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Estimating Trade and Investment Flows: Partners and Volumes

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Abstract:
I present a new stylized fact from a large sample of countries for the period 2000-2006: bilateral foreign direct investment (FDI) flows are almost never observed in the absence of bilateral trade flows. I document a similar pattern using bilateral foreign affiliate sales (FAS), aggregating them up from a large firm level dataset (ORBIS), which includes over 45,000 firms.

I propose a model where heterogeneous firms can decide whether to serve foreign markets through export or FDI. I derive theory-based gravity-type equations for the aggregate bilateral trade and foreign affiliate sales (FAS) flows. I then suggest a two-stage estimation procedure structurally derived from the model. In the first stage, an *ordered Probit* model is used to retrieve consistent estimates of the terms needed to correct the flows equations for firms' heterogeneity and selection into exports and FDI. In the second stage, a maximum likelihood estimator is applied to the corrected trade and FAS equations.

The main results of the analysis are as follows: 1) The impact of distance, border and regional trade agreements on the amount bilateral foreign affiliate sales becomes substantially smaller after controlling for selection and firms' heterogeneity (hence separating the impact on the extensive versus the intensive margin). 2) The same "attenuation" result is found also for the trade equations, consistently with previous literature. 3) When FAS are observed, failing to take this into account when correcting for heterogeneity and selection in the trade equations does not leads to significant differences in the estimated coefficients.

Keywords: Trade Flows, Investment Flows, Gravity, Two–stage Estimation Procedure

JEL Classification: F10, F14, F21, F23

1 Introduction

Three facts constitute the background of this work. First, trade and Foreign Direct Investment (FDI) have been among the fastest growing economic activities around the world in the last decades. While clearly interconnected, these two phenomena have often been treated separately in the economics literature. An important exception is Helpman, Melitz and Yeaple (2004, henceforth HMY), who extend the Melitz (2003) model of trade to the case of trade and *horizontal* FDI.[1] Second, bilateral trade flows are characterized by the presence of a lot of zeroes (i.e. the absence of flows among many country pairs). This observation motivated Helpman, Melitz and Rubinstein (2008, henceforth HMR) to propose a two-stage estimation methodology that corrects the gravity-type specification for bilateral trade flows for selection and, more importantly, for firms' heterogeneity. Third, work by Razin and Sadka (2007) showed that selection also plays an important role in the FDI case, and they illustrate the advantages of using sample selection models when estimating bilateral investment flows.

In this paper, I start by documenting a new stylized fact: bilateral investment flows are almost never observed in the absence of bilateral trade flows, thus configuring an *order* of trade and investment flows. The same pattern is uncovered using firm-level data from a novel dataset (ORBIS) and then constructing a series of aggregate bilateral foreign affiliate sales (FAS) in the manufacturing sector.[2]

Consistent with this evidence, I present a model where heterogeneous firms face a proximity-concentration trade-off in deciding whether to serve foreign markets through export or FDI, along

[1] Defined as the investment abroad aimed at serving the foreign market, as opposed to *vertical* FDI, which are investments aimed at reducing costs through the vertical disintegration of the production process, such as the case of the Mexican *Maquiladoras*. Another notable exception is the work by Ramondo and Rodriguez-Clare (2010)

[2] Bilateral foreign affiliate sales are observed in the absence of trade mostly for countries like Liechenstein, Bermuda or Luxemburg, which are often only the places where the head-quarters of multinational firms are established in order to benefit from a more favorable tax-treatment of the profits.

the lines of HMY. If a firm serves the foreign market through export, it pays a lower fixed cost but bears a higher variable cost due to the existence of an *iceberg* transportation cost. If it decides to invest abroad, the fixed cost is higher[3] but the variable cost is lower. Departing from HMY, I assume that investing abroad implies the existence of a *cost disadvantage* for the foreign affiliate vis a vis the domestic firms, which is conveniently defined as a fraction of the transport cost and depends on the *economic distance* between countries. This allows me to derive the implications of the model for aggregate bilateral trade and foreign affiliate sales flows in the form of theory-based gravity-type equations.

I then suggest a two-stage estimation procedure along the lines of HMR. In the first stage, an *ordered Probit* model is used to retrieve consistent estimates of the terms needed to correct the flows equations for heterogeneity and selection. The ordered Probit is derived from theory and from the definition of appropriate latent variables, under the assumptions that the marginal cost in the case of investment is a fraction of the marginal cost in the case of export while the fixed cost of investing is a multiple of the fixed cost of exporting. In the second stage, maximum likelihood (ML) can be applied to the corrected trade, FDI and foreign affiliate sales flows equations.

The main results of the analysis are as follows: 1) The impact of distance, border and regional trade agreements on bilateral foreign affiliate sales becomes substantially smaller after controlling for selection and firms' heterogeneity (hence separating the impact on the extensive versus the intensive margin). 2) The same "attenuation" result is found also for the trade equations, consistently with previous literature. 3) When FAS are observed, failing to take this into account when correcting for heterogeneity and selection in the trade equations does not leads to significant differences in the estimated coefficients.

[3] A multiple of the fixed cost of exporting.

This paper is linked to several strands of the literature. First, this work is related to the literature on models of trade with heterogeneous firms (Melitz, 2003 ; HMY) as well as to the gravity models of bilateral trade flows (Anderson, 1979; Anderson and van Wincoop, 2003) and to the recently proposed HMR procedure of estimating trade flows correcting for selection and heterogeneity.

Second, this work is related to the literature on FDI and FAS. Kleinert and Toubal (2009) derive gravity-type equations or bilateral FDI flows. Aisbett (2007) explores the importance of Bilateral Investment Treaties on bilateral investment flows.[4] Razin and Sadka (2007) propose a detailed study of aggregate bilateral FDI flows showing the importance of selection in this context.

Third, some recent work has tried to jointly consider trade and investment flows. Aviat and Coeurdacier (2007) explore the complementarity between bilateral trade in goods and asset holdings in a simultaneous gravity equation framework. Bergstrand and Egger (2007) augment a 2x2x2 Knowledge capital model with physical capital and provide a rationale for gravity-type equations for FDI. Lai and Zhu (2006) propose a non linear joint ML estimation for trade and foreign affiliate sales for US based multinational firms. Ramondo, Rappoport and Ruhl (2009) analyze the proximity-concentration trade-off in the presence of risk. Most recently, Ramondo and Rodriguez-Clare (2010) propose a model to evaluate the gain from openness featuring a rich interaction between trade and FDI and Irarrazabal, Moxnes and Opromolla (2010) provide a quantitative framework to analyze jointly trade and multinational production with they test using firm level Norwegian data. I contribute to this literature by proposing a methodology that allows to correct FAS and trade gravity equations for selection and heterogeneity when only aggregate data are available.

