDI affiliates) and the sales volume of affiliates in country* j *(ESFDI and HFDI affiliates), i.e* $\frac{\partial (S_{ij}^x + S_{ij}^d)}{\partial \tau_{ij}} < 0$ *and* $\frac{\partial (S_{ij}^d + S_{ij}^f)}{\partial \tau_{ij}} < 0$

[18]Note that in the model each firm has at most one affiliate in a foreign market, so that the measure of parents in i with a particular type of affiliate in country j equals the measure of i affiliates of this type in j.

[19]For the comparative statics, I follow Chaney (2008) in assuming that no country is large compared to the other countries and the number of countries is sufficiently large to assure that changes in the variable cost of trade with one of the trading partners have no first-order effect on the index of overall remoteness of the importing country θ_j.

Proof: see appendix.

Proposition 3 and 4 summarize the main theoretical results of the model. Before turning to their interpretation, it is convenient to state the following proposition, which will be useful in the empirical analysis:

Proposition 5 *Under the cost structure in* (1)*, a fall in variable trade costs between market i and market j implies for FDI from i to j*

(i) an increase in the measure of ESFDI affiliates relative to the measure of overall FDI affiliates i.e. $\frac{\partial[n_{ij}^d/(n_{ij}^d+n_{ij}^f)]}{\partial\tau_{ij}} < 0$.

(ii) an increase in the sales volume of ESFDI affiliates relative to overall affiliate sales i.e. $\frac{\partial[S_{ij}^d/(S_{ij}^d+S_{ij}^f)]}{\partial\tau_{ij}} < 0$.

Proof: see appendix.

4 Interpretation of the Theoretical Results

This section discusses the main theoretical results on the tradeoff between ESFDI and HFDI, complementarity between trade and FDI as well as the conjecture of Neary (2009) that a fall in trade costs might have led to the simultaneous increase in trade and FDI. In addition, testable implications are presented and discussed.

4.1 The main tradeoffs and the increase of trade and FDI

Proposition 3 summarizes the role variable trade costs play for the main tradeoffs in the model. Both for the number of firms serving market j as well as for the sales in market j, the model implies that a fall in variable trade costs unambiguously increases 'classic' exporting and ESFDI while HFDI decreases.

There are two effects shaping this result. The first is the *proximity-concentration effect* which governs the tradeoff between HFDI and ESFDI. The incentive to pay the high fixed cost of HFDI is to avoid the variable trade cost. When this cost falls, less firms have an incentive to choose HFDI, so the less productive HFDI firms switch to ESFDI.

The second important effect is the *expansion effect*. Given lower variable trade costs all firms choose to increase their sales volumes. For the 'classic' exporters just below the ESFDI cutoff, it now pays to invest the higher fixed cost of ESFDI.[20]

Taking the two effects together it turns out that ESFDI gains on both possible margins when

[20]The same effect leads additional firms to newly enter the export market starting as 'classic' exporters. Proposition 3 shows that the net effect is positive both for the number of firms as for the sales volumes. So the loss of firms switching from 'classic' exporting to ESFDI is more than compensated by new exporters.

variable trade costs fall. On both sides of the productivity distribution firms start ESFDI: HFDI firms close to the cutoff have less reason to avoid variable trade costs and thus opt for ESFDI. On the other side of the distribution, 'classic' exporters close to the cutoff react to lower variable costs by increasing their sales volume, which then justifies to pay the higher fixed cost of ESFDI. Figure 2 illustrates the effect of a fall in variable trade costs on the number of firms. ESFDI gains on both possible margins, while the number of HFDI affiliates decreases and the number of 'classic' exporters increases. The same holds true for the case of sales volumes, which is illustrated in Figure 3.[21]

This unambiguous increase in ESFDI delivers a possible rational for the conjecture of Neary (2009) that falling trade costs might have been the driving force behind the simultaneous increase in trade and FDI during the 1990s. While trade and HFDI remain substitutes in the model, trade and ESFDI clearly are complements. Proposition 4 shows that the effect of falling variable trade costs does indeed increase overall trade and overall FDI activity measured both by the number of firms and sales volumes. The model thus very naturally links variable trade costs to increases in both trade and FDI activity: falling variable trade costs favor *export-supporting* FDI activities, which account for both trade *and* FDI.

Again, Figures 2 and 3 illustrate the intuition. The increase in ESFDI leads to more trade and more FDI activity. While the effect for the number of firms is clear, Figure 3 illustrates that the switch from HFDI to ESFDI of some firms decreases the sales volumes of these firms as a lower fixed cost needs to be recovered (area C). This negative effect of overall FDI sales is, however, offset by the sales volume generated by 'classic' exporters switching to ESFDI (areas A and A').

4.2 Testable implications

Proposition 1 provides a simple but important testable implication of the model. Under the cost structure in (1), the model implies a clear productivity ranking, where parents with intermediate productivity levels choose ESFDI. Less productive firms opt for lower sales volumes and thus choose the option with the lowest fixed costs. Very productive firms choose a high sales volume and are thus willing to pay the high fixed cost of HFDI to reduce their variable costs. Note that condition (1) assures both the ranking and coexistence of the three modes.[22]

The second major prediction of the model is the tradeoff between ESFDI and HFDI reported in Proposition 3. A first-pass to test this prediction would be to estimate two separate gravity equations for ESFDI and HFDI and compare the distance effects. As most firm level FDI

[21] For presentational convenience the graph only displays effects on the extensive margin (i.e. the changes in sales volumes caused by changes in the measures of firms choosing the respective strategies). It is well understood that a decrease in variable trade costs also increases the sales of each individual firm even if it does not change its strategy (intensive margin). Propositions 3 and 4 account for this effect.

[22] Conditional on coexistence, the assumption of $f_{ij}^x < f_{ij}^d < f_{ij}^f$ would be sufficient for the ranking to be satisfied.

datasets, the MiDi dataset used in the empirical section, only contains information on one country of origin (Germany). This implies that the destination market fixed effect, which would be needed to account e.g. for multilateral resistance (represented in the model by the parameter θ_j) would be perfectly collinear with the distance variable. The effect of distance on ESFDI and HFDI could thus not be tested.

Proposition 5 frames the ESFDI vs. HFDI tradeoff in a way that can be brought to the data more easily. The ratio of ESFDI (number and sales) over overall FDI activity (ESFDI+HFDI) represents a measure of the *relative* importance of ESFDI. This relative importance basically represents the tradeoff between the two alternative strategies: when variable trade costs are low, firms should tend to choose ESFDI rather than HFDI, i.e. the ratio should be higher than for the case of high variable trade costs. It can be seen that all destination specific variables (except the different cost types) affect the number of firms (equations (7) and (8): K_j and θ_j) and their sales volumes (equations (10) and (11): M_j and θ_j) in exactly the same way. All these variables cancel out when considering the ratios, while only the variables remain which truly shape the tradeoff. These are only trade, FDI and distribution costs.[23]

5 The Export-Supporting side of German FDI

In the remainder of the paper I use firm level data on ESFDI activities by German manufacturing parents. The analysis underlines the empirical relevance of ESFDI and provides support to the two central implications of the theoretical model: the productivity ranking and the relevance of trade costs for the ESFDI vs. HFDI decision.

5.1 MiDi Data and Counterparts of HFDI and ESFDI:

The Microdatabase Direct Investment (MiDi) of the Deutsche Bundesbank is a comprehensive firm-level dataset of German FDI activity. On the outward FDI side it contains data on all foreign affiliates owned by German parents. Here 'all' refers to the universe of affiliates with a minimum level of total assets of which the reporting parent holds a minimum level of shares.[24] In order to construct the empirical counterparts of ESFDI and HFDI, I use the sectoral groupings from the MiDi database, in which there are 13 manufacturing sectors. A description of these manufacturing sectors is provided in Table 2 in the appendix.[25] A more detailed description

[23]Variable trade costs, the distribution cost and the fixed cost could in principle all depend on distance. It will be argued below that in our context bilateral distance is a good proxy for variable trade costs. The reason is that, except for variable trade costs, all other cost types enter as ratios, so that even if they depend on distance, these effects tend to offset each other.

[24]In the dataset the criterion is x% of participating interests or voting rights. For simplicity, I just refer to 'shares' in the text.

[25]Note that for expositional convenience Tables 1, 2, 3 and 4 only include 11 sectors. The two sectors not included in the tabels (but included in the remainder of the analysis) are DD (Manufacture of wood and wood products (excl. furniture)) and DF (manufacture of coke, refined petroleum products and nuclear fuel). These two sectors only account for small numbers of affiliates and very little affiliate sales.

including the corresponding NACE codes is provided in Lipponer (2008) p. 24 f.

I will consider an investment as horizontal FDI (HFDI) when the affiliate is in the same sectoral group as the parent firm.[26] Since the focus of the analysis is not on the trade-off between horizontal and vertical FDI, the use of 13 relatively broad manufacturing sectors provided in the data base appears sufficiently detailed.