The paper is organized as follows. Section 2 document the new stylized fact establishing the

[4] I'm particularly grateful to her for providing the data for preliminary work on the key idea of this paper.

ordering of trade and investment flows. Section 3 contains the model and section 4 the empirical methodology. In section 5, I present the main results of the analysis and section 6 concludes suggesting some lines for future research.

2 A New Stylized Fact

I will use four data sources in the paper. The first is the OECD International Investment Database, which contains information about the aggregate Outward FDI flows reported by 30 OECD countries and over 200 possible destination countries in the period 2000-2007. Importantly, in this dataset true zeroes are distinguished from missing data, thus providing a reliable information about the country pairs where no FDI takes place.

The second source of data is a firm-level dataset (ORBIS), which contains data on the location of the global owner and the level of sales for the period 2000-2006 for a sample of over 45,000 active manufacturing firms located in over 90 developed and developing countries. I use this dataset to build a series of *aggregate bilateral foreign affiliate sales*.[5] While it is difficult to grasp the overall coverage that a commercial firm level dataset can guarantee, I can provide the comparison for the U.S. with the BEA data, which provides representative data for the U.S. The dataset covers on average 25% of the total sales in the manufacturing sector by foreign affiliates of U.S. firms.[6]

[5] The zeroes at the firm-level come from cases in which active firms are present in country i but do not report sales. If this is true for all the firms owned by a parent company based in country j, then the aggregate FAS from country j to country i is considered a zero.

[6] The countries included in the sample are: Algeria, Andorra, Angola, Argentina, Australia, Austria, Bahamas, Barbados, Belgium, Benin, Bermuda, Bolivia, Brazil, Bulgaria, Burkina Faso, Cameroon, Canada, Cayman Islands, Chile, China, Colombia, Costa Rica, Cyprus, Czech Republic, Denmark, Dominica, Ecuador, Egypt, Finland, France, French Guyana, Gabon, Germany, Ghana, Greece, Guadelupe, Guatemala, Guyana, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Kuwait, Lebanon, Malawi, Malaysia, Mauritius, Mexico, Morocco, Mozambique, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Senegal, Singapore, Slovakia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, UK, United Arab Emirates, Uruguay, USA, Venezuela, Vietnam, Zambia and Zimbabwe.

The source for trade data and the gravity variables are more standard. I will use the UN-COMTRADE database for trade flows and the CEPII distance dataset for the gravity regressors.

I build indicator variables called TRADE, FAS and FDI to indicate the presence of positive flows. Table 1 reports the distribution of available observations into the four possible cases (NO TRADE-NO FDI, TRADE-NO FDI, TRADE-FDI and NO TRADE-FDI) using the OECD data for FDI and the COMTRADE data for exports. Two observations stand out. First, the number of zeroes is clearly not irrelevant both for the trade and the investment flows. The number of zero trade flows is smaller than that documented in HMR (2008) because the table excludes all the observations which report a missing for the investment flows. Second, probably most interestingly, the case of FDI- NO TRADE is very infrequent. In particular, out of 351 observations, in 66 cases the importing (host) country is Liechenstein and in 76 cases the exporting (home) country is Luxemburg. Almost half of the cases in which bilateral FDI flows are observed in the absence of trade flows are likely due to tax-treatment of corporate profits.

Table 2 reports similar statistics obtained using the bilateral FAS dataset.[7] I selected only manufacturing firms from the ORBIS dataset. For consistency, I then retrieved from the UN-COMTRADE database the aggregate trade in manufacturing sector. The evidence is similar to that reported in Table 1. The number of cases in which bilateral foreign affiliate sales are observed in the absence of bilateral trade flows is infrequent. Also in this case, most of the observations in the bin NO TRADE-FAS are accounted for by tax heavens like Bermuda, Antilles or Cyprus.[8]

The evidence proposed in Table 1 and 2 suggests a sort of *ordering* of trade and investment flows, for which the existence of bilateral trade flows is a necessary condition for the existence of

[7]Now the four possible cases become NO TRADE-NO FAS, TRADE-NO FAS, TRADE-FAS and NO TRADE-FAS.

[8]Out of 338 observations Bermuda appears 146 times as the exporter (home), Cyprus appears 60 times and Antilles appears 59 times.

bilateral investment flows and foreign affiliate sales. The theoretical model presented in the next section implies exactly this pattern for the aggregate flows.

3 Theory

Consider a world economy made up of J countries. In each country, a representative consumer derives utility from a continuum of goods, defined as follows for a generic country j:

$$u_j = \left(\int_{l \in \Omega_j} x_j(l)^{\alpha} dl \right)^{\frac{1}{\alpha}} \tag{1}$$

where $x_j(l)$ is the consumption of product l and Ω_j is the set of available varieties in country j and $\epsilon = \frac{1}{1-\alpha} > 1$ is the elasticity of substitution, assumed to be equal across countries. Define as Y_j the income in country j (equal to expenditure by country j). Then, the consumer's utility maximization problem allows us to express the demand for each good as:

$$x_j(l) = \frac{\check{p}_j(l)^{-\epsilon}}{P_j^{1-\epsilon}} Y_j \tag{2}$$

where $\check{p}_j$ is the price of product l in country j and P_j is the standard CES ideal price index.[9] As for technology, in country j the unit production cost of the firms is represented by a cost minimizing combination of inputs that costs $c_j a$, where c_j is country specific, while a is a firm-specific inverse indicator of productivity. Firms draw a randomly from a distribution $G(a)$, which is common across countries. The support for a is exogenously defined to be $[a_L, a_H]$.[10] There are not fixed production costs, hence firms never exit from the domestic market. The market structure is characterized by

[9] Expressed by $P_j^{1-\epsilon} = \int_{l \in \Omega_j} \check{p}_j(l)^{1-\epsilon} dl$

[10] Also common across countries

usual monopolistic competition, hence the firms' profit maximization problem gives the optimal pricing rule as a constant mark-up over marginal cost:

$$p_{jj}(l) = \frac{c_j a}{\alpha} \tag{3}$$

where p_{jj} is the mill price of a variety produced in country j and sold in country j. There is no entry and the number of firms in country j is N_j.[11] A domestic firm, besides serving the domestic market, can decide to serve foreign market i in two ways. If it decides to export, it has to bear a fixed cost $c_j f_{ij}^x$ and it is subject to an iceberg melting cost $\tau_{ij} > 1$.[12] The price in i of a good shipped from j will be therefore:

$$p_{ij}(l) = \tau_{ij}\frac{c_j a}{\alpha} \tag{4}$$

On the other hand, if the firm in country j decides to invest abroad, it has to bear a fixed cost $c_j f_{ij}^I$ but it does not have to pay the transport cost. Departing here from HMY, I assume that multinational operations involve higher costs than domestic operations due to a *cost disadvantage* for foreign firms in the purchase of intermediate inputs from local producers. Examples of how this cost disadvantage could arise include having less information about local markets or less experience dealing with local bureaucracy. Due to the presence of this cost disadvantage, p_{ii}^*, the price charged in country i by a multinational firm whose headquarters is located in country j will be:

$$p_{ii}^*(l) = \tau_{ij}^I \frac{c_i a}{\alpha} \tag{5}$$

τ_{ij}^I is the cost disadvantage over local producers, which is assumed to be increasing in the *cultural*

[11] Like in HMR, but differently from HMY and Melitz(2003).

[12] As usual, $\tau_{jj} = 1$

distance between the two countries. The assumption of the presence of this cost disadvantage is a partial answer to the observation that "standard models of the proximity-concentration trade-off are missing an ingredient that would explain why the unit cost of serving foreign markets appears to rise in distance"(Yeaple, 2009). Another interpretation of the presence of the term τ^I in the marginal cost of the investing firm is the need to import some intermediates from the parent company, as in Irarrazabal, Moxnes and Opromolla (2010).[13] τ^I_{ij} is defined for convenience to be a fraction of the transportation cost: $\tau^I_{ij} = \tau^b_{ij}$ with $b < 1$. The firms still face the concentration-proximity trade-off empirically documented in previous literature (Brainard, 1997).

Substituting the demand expression and the pricing rule into the expression for firms' profits and assuming a symmetric equilibrium, it is possible to express the *additional* profit that a firm gets from exporting as:

$$\pi^x_{ij} = (1-\alpha)\left(\frac{\tau_{ij}c_j a}{\alpha P_i}\right)^{1-\epsilon} Y_i - c_j f^x_{ij} \tag{6}$$

Notice the dependence of profits on firm-specific productivity a. Similarly, the additional operational profits for a firm that invests abroad can be expressed as

$$\pi^I_{ij} = (1-\alpha)\left(\frac{\tau^b_{ij}c_i a}{\alpha P_i}\right)^{1-\epsilon} Y_i - c_j f^I_{ij} \tag{7}$$

Following HMY, and calling $A_i = (1-\alpha)\frac{1}{(\alpha P_i)^{1-\epsilon}}Y_i$, I can re-write the previous expressions as:

$$\pi^x_{ij} = A_i(\tau_{ij}c_j)^{1-\epsilon}a^{1-\epsilon} - c_j f^x_{ij} \tag{8}$$

[13] A further alternative interpretation relies on the presence of monitoring costs, which increase the variable costs for affiliate of foreign companies over the marginal cost of domestic firms (Aizenman & Spiegel, 2007). In this case it is natural for cost to increase with distance.

and

$$\pi_{ij}^I = A_i(\tau_{ij}^b c_i)^{1-\epsilon} a^{1-\epsilon} - c_j f_{ij}^I \tag{9}$$

Note that, with $\epsilon > 1$, the previous expressions are linear functions of a variable increasing in productivity. Figure 1 shows on the same graph equations (8) and (9), where I further impose two parameter restrictions:

$$(\tau_{ij} c_j)^{1-\epsilon} \quad < \quad (\tau_{ij}^b c_i)^{1-\epsilon} \tag{10}$$

$$\left(\frac{c_j}{c_i}\right)^{1-\epsilon} f_{ij}^I \quad > \quad \tau^{(1-b)(\epsilon-1)} f_{ij}^x \tag{11}$$

Eq (10) is needed to guarantee that we will observe FDI for some country-pairs. Equation (11) implies that FDI flows are observed only in the presence of trade flows, consistent with the evidence presented in section two.[14] It is clear from Figure 1 that there will be a productivity cut-off $(a_{ij}^x)^{1-\epsilon}$ below which the firm will not find it profitable to export. Most interestingly, though, there will be a second cut-off productivity $(a_{ij}^I)^{1-\epsilon}$, above which firms will prefer to invest abroad. The two cut-offs are implicitly defined by the following conditions:

$$(1-\alpha)\left(\frac{\tau_{ij} c_j a_{ij}^x}{\alpha P_i}\right)^{1-\epsilon} Y_i = c_j f_{ij}^x \tag{12}$$

and

$$(1-\alpha)\frac{Y_i}{(\alpha P_i)^{1-\epsilon}}\left[\left(\tau_{ij}^b c_i\right)^{1-\epsilon} - (\tau_{ij} c_j)^{1-\epsilon}\right]\left(a_{ij}^I\right)^{1-\epsilon} = c_j\left(f_{ij}^I - f_{ij}^x\right) \tag{13}$$

In equation (12) the cutoff a_{ij}^x is defined as the productivity of the firm which is just indifferent between exporting or not, given that its additional profits from exporting are just enough to pay

[14] Equation (11) is similar to the parameter restriction imposed in HMY.

for the fixed costs. Equation (12), instead, defines the second cut-off a_{ij}^I as the productivity of the firm that is indifferent between serving the foreign market by exporting or by FDI. The reason for this indifference is that the additional profits are the same in the two cases.

The pattern of possibilities that emerges from the interaction between the two cut-offs implicitly identified by (12) and (13) and the exogenous support for the productivity draws is very rich and extends the possibilities allowed for by HMR. Figure 2 helps visualize the three possibilities. If $a_L^{1-\epsilon}$ [15] is lower than the trade productivity cut off, neither trade nor FDI flows will be observed between the two countries. If $a_L^{1-\epsilon}$ is between the two cut-offs, a fraction T_{ij} of firms will find it profitable to export, hence we will observe trade, but no FDI between the two countries. Finally, if $a_L^{1-\epsilon}$ is bigger than both cut-offs, we will observe both firms investing abroad (a fraction F_{ij} of them) and exporting (a fraction T_{ij}). In this case we will observe both FDI and bilateral trade flows. The three possible outcomes, hence, are fully consistent with the empirical evidence presented in section 2.

Finally, it is possible to derive expressions for the bilateral trade and investment flows. First, define two variables that represent the fraction of firms exporting and investing from country j to country i respectively:

$$T_{ij} = \begin{cases} \int_{a_{ij}^I}^{a_{ij}^x} a^{1-\epsilon} dG(a) & \text{if } a_L < a_{ij}^I \\ \int_{a_L}^{a_{ij}^x} a^{1-\epsilon} dG(a) & \text{if } a_{ji}^I < a_L < a_{ij}^x \\ 0 & \text{otherwise} \end{cases}$$

$$F_{ij} = \begin{cases} \int_{a_L}^{a_{ij}^I} a^{1-\epsilon} dG(a) & \text{if } a_L < a_{ij}^I \\ 0 & \text{otherwise} \end{cases}$$

[15] The level of productivity of the most productive firm.