The measure of export-supporting FDI (ESFDI) includes all FDI of manufacturing parents into the wholesales sector (NACE classification 51). Since the concept of ESFDI is slightly broader than just wholesale FDI, the measure should also include the NACE classification 50.1 - 50.4 (sale, maintenance and repair of motor vehicles and motor cycles). For simplicity I stick to the sectoral classification scheme of the MiDi data, using the sectoral groups "GRO" (NACE 51) and "EIN" (NACE 50 and 52). Hardly any manufacturing firms have affiliates in the NACE 52 sectoral group (retail trade, except of motor vehicles and motor cycles; repair of personal and household goods) so its inclusion does not affect the results.

5.2 Sample size considerations:

Between 1989 and 2005 there have been several changes in reporting requirements and thus in the composition of the data set. The two relevant dimensions are the threshold for shares held by the parent and the total assets of the affiliate.

The threshold for the shares varies between 10% and 50%. When data from different years is used the sample is homogenized by keeping only majority owned affiliates. When only data from one particular year is analyzed the standard 'related party' definition of more than 10% of shares is used when possible (see e.g. Bernard, Jensen, Redding, and Schott (2009)).[27]

An important feature of the data, which has implications for the whole empirical analysis, is that the reporting threshold on total assets of the *affiliate* increased from 0.5 million Euro to 3 million Euro between 2001 and 2002. From the model one would expect such an increase to disproportionately reduce the presence of ESFDI affiliates in the sample as they are smaller (see discussion of Proposition 2) and require a lower fixed setup cost. We will see below that this is precisely what we observe in the data: after the change in the reporting requirement the number of both types of FDI drops, but the drop in the number of ESFDI affiliates is much stronger.

Along the cross-sectional dimension a lot of relevant information on ESFDI affiliates is thus lost from 2002 onwards. In the regression analysis I deal with this issue by considering a sample that

[26] As outlined in footnote 7, the presence of trade in intermediaries between the parent and the HFDI affiliate does not affect the tradeoff between ESFDI and HFDI and is thus not a concern in the empirical analysis. If anything, the presence of trade in intermediate inputs would make it more difficult to find a significant impact of variable trade cost on the ESFDI-HFDI tradeoff.

[27] This is the case for the comparison of the parent size distributions in section 6 which are carried out marked by market. Using the 'related party' definition allows to keep a maximum number of observations. Robustness checks show that in the majority of cases results are identical when only majority owned affiliates are considered.

includes affiliates with total assets of at least 0.5 million Euro (1 million DM) until 2001. And a second sample reaching to 2005 in which in every year only affiliates with total assets above 3 million Euro (6 million DM) are kept. In both samples the 0.1% of affiliates with the highest sales are dropped. This is convenient because for some years the overall sales of affiliates can be significantly influenced by very large single observations.[28]

An additional issue is a change in the sectoral classification scheme between 1994 and 1995, which makes the use of the sectoral classifications over the full sample potentially problematic. The change in the classification scheme brings about mostly changes within the group of manufacturing sectors, so that the distinction between 'manufacturing' and 'wholesale' should be mainly unaffected. The years 1989 to 1995 will be included into the analysis for example when changes of ESFDI and HFDI over time are considered. They will not be included in the regression analysis, which only reaches from 1996-2001 (sample 1) and from 1996-2005 (sample 2). Robustness checks show that this does not affect the results.

5.3 Quantitative Importance of ESFDI

Table 1 in the introduction reports the sum of all sales of foreign affiliates by sector of the parent and sector of the affiliate in 2001.[29] The diagonal of the table represents what has been defined as HFDI sales above: sales of affiliates that belong to the same sector as their parent company. The second last column ('Who/Ret') reflects ESFDI activity: sales of affiliates in wholesale and retail with parents in the manufacturing sector.

For most parent sectors the largest volume of sales is realized by affiliates in the same sector as the parent (HFDI). Relative to these numbers, most of the off-diagonal elements are small and do not show a systematic pattern. The only exception are the sales volumes of wholesale and retail affiliates which are fairly high for all sectors. In some cases they even outweigh the HFDI sales. This table shows that there is an FDI strategy of manufacturing firms that involves the creation of affiliates in the wholesale and retail sector. And that this strategy is quantitatively important.

In Tables 3 and 4 (see Appendix C) the number of affiliates and their employment levels are used as measures of FDI activity. Also in these cases ESFDI plays an important role in overall FDI activity.[30] We have seen in Proposition 2 that the model predicts ESFDI affiliates to have a

[28] A typical example would be a large acquisition by a German multinational, which would turn a domestic firm into an affiliate and would thus lead to a jump in aggregate affiliate sales.

[29] I use data from 2001 because it is the last year before the increase in the reporting threshold on total assets. Using data from 2005 the general patterns are identical but the more than proportional decrease in the number of ESFDI affiliates is visible. Results are available upon request. In 2001 the reporting threshold on shares held by the parent varies between 10% and 50% according to the total assets of the affiliate. To avoid an under-representation of of smaller affiliates, only majority owned affiliates are considered.

[30] Employment is a slightly problematic variable because it was not mandatory for firms to report it before 2004. Missing values were estimated by the Bundesbank based on sales volume. I thus focus on the number of affiliates and sales volume. Results on employment are reported for completeness.

higher share in the number of affiliates than in affiliate sales. This stems from the fact that they have lower sales than HFDI affiliates. Comparing the 'ratio' terms in Tables 1 and 3 it turns out that this prediction of the model is confirmed in 8 of the 11 reported sectors. In line with the predictions of the model, in most sectors the ratio ESFDI/HFDI is much higher for the number of affiliates than for affiliate sales volume. For two sectors (Transportation Equipment and Other Manufacturing) the ratios are about equal, and only for Textiles the pattern is reversed.

5.4 ESFDI over Time and in Europe:

The first graph in Figure 4 plots the number of ESFDI and HFDI affiliates for the sample from 1989 to 2005 with all majority owned affiliates and total assets above 0.5 million Euro. After the change in the reporting requirement from 2001 to 2002, the absolute number of both HFDI and ESFDI almost halves. Until 2001 there are more ESFDI affiliates than HFDI affiliates in the sample, afterwards the number of ESFDI affiliates falls below the number of HFDI affiliates. In line with the considerations made above, this shows that the increase of the reporting requirements on total assets from 0.5 million to 3 million has indeed led to a more than proportional reduction of ESFDI affiliates in the sample. Thus, only using affiliates with total assets above 3 million will make it more difficult to confirm the predictions of the theoretical model as many relevant observations are lost.

Using the homogenized sample of affiliates with total assets above 3 million Euro, the second graph in Figure 4 shows the increase over time of German affiliates' sales volumes. Over the sample period, affiliate sales of both types of affiliates have strongly increased. The rise in ESFDI sales is particularly pronounced after 1993.

Also using the MiDi data, Buch, Kleinert, Lipponer, and Toubal (2005) show that European host countries play a crucial role in German FDI activity. The graph in the lower left corner of Figure 4 shows the number of ESFDI and HFDI affiliates for Western Europe. Relative to HFDI, ESFDI plays a more important role for German FDI in Western Europe than for FDI in the whole world plotted in the first graph. Provided that variable trade costs between Germany and the rest of Western Europe are low, this is exactly what we would expect from the model. Apart from this, the overall pattern is quite similar to the sample including the whole world. As for the whole world, the increase in the reporting requirement for total assets has a stronger impact on ESFDI affiliates than on HFDI affiliates.

The pattern for Eastern Europe is quite different. The last graph in Figure 4 plots the number of affiliates for Eastern European host countries. Two features stand out: firstly, HFDI clearly dominates and, secondly, we observe a very fast increase over time basically starting from zero in 1990.

For testing the model of ESFDI, the use of Eastern European data thus appears problematic for at least two reasons. First, the data for Eastern Europe clearly reflect an adjustment process after these countries have opened up to German FDI around 1990 while the model is constructed to analyze and compare steady states. Second, during this adjustment process, factor price differences (which are not included in the theoretical model) have played a crucial role (see e.g. see Buch, Kleinert, Lipponer, and Toubal (2005)). This 'particularity' of the Eastern European countries for German FDI will be accounted for in the subsequent analysis.

6 Distributions of Parents' Productivities

According to Proposition 1 firms doing HFDI are more productive than firms that choose ESFDI. When in the empirical analysis only noisy measures of the 'true' productivities are available, one would not expect to find the strict ordering implied by the model. Parents with the same observed productivities choose different types of FDI if their 'true' productivities are sufficiently different. So the two CDFs of the productivity measures should be distinct, but their domains could overlap.

To determine whether firms choosing HFDI are indeed systematically more productive, I test whether the CDF of their size measures first-order stochastically dominates the CDF of ESFDI parents. This is standard in the literature (see e.g. Delgado, Farinas, and Ruano (2002) and Girma, Görg, and Strobl (2004)).

6.1 Testing for Stochastic Dominance using the MiDi Data

Three potential problems arise when comparing such distributions using the MiDi data. First, there is no direct measure of firm productivity in the data. Second, (consistent with the model) one and the same parent might choose ESFDI in one market, and HFDI in the other. And finally, in the data some firms might have more than one affiliate in a given market and these affiliates can even be of the ESFDI and HFDI type.[31]

Since no direct productivity measures are available in the data, I exploit the direct link between firm productivity and firm size in the model (in fact, Proposition 1 can be rewritten in terms of size) using total assets of the parent to proxy for its size.[32] We have seen above that a large number of ESFDI observations is lost after the change in the reporting requirements from 2001 to 2002. Unfortunately size measures for the parent firm are only available from 2002 onwards. So the sample used to find support for the productivity ranking is biased against ESFDI affiliates. This is expected to make it more difficult to establish a significant difference between the CDFs. The model implies that depending on trade costs and market size, one and the same parent

[31] It turns out, however, that only a relatively small number of parents has ESFDI and HFDI affiliates in the same country.

[32] Results for sales as size measure are almost identical to the results for total assets.

might have an ESFDI affiliate in one market and an HFDI affiliate in an other. To have a clearer classification of parents, I look at the different distribution functions country by country for the most important destination markets of German FDI.[33]

Finally, firms in the model will choose only one type of FDI in one particular destination. Reality is a bit more complex: some parents have both types of affiliates in the same country. Their number, however, is relatively small (between 7% for Great Britain and 11% for France in 2005). I determine for each parent which of the two FDI types has the larger sales and assign the respective category to the parent.[34]

Table 5 describes the composition of the samples used to analyze the CDFs.[35] The destination countries were chosen according to the number of affiliates. Except for Japan, the number of ESFDI and HFDI affiliates is relatively balanced. On the side of the parents, it turns out that most have only one affiliate in the respective country. Only about half of the parents with more than one affiliate have an HFDI and an ESFDI affiliate. Moreover, the number of affiliates decreases very quickly: there are hardly any parents with more than five affiliates per market.

6.2 Results:

Figure 5 plots the cumulative distribution functions of parents mainly engaging in one of the two FDI types market by market. In each graph the dashed blue line represents the CDF of the total assets (in logs) of ESFDI parents while the solid red line represents the CDF of HFDI parents.

For France, US, Italy and Japan, a relatively clear pattern emerges: the CDF of the parents with ESFDI affiliates tends to be to the left of the CDF of the parents engaging in HFDI. As predicted by the theoretical model, these findings suggest that firms choosing ESFDI to serve a foreign market tend to be smaller than firms which serve the same market via HFDI. In the cases of Great Britain and Spain, the pattern is not clear-cut. This feature will be discussed in detail below.[36]

The distributions can be distinguished formally using the Kolmogorov-Smirnov test (KS test) for first-order stochastic dominance. The results of the KS tests for both total assets and sales

[33]Namely France, US, GB, Italy, Spain and Japan.

[34]Robustness checks show that results are not sensitive to the precise criterion. Taking for example France, when only parents are included where one type of FDI sales dominates at least 2:1, results remain unaffected.

[35]Considering the size distributions market by market strongly reduces the number of observations. In order to keep as many observations as possible, I use the standard related party definition i.e. all cases where the German firm owns at least 10% of the foreign firm are included. Robustness checks (available upon request) show that all results are identical when only majority owned affiliates are considered. The only exception is Japan, where the number of HFDI parents becomes so low that a comparison of the distributions is not possible.

[36]It should be noted that for some smaller countries like e.g. Belgium, the pattern reverses. Since for small countries the number of observations tends to be small, it is problematic to draw general conclusions from their example. In addition, many small markets in Europe are so strongly integrated with their larger neighbors (often even sharing a language) that when looking at market access motives of FDI it might be more appropriate to treat them like economic regions of larger countries.

as measures of the parents' size are presented in Table 6. As an illustrative example take the cell for France-total assets. The hypothesis that the ESFDI group has smaller values cannot be rejected ($p = 0.55$), the opposite hypothesis that HFDI group has smaller values is rejected at the 5% confidence level ($p = 0.023$) and so is the hypothesis that the two distributions are the same ($p = 0.046$).

The formal tests confirm the results of the casual observation of the graphs in Figure 5: for France, US, Italy and Japan they mostly suggest that the distributions are significantly different and that the distributions of firms choosing HFDI first-order stochastically dominates the distributions of firms opting for ESFDI. These conclusions remain also valid when the parents' sales are used as a proxy for size (and thus productivity).

Although, overall, the evidence clearly supports the theoretical predictions, two features stand out that appear not to be in line with the model. First, when looking at small parents, with the exception of Japan, the CDF of the ESFDI parents tends to be to the right of the HFDI parents' CDF. Second, the predicted size ranking can not be confirmed for Great Britain and Spain. The next subsection suggests an explanation for both patterns.

6.3 Why are there so many small HFDI parents in the sample?

The model implies that (even when a noisy productivity measure is used) the CDF of the ESFDI parents should be to the left of the HFDI parents' CDF for *any* level of parent size. But (with the exception of Japan) for the low levels of parent size the CDF of the ESFDI parents is slightly to the right of the CDF of HFDI parents for the smallest parent firms. This pattern is reversed quickly and it does not affect the overall conclusions drawn above. It seems nevertheless to contradict the model that there are so many small HFDI parents in the sample.

The pattern is, however, in line with the model when there is a reporting threshold on *affiliate size* (not parent size), which is the case in the MiDi data. The reason is that ESFDI parents tend to have smaller affiliates.[37] For a given level of observed parent size an ESFDI parent is thus more likely to be dropped than an HFDI parent. This can explain why for small parents HFDI dominates: a more than proportional number of ESFDI parents with the same observed productivity levels have been dropped from the sample because their affiliates are too small. Based on this reasoning one would expect this effect to die out progressively, which can actually be observed in all the graphs.

The same mechanism delivers a possible explanation for the pattern observed for Great Britain

[37] We have seen above that when measuring size by affiliate sales there are two reasons for this. First, ESFDI parents tend to have a lower true productivity, so for a given level of a noisy productivity measure HFDI parents should have (on average) higher true productivities (that is why they self-selected into HFDI). Second, when ESFDI is chosen, lower fixed cost need to be recovered which decreases the optimal sales level even for identical true productivity levels. In addition, the lower fixed costs of ESFDI directly imply that ESFDI affiliates are expected to have lower total assets.

and Spain. Although the CDFs are quite close to each other, it can be seen in both cases that the ESFDI parents' CDF is to the right of the CDF of HFDI parents (contradicting the theoretical prediction) for small parents. But for higher parent sales it switches to the left. We have just seen that for low parent sizes the sample is strongly biased against ESFDI parents. But the bias should die out for higher values of parent sales. And indeed, when smaller parents are dropped, the pattern predicted by the model emerges. When about the smaller half of parents of each type are dropped, the null of ESFDI parents being smaller than HFDI parents cannot be rejected, while the opposite hypothesis is rejected at least at the 10% significance level.[38]

Despite the bias introduced by the reporting threshold on affiliate size, the data on the six most important host markets for German FDI activity clearly support a crucial prediction of the model: HFDI parents tend to be larger than ESFDI parents.

7 Trade Costs and the Relative Importance of ESFDI

We have seen in Proposition 3 that variable trade costs play a crucial role for the trade-off between ESFDI and HFDI. As outlined above, it is not possible to estimate two separate gravity equations for ESFDI and HFDI and compare the distance effects, since the model implies that destination fixed effects have to be included into the regression. These would be perfectly collinear with the distance variable.

Similar in spirit to Brainard (1997), I deal with this issue by using ratios as dependent variable. In this case, all terms that would require the introduction of destination fixed effects cancel out and only the different cost terms remain. The predictions of the model for the effect of variable trade costs on the ratios are summarized in Proposition 5: lower variable trade costs increase ESFDI activity relative to overall FDI activity.

7.1 Distance and the relative importance of ESFDI

As standard in the empirical literature on trade and FDI, I use bilateral distance as a proxy for variable trade costs. A potential problem could be that the different fixed costs and the distribution cost might also depend on distance. It is argued in the appendix F.1 that when considering *ratios* it appears justified to use distance as a proxy for variable costs only.[39]

In my baseline specification, I regress the logarithm of the empirical counterparts of the ratios $n_i^d/(n_i^d + n_i^f)$ and $S_i^d/(S_i^d + S_i^f)$ on the logarithm of geographic distance between Germany and the destination market. Furthermore, a constant and sets of sectoral and year dummies are

[38] The only exception is the case of Spain when total sales are used as a size proxy. In this case the CDFs do not differ significantly. Results of the KS tests are available upon request.

[39] In the ratios, all costs (except the variable trade cost) have a countervailing corresponding term. So as long as these costs depend on distance in a 'similar' way, the distance effects in the ratios will offset. Distance then only enters via the variable trade cost, which is the only cost not entering the expressions in a ratio.

included in the regression.

Each observation is constructed summing the firm level ESFDI and HFDI variables by year, destination and parent sector. So all affiliates which (a) in in the same year, are (b) located in the same host country and (c) belong to parent firms that are in the same sector, form one observation. The size of these groups varies between several hundreds for popular destination-sector combinations and zero for unpopular ones.[40] To account for these variations, I use the inverse of the total size of the sub-group to weight the variance.

We have seen above that German FDI activity in Eastern Europe differs from FDI activity in the rest of the world. Proximity, factor price differences and the radical adjustment process after 1989 (starting from zero) render Eastern Europe a very special case. I account for this particularity by adding a dummy variable that takes the value of unity when the host country is the Czech Republic, Hungary, Romania, Poland or the Slovak Republic.