Then, the *value of imports* in country i from country j is given by:

$$M_{ij} = \left(\tau_{ij} \frac{c_j}{\alpha P_i} \right)^{1-\epsilon} Y_i N_j T_{ij} \tag{14}$$

and the *value of the foreign affiliate sales (FAS)* in country i from country j would be given by:

$$FAS_{ij} = \left(\tau_{ij}^b \frac{c_i}{\alpha P_i} \right)^{1-\epsilon} Y_i N_j F_{ij} \tag{15}$$

It is important to stress that equation (15) refers to FAS more than to FDI. This is the reason why in the implementation of the empirical methodology presented in the next section I will only use the dataset on bilateral FAS coming from the ORBIS firm-level dataset.

4 Empirical framework

Productivity is assumed to be drawn from a Pareto distribution, hence $G(a) = \frac{a^k - a_L^k}{a_H^k - a_L^k}$. Analogously to HMR, F_{ij} can be found as:

$$F_{ij} = \frac{k a_L^{k-\epsilon+1}}{(k-\epsilon+1)(a_H^k - a_L^k)} W_{ij}^1 \tag{16}$$

where

$$W_{ij}^1 = max \left[\left(\frac{a_{ji}^I}{a_L} \right)^{k-\epsilon+1} - 1, 0 \right] \tag{17}$$

Things are more complicated, instead, for the trade equation, since now the fraction of exporting firms depends on whether there are firms from country j investing in country i or not. In particular, we would have

$$T_{ij} = \begin{cases} \frac{ka_L^{k-\epsilon+1}}{(k-\epsilon+1)(a_H^k - a_L^k)} W_{ij}^2 & \text{if } F_{ij} = 0 \\ \frac{ka_L^{k-\epsilon+1}}{(k-\epsilon+1)(a_H^k - a_L^k)} W_{ij}^3 & \text{if } F_{ij} \neq 0 \end{cases}$$

where

$$W_{ij}^2 = max\left[\left(\frac{a_{ij}^x}{a_L}\right)^{k-\epsilon+1} - 1, 0\right] \tag{18}$$

and

$$W_{ij}^3 = \left[\left(\frac{a_{ij}^x}{a_L}\right)^{k-\epsilon+1} - \left(\frac{a_{ij}^I}{a_L}\right)^{k-\epsilon+1}\right] \tag{19}$$

From (15), it is possible to express the foreign affiliate sales equation in its log-linear form as:

$$fas_{ij} = (\epsilon - 1)ln\alpha - (\epsilon - 1)lnc_i + n_j + (\epsilon - 1)p_i + y_i + b(1-\epsilon)ln\tau_{ij} + f_{ij} \tag{20}$$

where the lower case variables represent the natural logarithm of the corresponding upper case variables. I assume $\tau_{ij} = D_{ij}^{\gamma}$, where D_{ij} is an indicator of the economic distance between j and i. I introduce randomness in the form of measurement error of the dependent variable (u_{ij}^1). Hence, I can express equation (20) as the following estimating equation:

$$fas_{ij} = \theta_0 + \Psi_j^I + \Upsilon_i^I - \gamma_1 d_{ij} + w_{ij}^1 + u_{ij}^1 \tag{21}$$

where $\Psi_j^I = n_j$ is a home country fixed effect and $\Upsilon_i^I = -(\epsilon - 1)lnc_i + (\epsilon - 1)p_i + y_i$ is a host country fixed effect, $\gamma_1 = b\gamma$ and θ_0 contain the elements in F_{ij} besides W_{ij}^1. u_{ij}^1 is assumed to be i.i.d. distributed with mean zero and variance $\sigma_{u^1}^2$. On the other hand, taking logs of equation (14) and taking into account equations (18) and (19), it is possible to express the trade flow equation as the following estimable equation:

$$m_{ij} = \theta_1 + \Psi_j^x + \Upsilon_i^x - \gamma d_{ij} + w_{ij}^s + u_{ij}^2 \tag{22}$$

where $\Psi_j^x = n_j - (\epsilon - 1)lnc_j$ is an exporter fixed effect, $\Upsilon_i^x = (\epsilon - 1)p_i + y_i$ is an importer fixed effect and θ_1 includes all the elements in T_{ij} besides W^s, with $s = [2, 3]$. u_{ij}^2 represents measurement error in the dependent variable. It is i.i.d. distributed, with mean zero and variance $\sigma^2_{u^2_{ij}}$.

Looking at equations (21) and (22), three things are worth noticing. First, not taking into account the term W^s might lead to inconsistent estimates of all the coefficients. Second, the model has clear predictions regarding the relative magnitude of the distance coefficients in the trade and FAS equations: they are expected to be higher in the trade flows equation. Third, the form of the estimating equation for the trade flows will differ according to whether FAS are observed or not, since in the presence (or absence) of FAS changes the correction term for firm heterogeneity (w_{ij}). Not recognizing the option for a firm to serve a foreign market by directly investing instead of exporting leads to an overestimate of the fraction of exporting firms that could affect the estimates of all the coefficients in equation (22). The importance of this possible bias is ultimately an empirical question.

The next subsection outlines a two-stage procedure aimed at consistently estimating equations (21) and (22).

4.1 First Stage: Selection

As explained before, this framework allows for endogenous selection into Export and FAS. The first stage evaluates the self-selection problem and can be best understood as a three-steps process.

The first step consists of defining adequate latent variables. In particular, analogously to HMR, I can define a latent variable Z_{ij}^x which determines whether we should observe trade flows from country j to country i as follows:

$$Z_{ij}^{x} = \frac{(1-\alpha)\left(\frac{\tau_{ij}c_j}{\alpha P_i}\right)^{1-\epsilon} Y_i a_L^{1-\epsilon}}{c_j f_{ij}} \tag{23}$$

Z_{ij}^{x} represents the ratio of the variable export profit for the most productive firms to the fixed export costs where $f_{ij}^{x} = f_{ij}$. Clearly, we would observe export from j to i only if $Z_{ij}^{x} > 1$.