In my preferred specification I use the data sample from 1996-2001, which is cross-sectionally richer because it contains all affiliates with total assets above 0.5 million Euro (Sample 1). Sample 2 has a longer time dimension (1996-2005) but only uses affiliates with total assets above 3 million Euro. Results of the weighted least squares regressions are reported in Table 7. The first two rows are the regressions with the (log of the) ratio of sales as dependent variable. The coefficients of bilateral distance are significant and have the expected (negative) sign. When the dummy dEAST for the 5 Eastern European countries is introduced, it is highly significant and also increases the distance coefficient as well as its significance level. For the number of affiliates as dependent variable, the coefficient on distance has the expected sign but is not significant. It does, however, become highly significant when the dEAST dummy is included. Results for sample 2 are very similar.

The strong impact of the dummy for Eastern Europe on the level of the distance coefficients and the significance levels suggests that German FDI activity in these counties is driven by forces outside the model. By the same token the results imply that for the sample without the five Eastern European countries the predictions of the model are confirmed in the data.

The results of the baseline regressions provide strong support for a crucial implication of the model, namely that when variable trade costs increase, the share of ESFDI in overall FDI activity decreases. It is worth pointing out that this is not a trivial result in the sense that gravity-type equations seem to work pretty well most of the time. Without the guidance of the model of ESFDI and heterogeneous firms, it would a priory not have been obvious at all how distance should affect the *ratio* of two different types of FDI. The fact that all coefficients on distance have

[40] In the sample used in the baseline specification groups were dropped when one of the two FDI types is not represented at all. Robustness checks presented below show that dropping these observations does not affect the qualitative results.

the expected sign and most of them are highly significant (both statistically and economically), suggests that the theoretical model reveals an important relation between ESFDI and HFDI.

7.2 Robustness Checks for the Distance Regressions:

Adding 1989 to 1995: The first rows in Table 8 report the results of the same regressions as in the baseline case, but based on a longer sample (sample R1), which also includes the years between 1989 and 1995. Due to the uncertain effects of the change in sectoral classifications discussed above, these years were not included into the baseline specification. The results are qualitatively identical to the benchmark case. Overall, the increased sample size leads to higher significance levels. In particular, the distance coefficients are now significant at the 10% level also for the number of affiliates even when no dummy for Eastern Europe is included.

No sectoral dummies: Using a similar dataset for the US, Yeaple (2008) analyzes the different margins of adjustment of FDI to trade barriers in a gravity context. Although his data contains sectoral information, his preferred specification is the one in which he sums across all sectors. This leaves him with one observation per destination market. He argues that this is preferable to using observations at the destination-sector level because of the very large number of destination-sector combinations that actually have zero FDI.

While this is a concern when the dependent variables are in levels, this seems less of a problem when looking at the ratios of two types of FDI in one particular (year - destination - parent sector) group. If both types of FDI are zero, there is nothing to be learned about the determinants of the ratio.[41]

In sample R2 all observations have been summed across sectors so that we are left with one observation per year-destination combination. Standard errors are still clustered by country (because we have six years in the sample, there are up to six observations for each country). The results are very similar to the baseline specification where information about the sector of the parent company is included.

Keeping 'one-sided' zeros: In the baseline specification, all observations with zero HFDI and/or zero ESFDI values have been dropped. A recent literature (see e.g. Helpman, Melitz, and Rubinstein (2008) or Felbermayr and Kohler (2005)) argues that in gravity equations the zero observations provide valuable information (namely: trade flows *could* be positive but *are* zero). When the dependent variables are ratios, observations in which both ESFDI and HFDI are zero do not provide any relevant information. In the case where one type of FDI is positive but the other is zero, firms choose one type of FDI but *not* the other so that a 'zero' contains valuable

[41] The case conceptually relevant case where only one type of FDI is observed in a destination-sector combination will be addressed below. Including these 'one-sided' zeros does not affect the conclusions drawn from the baseline specification.

information.

When in some year - destination - parent sector combination no ESFDI takes place (but HFDI does), the ratio becomes zero which is a problem when taking logs. I add one unit of measurement to the 'number' and 'sales' variables to circumvent this problem. An observation with zero ESFDI and 10 HFDI affiliates, would be transformed into $n^d = 1$ and $n^f = 11$. This transformation induces a bias, but the larger the sub-group, the lower the bias. Using weighted least squares, the observations with the lowest bias receive the highest weight, so that this does not appear to be a major concern.

The results of the same regressions as in the baseline specification but based on the transformed sample are reported under sample R3 in Table 8. The results are quite similar to the baseline specification. Taking into account the 'one-sided' zero observation does not change the results.

8 Conclusions

Despite the empirical relevance of 'Export-Supporting' FDI in the data, the FDI literature focuses almost exclusively on production activities in foreign countries.

The theoretical contribution of this paper is to provide a tractable model of trade, ESFDI and HFDI with heterogeneous firms along the lines of Helpman, Melitz, and Yeaple (2004). ESFDI involves both export and FDI activity so that more ESFDI implies more trade. It thus provides a possible explanation for the complementarity usually found between trade and FDI in the data. The model also implies that a decrease in variable trade costs leads to an unambiguous increase in ESFDI. This provides a simple mechanism within a proximity-concentration framework that can rationalize the simultaneous increase of trade and FDI in periods of falling trade costs.

An empirical analysis using German firm level FDI data confirms that ESFDI is a quantitatively important strategy of German multinationals in the manufacturing sector. Two crucial implications of the model find support in the data: HFDI parents tend to be larger than ESFDI parents and ESFDI plays a more important role in markets closer to Germany.

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Appendix

A Equilibrium

A.1 Profits under Condition (1)

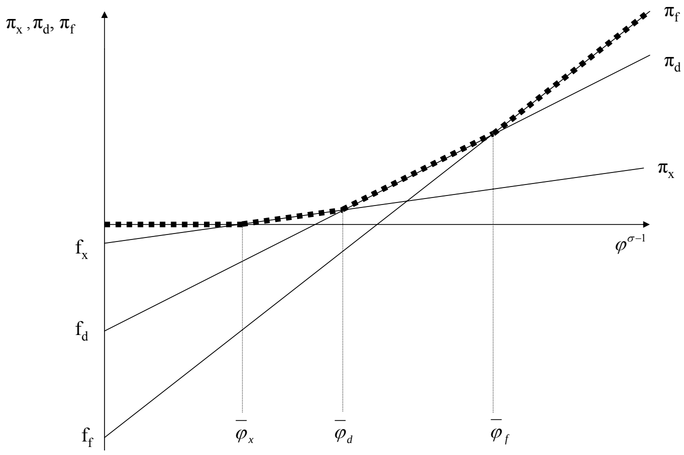

Figure 1: Profits from 'classic' exporting π_x, FDI-supported exporting π_d and HFDI with production and distribution in the foreign market π_f. The fixed cost ranking $f_{ij}^x < f_{ij}^d < f_{ij}^f$ is reflected by the intercepts. Condition (1) as a whole assures that also the slopes are such that each strategy is optimal for some firms, which is in line with the coexistence of exports, ESFDI and HFDI observed in the data.

A.2 Constant Terms

Wherever possible, sectoral subscripts are omitted.

$$
\begin{aligned}
E_j &= \left[\frac{\mu}{\sigma}\left(1+\frac{\Pi}{L}\right)L_j\right]^{\frac{1}{\gamma}-\frac{1}{\sigma-1}} \left(\frac{\gamma}{\gamma-(\sigma-1)}\right)^{-\frac{1}{\gamma}} \frac{\sigma}{\sigma-1} \\
G_j &= \left[\frac{\mu}{\sigma}\left(1+\frac{\Pi}{L}\right)L_j\right]^{-\frac{1}{\gamma}} \left(\frac{\gamma}{\gamma-(\sigma-1)}\right)^{\frac{1}{\gamma}} \\
I_j &= \left[\frac{\mu}{\sigma}\left(1+\frac{\Pi}{L}\right)L_j\right]^{\frac{\sigma-1}{\gamma}} \left(\frac{\gamma}{\gamma-(\sigma-1)}\right)^{-\frac{\sigma-1}{\gamma}} \\
J_j &= \left[\frac{\mu}{\sigma}\left(1+\frac{\Pi}{L}\right)L_j\right]^{\frac{\sigma-1}{\gamma}} \left(\frac{\gamma}{\gamma-(\sigma-1)}\right)^{-\frac{\sigma-1}{\gamma}} \sigma \\
K_j &= \left[\frac{\mu}{\sigma}\left(1+\frac{\Pi}{L}\right)L_j\right] \left(\frac{\gamma}{\gamma-(\sigma-1)}\right)^{-1} \\
M_j &= \mu\left(1+\frac{\Pi}{L}\right)L_j
\end{aligned}
$$

$$
\text{With} \quad \Pi = \frac{\sum_{h=1}^{H}\left(\frac{\sigma_h-1}{\gamma_h}\right)\frac{\mu_h}{\sigma_h}}{1-\sum_{h=1}^{H}\left(\frac{\sigma_h-1}{\gamma_h}\right)\frac{\mu_h}{\sigma_h}}L.
$$

A.3 Aggregate World Profits

World profits are defined as the sum of the profits any firm makes in any market

$$\Pi = \sum_{h=1}^{H} \sum_{k,l=1}^{N} L_k \left[\int_{\bar{\varphi}_{kj}^{h,x}}^{\bar{\varphi}_{kj}^{h,d}} \pi_{kl}^{h,x}(\varphi)\ dF_h(\varphi)\ +\ \int_{\bar{\varphi}_{kj}^{h,d}}^{\bar{\varphi}_{kj}^{h,f}} \pi_{kl}^{h,d}(\varphi)\ dF_h(\varphi)\ +\ \int_{\bar{\varphi}_{kj}^{h,f}}^{\infty} \pi_{kl}^{h,f}(\varphi)\ dF_h(\varphi) \right]$$

where $\pi_{kl}^{h,x}(\varphi)$, $\pi_{kl}^{h,d}(\varphi)$ and $\pi_{kl}^{h,f}(\varphi)$ are net profits a firm with productivity φ in sector h of country k makes by serving market l by 'classic' exporting, ESFDI and HFDI respectively. Individual firm profits as a function of productivity can be obtained using the definition of firm profits and the equilibrium price index from equation (2), which gives (again, sectoral indices are dropped)

$$\pi_{ij}^{x}(\varphi) = I_j\ \theta_j^{\sigma-1}\ \tau_{ij}^{1-\sigma}\ \delta_{ij}^{1-\sigma}\ \varphi^{\sigma-1} - f_{ij}^{x}.$$

Profits from export-supporting FDI are given by

$$\pi_{ij}^{d}(\varphi) = I_j\ \theta_j^{\sigma-1}\ \tau_{ij}^{1-\sigma}\ \varphi^{\sigma-1} - f_{ij}^{d}.$$

And firms transferring both distribution and production to j, make profits of

$$\pi_{ij}^{f}(\varphi) = I_j\ \theta_j^{\sigma-1}\ \varphi^{\sigma-1} - f_{ij}^{f}.$$

The constant I_j is defined in appendix B. Evaluating the integrals and using the definition of θ_j, leads to the expression for aggregate world profits:

$$\Pi = \frac{\sum_{h=1}^{H} \left(\frac{\sigma_h - 1}{\gamma_h}\right) \frac{\mu_h}{\sigma_h}}{1 - \sum_{h=1}^{H} \left(\frac{\sigma_h - 1}{\gamma_h}\right) \frac{\mu_h}{\sigma_h}} L.$$

It is important to note that in equilibrium aggregate world profits depend on exogenous parameters and constants only.

B Variable Trade Costs

B.1 Variable Trade Costs: Figures

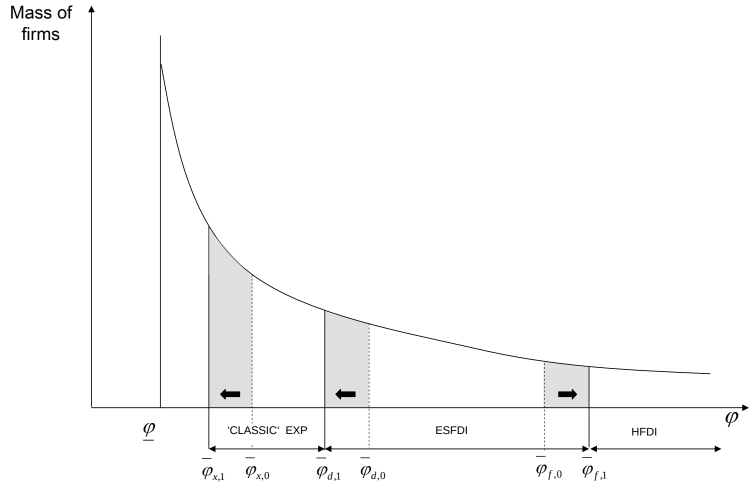

Figure 2: A decrease in variable trade costs increases the number of firms choosing ESFDI on both possible margins: lower variable costs decrease the incentive to do HFDI, so firms close to the cutoff switch to ESFDI (proximity-concentration effect). With lower variable trade costs the optimal sales volume of 'classic' exporters increases. For firms close to the cutoff it now pays to incur the higher fixed cost of ESFDI (expansion effect).

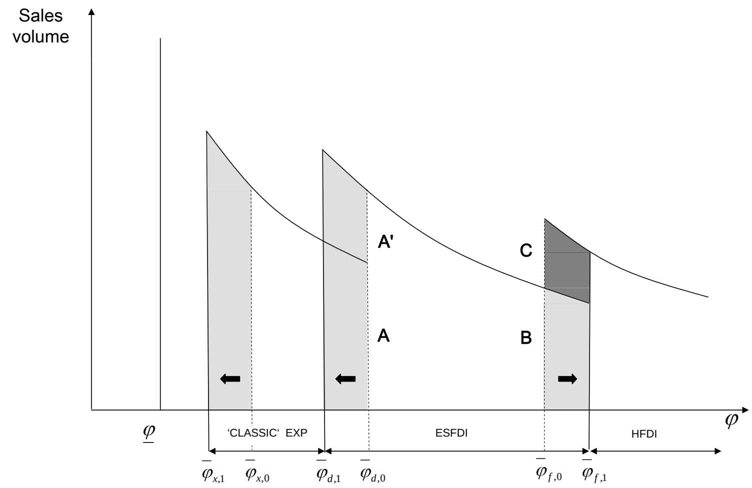

Figure 3: This graph illustrates the countervailing effects (on the extensive margin) of a fall in variable trade costs on overall FDI sales. ESFDI sales increase by $A + A' + B$ while HFDI sales decrease by $B + C$. Also taking into account the intensive margin, Proposition 4 shows formally that the increase in ESFDI sales dominates the decrease in HFDI sales so that the overall FDI sales increase unambiguously.

B.2 Variable Trade Costs: Proofs

Before turning to the formal proofs it is useful to establish some results that will be used in the proofs.

Define

$$Q_{ij} \equiv \tau_{ij}^{\sigma-1} \frac{f_{ij}^{d} - f_{ij}^{x}}{1-\delta_{ij}^{1-\sigma}} \quad \textit{and} \quad R_{ij} \equiv \frac{f_{ij}^{f} - f_{ij}^{d}}{1-\tau_{ij}^{1-\sigma}}$$

So that equation (1) can be written as $f_{ij}^{x}\ \tau_{ij}^{\sigma-1}\ \delta_{ij}^{\sigma-1} < Q_{ij} < R_{ij}$. Next, note that

$$\frac{\partial Q_{ij}}{\partial \tau} = \frac{\sigma-1}{\tau}\ Q_{ij} > 0 \quad \textit{and} \quad \frac{\partial R_{ij}}{\partial \tau} = -(\sigma-1)\ \frac{\tau^{-\sigma}}{1-\tau_{ij}^{1-\sigma}}\ R_{ij} < 0. \tag{12}$$

For notational convenience, also define

$$\varepsilon \equiv \frac{\gamma-(\sigma-1)}{\sigma-1} > 0. \tag{13}$$

Proof of Proposition 3

To prove *(i)*, note that

- $\frac{\partial n_{ij}^{x}}{\partial \tau_{ij}} < 0$ follows directly from equation (6).
- equation (7) implies

  $$\frac{\partial n_{ij}^{d}}{\partial \tau_{ij}} = K_j\ \theta_j^{\gamma}\ (\varepsilon+1)\ \left[R_{ij}^{-(\varepsilon+2)}\ \frac{\partial R_{ij}}{\partial \tau}\ -\ Q_{ij}^{-(\varepsilon+2)}\ \frac{\partial Q_{ij}}{\partial \tau}\right].$$

  From equations (1), (12) and (13), it then follows that $\frac{\partial n_{ij}^{d}}{\partial \tau_{ij}} < 0$.
- $\frac{\partial n_{ij}^{f}}{\partial \tau_{ij}} > 0$ follows directly from equation (8).

To prove *(ii)*, note that

- $\frac{\partial S_{ij}^{x}}{\partial \tau_{ij}} < 0$ follows from (9).
- equation (10) implies

  $$\begin{aligned}\frac{\partial S_{ij}^{d}}{\partial \tau_{ij}} = & -\ M_j\ \theta_j^{\gamma}\ (\sigma-1)\ \tau_{ij}^{-\sigma}\ \left[Q_{ij}^{-\varepsilon} - R_{ij}^{-\varepsilon}\right] \\ & -\ M_j\ \theta_j^{\gamma}\ \tau_{ij}^{1-\sigma}\ \left[\varepsilon\ Q_{ij}^{-\varepsilon-1}\ \frac{\partial Q_{ij}}{\partial \tau}\ -\ \varepsilon\ R_{ij}^{-\varepsilon-1}\ \frac{\partial R_{ij}}{\partial \tau}\right]\end{aligned}$$

  From equations (1), (12) and (13), it follows that all elements are negative and thus $\frac{\partial S_{ij}^{d}}{\partial \tau_{ij}} < 0$.
- $\frac{\partial S_{ij}^{f}}{\partial \tau_{ij}} > 0$ follows form (11).

q.e.d

Proof of Proposition 4

To prove *(i)*, note that

- $\frac{\partial(n^x_{ij}+n^d_{ij})}{\partial\tau_{ij}} < 0$ follows directly from Proposition 3 *(i)*.
- Adding equation (7) and (8) and differentiating with respect to τ_{ij} implies $\frac{\partial(n^d_{ij}+n^f_{ij})}{\partial\tau_{ij}} < 0$.