For simplicity, I assume the investment fixed cost to be a multiple of the trade fixed cost, i.e. $f_{ij}^{I} = qf_{ij}$ with $q > 1$. Then, starting from equation (12), it is possible to define a second latent variable Z_{ij}^{I}, which is the ratio of the difference in the variable profits from investment and export to the difference in the fixed costs:

$$Z_{ij}^{I} = \frac{(1-\alpha)\frac{Y_i}{(\alpha P_i)^{1-\epsilon}}\left[\left(\tau_{ij}^{b}c_i\right)^{1-\epsilon} - (\tau_{ij}c_j)^{1-\epsilon}\right](a_L)^{1-\epsilon}}{(q-1)c_j f_{ij}} \tag{24}$$

If $Z_{ij}^{I} > 1$ we should observe both trade and FAS between countries. Now it is convenient to define a third *auxiliary* latent variable Z_{ij}, representing the ratio of the variable profits from investment to the fixed cost of investment for the most productive firm:

$$Z_{ij} = \frac{(1-\alpha)\left(\frac{\tau_{ij}^{b}c_i}{\alpha P_i}\right)^{1-\epsilon} Y_i a_L^{1-\epsilon}}{c_j q f_{ij}} \tag{25}$$

In other words, $Z_{ij} > 1$ implies that the most productive firm *could* profitably invest abroad, even though it *might* prefer to export instead if its productivity is lower than $\left(a_{ij}^{I}\right)^{1-\epsilon}$. Equation (25) is particularly helpful because it allows me to express the other two latent variables as functions of Z. In fact, from (23) and (25) we can see how:

$$Z_{ij}^x = Z_{ij} q \left(\frac{\tau_{ij} c_j}{\tau_{ij}^b c_i} \right)^{1-\epsilon} \tag{26}$$

Hence, we would observe trade between country i and j if $Z_{ij} > \Delta_1$, where $\Delta_1 = \frac{1}{q} \left(\frac{\tau_{ij} c_j}{\tau_{ij}^b c_i} \right)^{\epsilon-1}$, which according to equation (11) is a quantity smaller than one. Importantly, I'm assuming here that $\left(\frac{\tau_{ij} c_j}{\tau_{ij}^b c_i} \right)^{\epsilon-1}$ is a constant (smaller than 1 by equation (10)). The economic meaning of this assumption is that the variable cost of a firm with productivity a who decides to invest abroad is a fraction of the variable cost that the same firm faces if it decides to export abroad instead.[16]

In a similar fashion, from equations (23) (24) (25) and (26) we can derive

$$Z_{ij}^I = \frac{q}{q-1} Z_{ij} - \frac{1}{q-1} Z_{ij}^x = \frac{q\Delta_1 - 1}{\Delta_1 (q-1)} Z_{ij} \tag{27}$$

Hence we will observe FAS between country j and country i if $Z_{ij}^I > 1$, or $Z_{ij} > \Delta_2$ where $\Delta_2 = \frac{\Delta_1(q-1)}{q\Delta_1 - 1}$, which given our parameter restrictions is a quantity bigger than 1. In order to derive an estimable equation from (25), I assume that fixed costs are stochastic due to unmeasured frictions. Specifically, I assume that:

$$f_{ij} = e^{\kappa \phi_{ij} - u_{ij}^3} \tag{28}$$

where ϕ_{ij} are a series of factors that influence the fixed costs of exporting (possibly common to the elements that enter in the definition of economic distance) and u_{ij}^3 is assumed to be i.i.d. normally distributed with mean zero and variance $\sigma_{u^3}^2$. I allow for the possibility that u_{ij}^3 might be correlated with u_{ij}^1 and u_{ij}^2, which introduce a selection problem that I will address in what follows.

[16] This is an admittedly strong assumption, which is however necessary to maintain the problem tractable. An interesting venue for future research is the extent to which the methodology here proposed can be extended in a way that allows relaxing this assumption.

With this assumption, I can express equation (25) as

$$z_{ij} = \theta_2 + \Psi_j + \Upsilon_i - \gamma d_{ij} - \kappa \phi_{ij} + u_{ij}^3 \tag{29}$$

where Ψ_j are exporter/home fixed effects and Υ_i are importer/host fixed effects. Notice also that, given the definitions of Δ_1 and Δ_2, it is possible to express the latent variables $z_{ij}^x = lnZ_{ij}^x = z_{ij} - \delta_1$ and $z_{ij}^I = lnZ_{ij}^I = z_{ij} - \delta_2$, where $\delta_1 = ln\Delta_1$ and $\delta_2 = ln\Delta_2$.

The dependence of both Z_{ij}^I and Z_{ij}^x on Z_{ij} allows me to use an *ordered Probit* model to control for selection and heterogeneity. The second step in the procedure is to define an *ordered outcome* variable $GLOBAL_{ij}$, which can take values zero ($TRADE_{ij} = 0, FDI_{ij} = 0$), one ($TRADE_{ij} = 1, FDI_{ij} = 0$) or two ($TRADE_{ij} = 1, FDI_{ij} = 1$), consistent with the pattern showed in section two.

Following HMR, I do not impose unitary variance on the error process and I divide equation (29) by $\sigma_{u_{ij}^3}$. It is thus possible to obtain the following ordered Probit model:

$$z_{ij}^* = \theta_2^* + \Psi_j^* + \Upsilon_i^* - \gamma^* d_{ij} - \kappa^* \phi_{ij} + u_{ij}^* \tag{30}$$

with

$$\begin{cases} TRADE_{ij} = 0, FDI_{ij} = 0 & \text{if } z_{ij}^* < \delta_1^* \\ TRADE_{ij} = 1, FDI_{ij} = 0 & \text{if } \delta_1^* < z_{ij}^* < \delta_2^* \\ TRADE_{ij} = 1, FDI_{ij} = 1 & \text{if } z_{ij}^* > \delta_2^* \end{cases}$$

where the starred variables and parameters represent the original variables and parameters divided by the relevant standard deviation and u_{ij}^* is now i.i.d. unit normally distributed. Importantly, as stressed by HMR, the selection equation is derived from firm-level decision and does not contain the unobserved terms W_{ij}^s.

Finally, as a third step, from the ordered Probit estimates it is possible to recover consistent estimates of W_{ij}^s,$s = [1,2,3]$, which can then be used in the flow equation to correct for heterogeneity. Let $\hat{p}_{ij}^0$ be the predicted probability of not observing trade nor FAS flows between countries j and i. Then, $\hat{z}_{ij}^{x*} = -\Phi^{-1}\left(\hat{p}_{ij}^0\right)$ is the predicted value of the latent variable $z_{ij}^{x*} = \frac{z_{ij}^x}{\sigma_{u_{ij}^3}}$.[17] In a similar fashion, calling $\hat{p}_{ij}^2$ the predicted probability of observing both trade and FAS between country i and j, $\hat{z}_{ij}^{I*} = \Phi^{-1}\left(\hat{p}_{ij}^2\right)$ is the predicted value of the latent variable $z_{ij}^{I*} = \frac{z_{ij}^I}{\sigma_{e_{ij}}}$.[18]With these two predicted values, we can obtain consistent estimates of W_{ij}^s, $s = [1,2,3]$ as follows:

$$W_{ij}^1 = max\left[\left(Z_{ij}^{I*}\right)^{\zeta} - 1, 0\right] \tag{31}$$

$$W_{ij}^2 = max\left[\left(Z_{ij}^{x*}\right)^{\zeta} - 1, 0\right] \tag{32}$$

$$W_{ij}^3 = \left[\left(Z_{ij}^{x*}\right)^{\zeta} - \left(Z_{ij}^{I*}\right)^{\zeta}\right] \tag{33}$$

with $\zeta = \sigma_{u_{ij}^3}\frac{k-\epsilon+1}{\epsilon-1}$.[19]

4.2 Second Stage: FAS and TRADE Log-Linear Equations

In order to consistently estimate equations (21) and (22), I need to correct for both heterogeneity and selection. Correcting for heterogeneity requires the estimation of the different expected values for w_{ij} for the cases of only trade or both trade and FAS flows between countries; hence, I need

[17] To see this, define for simplicity $\theta_2^* + \Psi_j^* + \Upsilon_i^* - \gamma^* d_{ij} - \kappa^* \phi_{ij} = x_{ij}\beta^*$. Then $p_{ij}^0 = Prob\left[x_{ij}\beta^* + e_{ij}^* < \delta_1^*\right] = \Phi\left(\delta_1^* - x_{ij}\beta^*\right)$. Hence $-\Phi^{-1}\left(\hat{p}_{ij}^0\right) = (x_{ij}\widehat{\beta^* - \delta_1^*}) = \hat{z}_{ij}^{x*}$.