To prove *(ii)*, note that

- $\frac{\partial(S^x_{ij}+S^d_{ij})}{\partial\tau_{ij}} < 0$ follows directly from Proposition 3 *(ii)*.
- Adding equation (10) and (11) gives

$$S^d_{ij} + S^f_{ij} = M_j\ \theta^\gamma_j\ \left[\tau^{1-\sigma}_{ij}\left(Q^{-\varepsilon}_{ij} - R^{-\varepsilon}_{ij}\right) + R^{-\varepsilon}_{ij}\right]$$

The partial derivative then fulfills

$$\begin{aligned}\frac{\partial(S^d_{ij}+S^f_{ij})}{\partial\tau_{ij}}\ \frac{1}{M_j\ \theta^\gamma_j} \quad = \quad & (1-\sigma)\ \tau^{-\sigma}_{ij}\ Q^{-\varepsilon}_{ij} - \tau^{1-\sigma}_{ij}\ \varepsilon\ Q^{-\varepsilon-1}_{ij}\ \frac{\partial Q_{ij}}{\partial\tau_{ij}} + (\sigma-1)\ \tau^{-\sigma}_{ij}\ R^{-\varepsilon}_{ij} \\ & -(1-\tau^{1-\sigma}_{ij})\ \varepsilon\ R^{-\varepsilon-1}_{ij}\ \frac{\partial R_{ij}}{\partial\tau_{it}}.\end{aligned}$$

Using the results in equation (12), this can be rewritten as

$$\frac{\partial(S^d_{ij}+S^f_{ij})}{\partial\tau_{ij}} = M_j\ \theta^\gamma_j\ (\sigma-1)\ \tau^{-\sigma}_{ij}\ (1+\varepsilon)\left(R^{-\varepsilon}_{ij} - Q^{-\varepsilon}_{ij}\right).$$

It then follows from equation (1) ($Q_{ij} < R_{ij}$) and equation (13) that $\frac{\partial(S^d_{ij}+S^f_{ij})}{\partial\tau_{ij}} < 0$.

q.e.d.

Proof of Proposition 5

To prove *(i)*, note that

- $\frac{\partial(n^d_{ij}/n^f_{ij})}{\partial\tau_{ij}} < 0$ follows directly from Proposition 3 *(i)*.
- Note that by (7) and (8), $\frac{n^d_{ij}}{n^d_{ij}+n^f_{ij}} = 1 - \left(\frac{Q_{ij}}{R_{ij}}\right)^{(\varepsilon+1)}$, so that taking the partial derivative with respect to τ_{ij} and using the derivatives in (12) shows that $\frac{\partial[n^d_{ij}/(n^d_{ij}+n^f_{ij})]}{\partial\tau_{ij}} < 0$.

To prove *(ii)*, note that

- $\frac{\partial(S^d_{ij}/S^f_{ij})}{\partial\tau_{ij}} < 0$ follows directly from Proposition 3 *(ii)*.

- Note that by (10) and (11),

$$\frac{\partial[S_{ij}^d/(S_{ij}^d+S_{ij}^f)]}{\partial\tau_{ij}} = \frac{\frac{\partial S_{ij}^d}{\partial\tau_{ij}}\ \left(S_{ij}^d+S_{ij}^f\right)\ -\ \left(\frac{\partial S_{ij}^d}{\partial\tau_{ij}}+\frac{\partial S_{ij}^f}{\partial\tau_{ij}}\right)\ S_{ij}^d}{\left(S_{ij}^d+S_{ij}^f\right)^2} = \frac{\frac{\partial S_{ij}^d}{\partial\tau_{ij}}\ S_{ij}^f\ -\ \frac{\partial S_{ij}^f}{\partial\tau_{ij}}\ S_{ij}^d}{\left(S_{ij}^d+S_{ij}^f\right)^2}.$$

By Proposition 3 *(ii)* if follows that $\frac{\partial[S_{ij}^d/(S_{ij}^d+S_{ij}^f)]}{\partial\tau_{ij}} < 0$.

q.e.d.

C Sectoral Structure of FDI:

Sectoral Groupings and Abbreviations

WZ	MiDi code	Description
DA	EUT	Manufacture of food products, beverages and tobacco
DB/DC	TBL	Textiles, apparel and leather goods
DE	PVD	Manufacture of pulp, paper and paper products; publishing and printing
DG	CHE	Manufacture of chemicals and chemical products
DH	GUK	Manufacture of rubber and plastic products
DI	GKV	Manufacture of other non-metallic mineral products
DJ	MET	Metal-working industry
DK	MAS	Manufacture of machinery and equipment n.e.c.
DL	ICT	Manufacture of office machineries, computers, electrical and optical equipment
DM	FZB	Manufacture of transport equipment
DN	MSR	Manufacturing n.e.c.
G	GRO+EIN	(here: 'Who/Ret') Wholesale trade + Retail trade (incl. NACE 50)

Table 2: Sectoral abbreviations and classifications used throughout the analysis. The corresponding NACE codes can be found in Lipponer (2008), p. 24f.

Number of foreign affiliates by sector of the parent and by sector of the affiliate in 2001

sector	affiliate												
parent	DA	DB/DC	DE	DG	DH	DI	DJ	DK	DL	DM	DN	Who/Ret	ratio
Food DA	**140**			*	*							**148**	1.06
Textiles DB/DC		**196**			*		*		*		3	**319**	1.63
Paper DE			**206**	*	*		*					**137**	0.67
Chemicals DG				**859**	10	*		9	9	*		**864**	1.01
Plastic DH	*	3	4	*	**322**		7	3	4	21	*	**196**	0.61
Minerals DI		4	*	*	6	**219**	*	4	*		*	**101**	0.46
Metal DJ		*		*	12	*	**432**	15	3	12	*	**437**	1.01
Machinery DK			4	67	10	*	39	**679**	25	22		**1364**	2.01
Electr. Equip. DL		*		*	3	*	6	48	**720**	20		**989**	1.37
Transp. Equip. DM		*			3	*	8	8	9	**412**	9	**319**	0.77
Other Mfg. DN						*	*				**71**	**118**	1.66

Table 3: Number of foreign affiliates by sector of the German manufacturing parent and by sector of the foreign affiliate in 2001. Sectors DA-DN are manufacturing sectors (description in Table 2) sector 'Who/Ret' is wholesale and retail. The vast majority of affiliates is either in the same manufacturing sector as the parent or in wholesale and retail. Under 'ratio' the ratio of affiliate sales in the wholesale and retail sector (column 'Who/Ret') to affiliate sales in the parent sector (diagonal) is reported.

Employment of foreign affiliates by sector of the parent and by sector of the affiliate in 2001

sector	affiliate												
parent	DA	DB/DC	DE	DG	DH	DI	DJ	DK	DL	DM	DN	Who/Ret	ratio
Food DA	**243**			*	*							**46**	0.19
Textiles DB/DC		**534**			*		*		*		7	**200**	0.37
Paper DE			**198**	*	*		*					**47**	0.24
Chemicals DG				**2043**	6	*		5	20	*		**422**	0.21
Plastic DH	*	5	1	*	**522**		4	2	9	61	*	**45**	0.61
Minerals DI		16	*	*	5	**390**	*	2	*		*	**30**	0.09
Metal DJ		*		*	15	*	**544**	14	1	33	*	**80**	0.08
Machinery DK			1	132	27	*	49	**1009**	56	64		**445**	0.14
Electr. Equip. DL		*		*	1	*	7	263	**2266**	348		**385**	0.44
Transp. Equip. DM		*			9	*	13	12	75	**3871**	166	**454**	0.77
Other Mfg. DN						*	*				**71**	**17**	0.17

Table 4: Employment of foreign affiliates by sector of the German manufacturing parent and by sector of the foreign affiliate in 2001 (in hundreds). Sectors DA-DN are manufacturing sectors (description in Table 2) sector 'Who/Ret' is wholesale and retail. The most employment is reported either by affiliates in the same manufacturing sector as the parent or by affiliates in wholesale and retail. Under 'ratio' the ratio of affiliate sales in the wholesale and retail sector (column 'Who/Ret') to affiliate sales in the parent sector (diagonal) is reported. Note that employment is a slightly problematic variable because it was not mandatory for firms to report it before 2004. Missing values were estimated by the Bundesbank based on sales volume.

D ESFDI over Time and in Europe

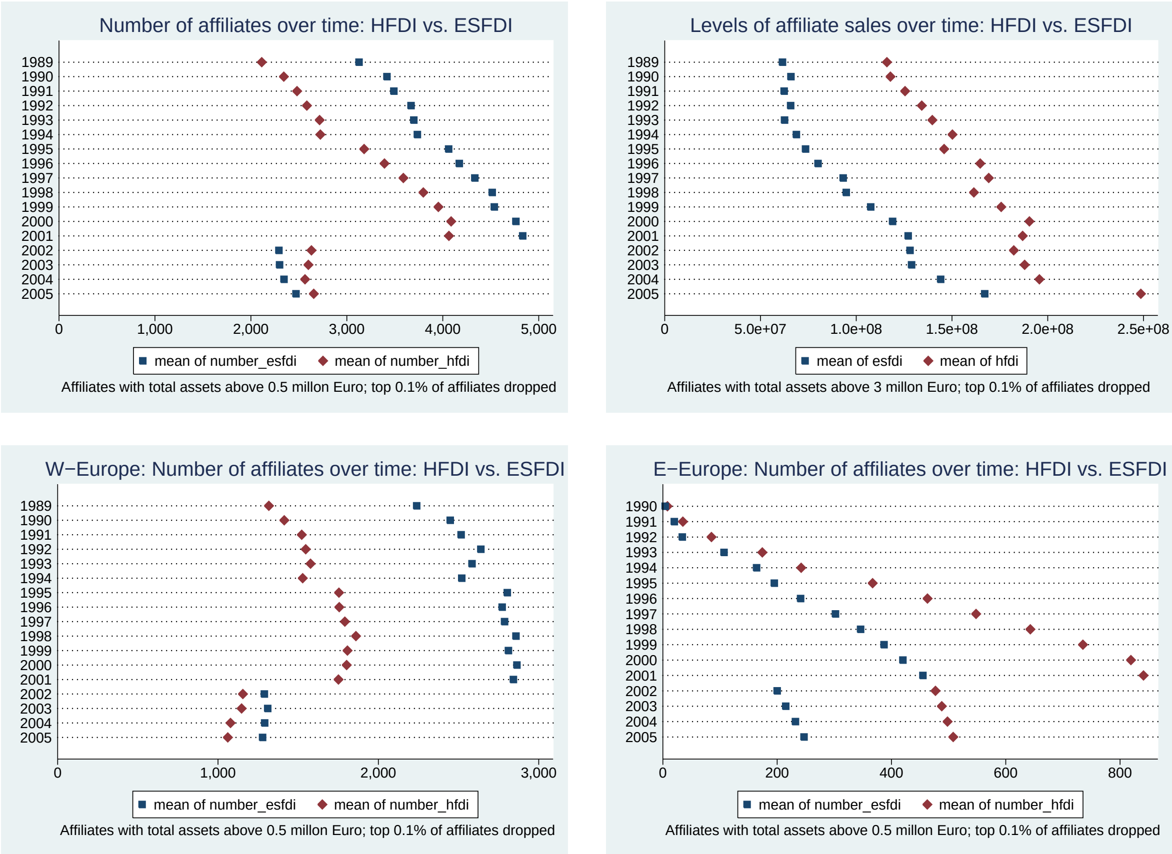

Figure 4: The four graphs plot the evolution of different FDI measures over time. Squares: ESFDI, diamonds: HFDI. In all Figures affiliates with the highest 0.1% sales are dropped. The first graph presents data on the number of affiliates and keeps all affiliates with total assets above 0.5 million Euro (1 million DM). It illustrates that the increased reporting threshold has a more than proportional impact on the number of ESFDI affiliates (ESFDI jumps from above to below HFDI). The graph to the right plots ESFDI and HFDI sales in a homogenized sample for affiliates with total assets above 3 million Euro. The graph in the lower left corner plots the number of affiliates with total assets above 0.5 million Euro for Western Europe the last graph plots the same for Eastern Europe. The patterns for Eastern and Western Europe differ substantially.

E Cumulative Distribution Functions

Number of affiliates and parents for ESFDI and HFDI by country in 2005

	affiliates			parents					
country	ESFDI	HFDI	Σ affi	ESFDI	HFDI	Σ parent	#affi>1	2 types	#affi>5
France	272	245	517	197	179	376	66	42	4
US	292	311	603	195	198	393	49	29	7
Italy	176	131	307	144	97	241	42	21	*
Japan	126	55	181	79	27	106	14	8	*
GB	192	151	343	159	114	273	31	20	*
Spain	138	158	296	88	118	206	33	16	*

Table 5: Decomposition of the data used to carry out the comparison of the CDFs. Columns 2-4 report the number of ESFDI and HFDI affiliates as well as their sum by destination market. The following three columns (5-7) report the number of parents that are classified 'ESFDI parents' and 'HFDI parents' for the different markets. Column '#affi>1' reports the number of parents with more than one affiliate in the destination market. The column '2 types' reports how many of these parents have both HFDI and ESFDI affiliates. Their share in the overall number of parents is quite low (c.f. column 'Σ parent'). Column '#affi>5' reports the number of parents with more than 5 affiliates in the destination market. To assure confidentiality, values of 0, 1 or 2 are replaced by *. Most parents serve the foreign markets with one or few affiliates.

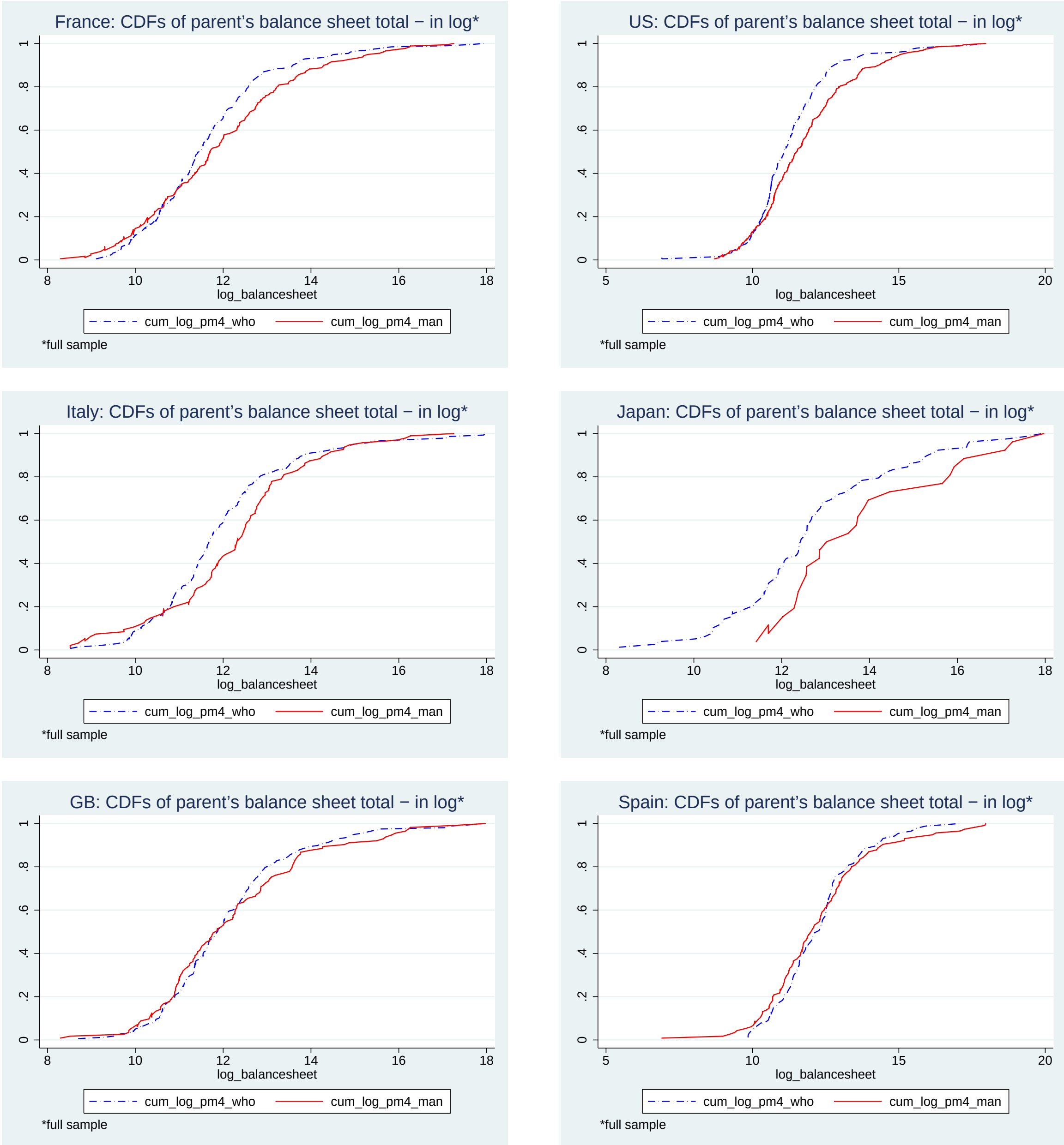

Figure 5: These graphs show the cumulative distribution functions of total assets (in the MiDi labeling: 'balance sheet total') of German parents with affiliates in France, Italy, US, Japan, Great Britain and Spain.