[18] Defining $x_{ij}\beta^*$ as in in the previous note, $p_{ij}^2 = Prob\left[x_{ij}\beta^* + e_{ij}^* > \delta_2^*\right] = \Phi\left(x_{ij}\beta^* - \delta_2^*\right)$. Hence $\Phi^{-1}\left(\hat{p}_{ij}^2\right) = (x_{ij}\widehat{\beta^* - \delta_2^*}) = \hat{z}_{ij}^{I*}$.

[19] See Equations (13) and (24) to derive equation (31) and equations (11) and (22) to get equations (32) and (33).

$E\left[w_{ij}^1|.,GLOBAL_{ij}=2\right]$, $E\left[w_{ij}^2|.,GLOBAL_{ij}=1\right]$ and $E\left[w_{ij}^3|.,GLOBAL_{ij}=2\right]$. Analogously to HMR, I exploit here the dependence of all these terms on u_{ij}^*, which is unit normal. In particular, using the properties of the truncated standard normal, I can derive:

$$E\left[u_{ij}^*|.,z_{ij}^*>\delta_2^*\right] = \frac{\phi\left(\hat{z}_{ij}^{I*}\right)}{\Phi\left(\hat{z}_{ij}^{I*}\right)} = \hat{\eta}_{ij}^1 \tag{34}$$

$$E\left[u_{ij}^*|.,z_{ij}^*>\delta_1^*\right] = \frac{\phi\left(\hat{z}_{ij}^{x*}\right)}{\Phi\left(\hat{z}_{ij}^{x*}\right)} = \hat{\eta}_{ij}^2 \tag{35}$$

$$E\left[u_{ij}^*|.,\delta_1^*<z_{ij}^*<\delta_2^*\right] = \frac{\phi\left(-\hat{z}_{ij}^{x*}\right)-\phi\left(-\hat{z}_{ij}^{I*}\right)}{\Phi\left(\hat{z}_{ij}^{I*}\right)-\Phi\left(\hat{z}_{ij}^{x*}\right)} = \hat{\eta}_{ij}^3 \tag{36}$$

where $\phi()$ and $\Phi()$ are the p.d.f. and the c.d.f. of the standard normal. Using equation (34), (35) and (36) I can get consistent estimates for w_{ij} as follows:

$$\hat{w}_{ij}^1 = ln\left\{exp\left[\zeta\left(\hat{z}_{ij}^{I*}+\hat{\eta}_{ij}^1\right)\right]-1\right\} \tag{37}$$

$$\hat{w}_{ij}^2 = ln\left\{exp\left[\zeta\left(\hat{z}_{ij}^{x*}+\hat{\eta}_{ij}^2\right)\right]-1\right\} \tag{38}$$

$$\hat{w}_{ij}^3 = ln\left\{exp\left[\zeta\left(\hat{z}_{ij}^{x*}+\hat{\eta}_{ij}^3\right)\right]-exp\left[\zeta\left(\hat{z}_{ij}^{I*}+\hat{\eta}_{ij}^1\right)\right]\right\} \tag{39}$$

Correcting for selection (the possible correlation between u_{ij}^3 and u_{ij}^1, u_{ij}^2) implies instead inserting in the equations for FAS and trade the relevant Heckman-type correction terms ($\hat{\eta}_{ij}^1$ $\hat{\eta}_{ij}^2$ and $\hat{\eta}_{ij}^3$). Hence, it is possible to consistently estimate equation (21) using the following transformation:

$$fas_{ij}=\theta_0+\Psi_j^I+\Upsilon_i^I-\gamma_1 d_{ij}+ln\left\{exp\left[\zeta\left(\hat{z}_{ij}^{I*}+\hat{\eta}_{ij}^1\right)\right]-1\right\}+\beta^1\hat{\eta}_{ij}^1+e_{ij}^1 \tag{40}$$

where e^1_{ij} is now an i.i.d error for which $E\left[e^1_{ij}|.,GLOBAL_{ij}=2\right]=0$. Equation (40) can be estimated via non-linear least squares (as in HMR) or through Maximum Likelihood (as I will do in the next section).

Consistent estimation of equation (22) now depends on whether we also observe investment flows between the two countries. If only trade is observed, then it is possible to estimate the trade flows gravity-type equation as:

$$m_{ij}=\theta_1+\Psi^x_j+\Upsilon^x_i-\gamma d_{ij}+ln\left\{exp\left[\zeta\left(\hat{z}^{x*}_{ij}+\hat{\eta}^2_{ij}\right)\right]-1\right\}+\beta^2\hat{\eta}^2_{ij}+e^2_{ij} \tag{41}$$

where e^2_{ij} is an i.i.d error for which $E\left[e^2_{ij}|.,GLOBAL_{ij}=1\right]=0$. On the other hand, if FDI (FAS) are also observed between countries, then the correct way to estimate equation (22) becomes:

$$m_{ij}=\theta_1+\Psi^x_j+\Upsilon^x_i-\gamma d_{ij}+ln\left\{exp\left[\zeta\left(\hat{z}^{x*}_{ij}+\hat{\eta}^3_{ij}\right)\right]-exp\left[\zeta\left(\hat{z}^{I*}_{ij}+\hat{\eta}^1_{ij}\right)\right]\right\}+\beta^3\hat{\eta}^3_{ij}+e^3_{ij} \tag{42}$$

where e^3_{ij} is an i.i.d error for which $E\left[e^3_{ij}|.,GLOBAL_{ij}=2\right]=0$. Importantly, using the correction terms contained in equation (41) to address cases where also FAS are present implies a possible omitted variable bias (given that the correct correction terms that should be applied are the one of equation (42)). The relevance of this potential problem is ultimately an empirical question.