Results of the Kolmogorov-Smirnov (KS) test

	France	US	Italy	Japan	GB	Spain
Total Assets	$p_1 = 0.550$	$p_1 = 0.893$	$p_1 = 0.613$	$p_1 = 0.976$	$p_1 = 0.434$	$p_1 = 0.303$
	$\mathbf{p_2 = 0.023}$	$\mathbf{p_2 = 0.008}$	$\mathbf{p_2 = 0.009}$	$\mathbf{p_2 = 0.089}$	$\mathbf{p_2 = 0.326}$	$\mathbf{p_2 = 0.496}$
	$p_c = 0.046$	$p_c = 0.015$	$p_c = 0.017$	$p_c = 0.178$	$p_c = 0.630$	$p_c = 0.589$
Sales	$p_1 = 0.094$	$p_1 = 0.449$	$p_1 = 0.320$	$p_1 = 0.944$	$p_1 = 0.107$	$p_1 = 0.212$
	$\mathbf{p_2 = 0.017}$	$\mathbf{p_2 = 0.001}$	$\mathbf{p_2 = 0.031}$	$\mathbf{p_2 = 0.106}$	$\mathbf{p_2 = 0.442}$	$\mathbf{p_2 = 0.548}$
	$p_c = 0.035$	$p_c = 0.002$	$p_c = 0.063$	$p_c = 0.211$	$p_c = 0.214$	$p_c = 0.420$

Table 6: This table reports results of the Kolmogorov-Smirnov (KS) test for equality of distributions. The first entry in a cell is the p-value of testing the null hypothesis that the ESFDI group contains smaller observations than the HFDI group (in line with the model). The second value is the p-value for testing the null that the HFDI group contains smaller observations than the ESFDI group (contradicting the model). When this null is rejected (low p-value) this is evidence for first-order stochastic dominance of the HFDI parent distribution. The third value is the p-value of the combined KS test that the distribution are the same.

F Impact of Distance

F.1 Distance as proxy for variable trade costs

This paragraph argues that using *ratios* of the different types of FDI as dependent variables, some relatively mild assumptions on the distance dependence of the different cost types are sufficient to use distance as a proxy for variable trade costs only.

It follows from equations (7) and (8) that $\frac{n_{ij}^d}{n_{ij}^d + n_{ij}^f} = 1 - \left(\tau^{\sigma-1} \frac{1-\tau_{ij}^{1-\sigma}}{1-\delta_{ij}^{1-\sigma}} \frac{f_{ij}^d - f_{ij}^x}{f_{ij}^f - f_{ij}^d}\right)^{\frac{\gamma}{\sigma-1}}$. First assume that all three fixed cost terms depend on distance. The impact of distance via the fixed costs is determined by the term $\frac{f_{ij}^d(d_{ij}) - f_{ij}^x(d_{ij})}{f_{ij}^f(d_{ij}) - f_{ij}^d(d_{ij})}$. Here distance d_{ij} enters with opposite signs. Consider for example the case that the fixed costs are multiples of each other (so that they have the same distance elasticity). Take e.g. $f_{ij}^x = d_{ij}^{\rho_f}$ and $f_{ij}^d = x f_{ij}^x$, $f_{ij}^f = y f_{ij}^x$ with $1 < x < y$. Then $\left(\frac{f_{ij}^f - f_{ij}^d}{f_{ij}^d - f_{ij}^x}\right) = \frac{y-x}{x-1}$ which is a constant and independent of d_{ij}. When considering ratios, distance-dependence of the fixed costs does thus not seem to be a major concern.

A similar argument holds for a potential distance dependence of the distribution cost δ_{ij}. If it is, just like variable trade costs increasing in distance, it will introduce an offsetting impact of distance on the ratio, which is directly implied by the term $\frac{1-\tau_{ij}^{1-\sigma}}{1-\delta_{ij}^{1-\sigma}}$. Considering e.g. the special case of $\tau_{ij} \approx \delta_{ij}$, the two effects offset each other and the overall effect of distance goes through the remaining variable trade cost parameter $\tau^{\sigma-1}$.

Of course it cannot be taken for granted that the the fixed cost are exact multiples of each other and that the two variable cost types are exactly equal. Nevertheless, the above considerations show that (due to taking the ratios) each distance dependency of variables other than variable trade costs has a countervailing effect that tends to neutralize it. It thus appears justified to use distance as a proxy for variable trade costs only.

F.2 Estimation results

Impact of distance on the share of ESFDI in overall FDI

		log dist.	dEAST	dummies	R^2	no. of obs.
Sample 1 *1996-2001* > 0.5 *mio*	$\frac{S_i^d}{(S_i^d+S_i^f)}$	-0.148^{**}	–	sector	0.199	2148
		(0.074)		year		
		-0.216^{***}	-0.677^{***}	sector	0.244	2148
		(0.068)	(0.190)	year		
	$\frac{n_i^d}{(n_i^d+n_i^f)}$	-0.072	–	sector	0.155	2173
		(0.062)		year		
		-0.145^{***}	-0.735^{***}	sector	0.321	2173
		(0.052)	(0.114)	year		
Sample 2 *1996-2005* > 3 *mio*	$\frac{S_i^d}{(S_i^d+S_i^f)}$	-0.127^{*}	–	sector	0.191	2775
		(0.072)		year		
		-0.187^{***}	-0.664^{***}	sector	0.227	2755
		(0.068)	(0.206)	year		
	$\frac{n_i^d}{(n_i^d+n_i^f)}$	-0.068	–	sector	0.139	2787
		(0.069)		year		
		-0.130^{**}	-0.684^{***}	sector	0.241	2787
		(0.064)	(0.127)	year		

Table 7: Sample 1 contains observations for majority owned affiliates with a reporting threshold on the affiliates' total assets of 0.5 million Euro from 1996 to 2001. Sample 2 reaches from 1996-2005, all affiliates with total assets below 3 million Euro (6 million DM) have been dropped to homogenize the sample before and after the change in reporting requirements. In all specifications coefficients are estimated with weighted least squares using the size of the sub-groups underlying a particular year-sector-destination observation to weight the variances. Standard errors (clustered by countries and robust to heteroscedasticity) are reported in parenthesis (***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively). Dependent variables are logarithms of the ratios of ESFDI sales and of the number of ESFDI affiliates. Independent variables are the log of bilateral distance between Germany and the destination market and dEAST which is a dummy variable taking the value of unity when the destination market is the Czech Republic, Hungary, Romania, Poland or the Slovak Republic. Sample 1 includes 80 destination markets, sample 2 contains 73. A constant and dummies for year and the sector of the parent company are included in all specifications. Coefficients of the constant and the sectoral and year dummies are not reported.

Impact of distance on the share of ESFDI in overall FDI: robustness checks

		log dist.	dEAST	dummies	R^2	no. of obs.
Sample R1 *1989-2001* > 0.5 *mio*	$\frac{S_i^d}{(S_i^d+S_i^f)}$	-0.171^{**} (0.071)	–	sector year	0.186	3879
		-0.215^{***} (0.071)	-0.641^{***} (0.172)	sector year	0.215	3879
	$\frac{n_i^d}{(n_i^d+n_i^f)}$	-0.098^{*} (0.055)	–	sector year	0.147	3928
		-0.147^{***} (0.052)	-0.737^{***} (0.103)	sector year	0.275	3928
Sample R2 *1996-2001* > 0.5 *mio* *sectoral*	$\frac{S_i^d}{(S_i^d+S_i^f)}$	-0.172^{*} (0.097)	–	year	0.089	465
		-0.259^{***} (0.092)	-0.842^{***} (0.248)	year	0.207	465
	$\frac{n_i^d}{(n_i^d+n_i^f)}$	-0.065 (0.053)	–	year	0.037	467
		-0.134^{**} (0.052)	-0.673^{***} (0.095)	year	0.270	467
Sample R3 *1996-2001* > 0.5 *mio* *incl. zeros*	$\frac{S_i^d}{(S_i^d+S_i^f)}$	-0.258^{**} (0.103)	–	sector year	0.115	3629
		-0.353^{***} (0.103)	-0.960^{***} (0.216)	sector year	0.139	3629
	$\frac{n_i^d}{(n_i^d+n_i^f)}$	-0.065 (0.054)	–	sector year	0.150	3629
		-0.131^{***} (0.045)	-0.650^{***} (0.102)	sector year	0.312	3629

Table 8: This table presents some robustness checks to the baseline specification in Table 7. Sample R1 adds the years 1989-1995 to sample 1 so that it reaches from 1989-2001. In sample R2 'number' and 'sales' variables are summed across sectors, reducing the number of observations to one per year-destination combination. Standard errors are clustered by countries (we have six years in the sample and thus six observations per country). The overall number of destination markets is 87. In Sample R3 observations are kept even when only one type of affiliates exists in a sector (these are dropped in the baseline specification). To deal with the zeros in the ratios, the values of the 'number' and 'sales' variables (n^d, n^f, S^d and S^f) are raised by one unit of measurement. Apart from this modification of the data, the specification is identical to the baseline specification. The overall number of destination markets is 104 for the regression with $S^d/(S^d + S^f)$ as dependent variable and 113 for the $n^d/(n^d + n^f)$.

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