Before proceeding to the results, it is probably useful to briefly summarize the notationally-intensive procedure. Essentially, I am proposing a two-stage procedure for the estimation of bilateral trade and FAS flows. In the first stage, the definition of convenient latent variables allows me to describe the self-selection of heterogeneous firms into trade and FAS with an ordered Probit model. From the ordered Probit estimates, it is possible to back out variables that allow me to correct the flows equations for selection and for the fraction of exporting/investing firms.

5 Results

This section reports the results obtained from applying the methodology introduced in the previous section to the dataset on bilateral trade and foreign affiliate sales in manufacturing introduced in section 2.

As regressors, I use variables from the distance dataset from the CEPII. This dataset provides me with data for a large sample of countries and includes variables such as geographic distance and dummies for common border, presence of a regional trade agreement common colonial past and common language.[20] I'll first present the OLS estimates and then move on to those from the two-stage procedure. All the trade, FDI and FAS flows values are measured in 2000 US dollars, converted using the US CPI.

I also add time fixed effects in all the equations. While the model presented in section three is static and should ideally be tested only on a large cross section of data, by pooling the data from several years and including year fixed effects I increase the number of observations available.

5.1 OLS Estimates

Table 3 contains the results obtained using OLS techniques on the bilateral FAS and trade in the manufacturing sector for the period 2000-2006.The first column includes the results obtained for the FAS equation and the second column includes the results obtained for the trade equation using

[20]The data on RTA are taken from the dataset by Head et al (2010).

only the observations where FAS were not observed. Finally, the third column reports the results obtained for the trade equation including only those observations where also FAS were observed.

Two interesting results emerge: First, the coefficient on distance is smaller in the FAS equation than in the trade equations. Second, the coefficient on distance in the trade (no FAS) equation is higher than the coefficient on distance in the trade (with FAS) equation. The first result is consistent with the proposed assumption of the theoretical model in section three. The difference in the two coefficients can be interpreted as a cost disadvantage faced by foreign firms that is less important than the transport cost needed to ship goods internationally. The second result, which is clearly not modeled here, could potentially be explained by the fact that countries also experiencing FDI are generally richer and more integrated. The *composition of trade* between those countries, hence, might be inherently characterized by goods less sensitive to distance.

Consistently with previous evidence, the presence of a common border, a common colonial origin, and an RTA appear to have positive effects on both the FAS and the trade bilateral flows. Sharing a common language appears to have a positive impact on bilateral trade flows but not on bilateral FAS flows.

5.2 Two-Stage Estimation

Table 4 reports the results of the ordered Probit regression. Given that all the coefficients have been divided by σ_e, the quantitative magnitude is not very revealing. Distance, as expected, decreases the probability of observing bilateral trade and FAS flows between countries. Colonial links and common language seem to be significant variables in determining the probability of observing positive trade/investment flows. The presence of a common border displays a positive coefficient, which is not statistically significant.[21]

Moreover, in order to avoid relying on identification through functional form in the estimation of equations (40), (41) and (42), it is necessary to include in the first stage a variable that is excluded in the second stage. Following HMR, I use a common religion variable as the excluded variable.[22] As Table 4 shows, common religion is a significant factor in determining the probability of observing trade and investment flows between countries, thus making it a useful excluded variable.[23]

Table 5 reports the results obtained for the bilateral FAS flow equation (40). The first columns report the OLS estimates to ease the comparison (equivalent to the first columns of Table 3). The second column of results are obtained by estimating equation (40) through maximum likelihood. The coefficient on distance is almost halved in the specification that corrects for heterogeneity and selection. Thus the result found by HMR for trade is found to be valid also for bilateral foreign affiliate sales. The OLS coefficient does not properly distinguish between the impact of distance on the extensive margin of the international activities (the number of firms able to invest, in this case) and their amount(the intensive margin). The importance of correcting the estimates for the presence of firm heterogeneity is witnessed by the coefficients on the corrections term ζ and $\hat{\eta}^1$, which are both highly statistically significant. The coefficient on colonial origin is half of what obtained with OLS (and become statistically insignificant), while the coefficient on RTA is reduced by roughly one third. The coefficient on border is also reduced, though to a lessen degree.

Table 6 reports the results obtained for the trade equations in the absence of FAS. The OLS estimates are reported for comparison. Also in the case of trade, the coefficient obtained with

[21]this last result is reminiscent of HMR, who find a negative coefficient on border in their first stage regression. HMR proposed as justification the effects of territorial border conflicts that suppresses trade between neighbors.

[22]Expressed as the probability that two randomly picked individuals in the two countries in 1996 belong to the same religion.

[23]Although not a perfect one. I plan in future work to explore the increased availability of possible excluded variables suitable for this framework.

the two-stage estimation procedure are smaller than the one obtained with OLS. The drop of the coefficients on distance and common border are between 10% and 15%, while the drops of the coefficients on RTA and common colonial origin are more substantial (of the order of 30%). Overall, the results in table 6 are broadly consistent with what previously found by HMR. The importance of correcting the estimates for selection and heterogeneity is confirmed by the strong statistical significance of both correction terms.

Finally, Table 7 reports the results of the trade equation obtained considering the cases where also FAS were present. The first column report the OLS estimates for comparison. The second column contain the results obtained by applying the correction terms included in equation (42), which do not take into account of the presence of FAS while the third column contains the correction terms that take into account of FAS.[24] The coefficients on all the variables are lower than the OLS estimates in both cases. However, the coefficients obtained taking into account of the FAS tend to be higher than the ones obtained without taking into account of the FAS. The intuition for this result is that not taking into account the the FAS implies overestimating the fraction of firms that export (including also some firms that actually invest and serve the foreign market through sales by its affiliate). Overestimating the fraction of exporting firms imply underestimating the importance of factors such as distance, RTA and so on on the intensive margin. From a quantitative point of view, however, the difference in the coefficients is not very large. Overall, I conclude that failing to properly take into account the presence of FAS when correcting the aggregate trade flow equation for selection and heterogeneity does not leads to significant differences in the estimated coefficients.

[24]The coefficients obtained in column two are not exactly the coefficients that would be derived by an HMR-type procedure because the correction terms still come from the first stage of the procedure proposed in this paper (the order probit). Conceptually, it would be necessary to compare the coefficients of column 3 with what would be obtained using a probit model for trade flows as first stage. Unfortunately, the small number of zeroes in the sample makes impossible to estimate a first stage fully consistent with the HMR procedure. This is a caveat that must be considered when examining the results.

6 Conclusion

I have uncovered a new pattern in the data, namely that bilateral FDI and FAS are almost never observed in the absence of bilateral trade flows. I developed a model with implications for aggregate trade flows and foreign affiliate sales that are consistent with this pattern. I proposed a two-stage methodology, structurally derived from the model, to estimate the trade and the FAS equations consistently. The main results of the analysis are as follows: 1) The impact of distance, border and regional trade agreements on bilateral foreign affiliate sales becomes substantially smaller after controlling for selection and firms' heterogeneity (hence separating the impact on the extensive versus the intensive margin). 2) The same "attenuation result" is found also for the trade equations, consistently with HMR. 3) When FAS are observed, failing to take this into account when correcting for heterogeneity and selection in the trade equations leads to differences in the estimated coefficients.

Interesting directions for related future research includes using the methodology proposed here on more disaggregated data (say at the level of single industries) to uncover possible differences across different sectors.

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Table 1: **Selection in Aggregate FDI and TRADE, 2000-2007**

	No Trade	**Trade**	**Total**
No FDI	2,671	14,978	17,649
FDI	**351**	9,884	10,235
Total	3,022	24,862	27,884

Table 2: **Selection in FAS and TRADE, Manufacturing, 2000-2006**

	No Trade	**Trade**	**Total**
No FAS	407	4,749	5,126
FAS	**338**	4,082	4,420
Total	745	8,831	9,576

Table 3: **OLS results, FAS and Trade, Manufacturing, 2000-2006**

Dep Variable	**FAS**	**trade NO FAS**	**trade FAS**
distance	-0.325***	-0.935***	-0.739***
	(0.059)	(0.025)	(0.022)
border	0.789***	0.303***	0.328***
	(0.135)	(0.070)	(0.049)
rta	0.644***	0.535***	0.718***
	(0.135)	(0.047)	(0.049)
colonial	0.442**	0.739***	0.401***
	(0.137)	(0.065)	(0.050)
language	-0.038	0.412***	0.328***
	(0.113)	(0.045)	(0.041)
Imp/Host FE	Yes	Yes	Yes
Exp/Home FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R-squared	0.556	0.869	0.921
N	4082	4749	4082

Standard Errors in Parenthesis
*,**,*** Statistically Significant at 10%, 5% and 1%

Table 4: **Ordered Probit Results**

distance	-0.171***
	(0.037)
border	0.052
	(0.099)
rta	0.288***
	(0.074)
colonial	0.318***
	(0.094)
language	0.493***
	(0.068)
religion	**0.894*** **
	(0.110)
Imp/Host FE	Yes
Exp/Home FE	Yes
Year FE	Yes
pseudo R squared	0.57
N	9238

Standard Errors in Parenthesis
*,**,*** Statistically Significant at 10%, 5% and 1%

Table 5: **FAS Results, Manufacturing, 2000-2006**

Technique	**OLS**	**ML**
distance	-0.325***	-0.149**
	(0.059)	(0.074)
border	0.789***	0.683***
	(0.135)	(0.133)
rta	0.644***	0.473***
	(0.135)	(0.141)
colonial	0.442***	0.226
	(0.137)	(0.157)
language	-0.038	-0.486***
	(0.113)	(0.157)
ζ		1.252***
		(0.243)
$\hat{\eta}^1$		0.721***
		(0.278)
Imp/Host FE	Yes	Yes
Exp/Home FE	Yes	Yes
Year FE	Yes	Yes
R-squared	0.55	
N	4082	3968

Standard Errors in Parenthesis
*,**,*** Statistically Significant at 10%, 5% and 1%

Table 6: **Trade Results with No FAS, Manufacturing, 2000-2006**

Technique	**OLS**	**ML**
distance	-0.935***	-0.798***
	(0.025)	(0.030)
border	0.303***	0.274***
	(0.070)	(0.068)
rta	0.535***	0.379***
	(0.047)	(0.050)
colonial	0.739***	0.469***
	(0.065)	(0.072)
language	0.412***	0.067
	(0.045)	(0.064)
ζ		0.451***
		(0.107)
$\hat{\eta}^2$		-0.671***
		(0.227)
Imp/Host FE	Yes	Yes
Exp/Home FE	Yes	Yes
Year FE	Yes	Yes
R-squared	0.86	
N	4749	4749

Standard Errors in Parenthesis
*,**,*** Statistically Significant at 10%, 5% and 1%

Table 7: **Trade results with FAS, Manufacturing, 2000-2006**

Technique	**OLS**	**ML-HMR**	**ML**
distance	-0.739***	-0.571***	-0.584***
	(0.022)	(0.027)	(0.028)
border	0.328***	0.256***	0.266***
	(0.049)	(0.049)	(0.049)
rta	0.718***	0.529***	0.548***
	(0.049)	(0.051)	(0.052)
colonial	0.401***	0.080	0.096
	(0.050)	(0.057)	(0.059)
language	0.328***	-0.107*	-0.069
ζ		0.766***	0.724***
		(0.080)	(0.213)
$\hat{\eta}^2$		-11.43***	
		(1.36)	
$\hat{\eta}^3$			-0.764***
			(0.383)
Imp/Host	Yes	Yes	Yes
Exp/Home FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R-squared	0.917		
N	4082	3971	3968

Standard Errors in Parenthesis
*,**,*** Statistically Significant at 10%, 5% and 1%

Figure 1: **Self-Selection into Export and FDI**

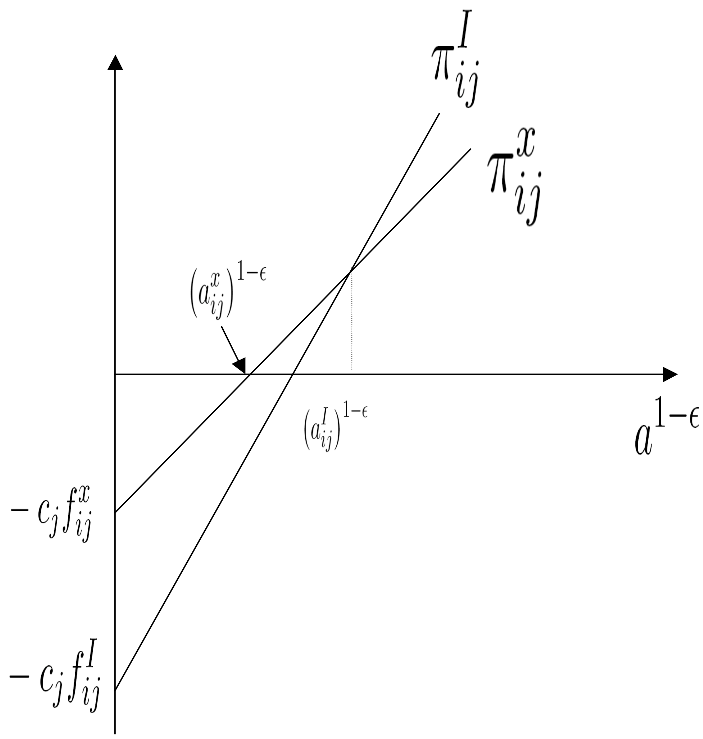

Figure 2: **Interaction between Bilateral Trade and FDI Thresholds and Most Productive Firm's Productivity: Three Possible Cases**