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ABSTRACT

A positive productivity shock in the host country tends typically to increase the volume of the desired FDI flows to the host country, through the standard marginal profitability effect. But, at the same time, such a shock may lower the likelihood of making any new FDI flows by the source country, through a total profitability effect, derived from the a general-equilibrium increase in domestic input prices. This is the gist of the theory that we develop in the paper. For a sample of 62 OECD and Non-OECD countries over the period 1987-2000, we provide supporting evidence for the existence of such conflicting effects of productivity change on bilateral FDI flows. We also uncover sizeable threshold barriers in our data set and link the analysis to the Lucas Paradox.

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1 Introduction

Maurice Obstfeld and Alan M. Taylor (2003) make a succinct observation : "A century ago, world income and productivity levels were far less divergent than they are today, so it is all the more remarkable that so much capital was directed to countries at or below the 20 percent and 40 percent income levels (relative to the United States). Today, a much larger fraction of the world's output and population is located in such low-productivity regions, but a smaller share of global foreign investment reaches them." Earlier, in a similar vein, Lucas (1990) put it like this: "Why doesn't capital flow from rich to poor countries?" Indeed, the law of diminishing returns implies that the marginal product of capital is high in poor, labor-abundant countries and low in rich, capital-abundant countries. With a standard constant-returns-to-scale production function, when the wage (per efficiency unit of labor) is higher in the rich country (due to poor-rich country differences in relative supplies of capital and labor), the return to capital must be lower in the rich countries than in the poor country. Therefore, capital is expected to flow from rich to poor countries. In practice, however, this is not easily seen in the data. Even though barriers to international capital mobility are by and large being eliminated, the wage gap is still in force, and migration quotas from poor to rich countries have to be enforced[1].

[1]Lucas reconciles this paradox (with a simple theory and skillful calibration) by appealing to a human capital externality (proxied by average years of schooling) that generates a Hicks-neutral productivity advantage for rich countries over poor countries.Note also that despite the expansion of international trade in goods, still the Stolper-Samualson factor price equalization theorem does not manage to eliminate the wage gap; see Stolper and

The present paper focuses on foreign direct investment (FDI), as a key channel of international capital flows, which is expected to be closely associated with cross country productivity differences. We develop a model with "lumpy" setup costs of new investments that govern the flow of bilateral foreign direct investment. Every country in this model may potentially be a source for FDI flows to several host countries; and each country may be a host for FDI flows from several source countries. But the rich and technologically-advanced countries have a comparative advantage in setting up foreign subsidiaries. As this advantage may also be industry-specific, the model is capable of generating two-way rich-rich, and rich-poor FDI flows. With setup costs of investment, it does not pay a firm to make a "small" foreign investment, even if such an investment is called for by marginal productivity conditions (that is, the standard first-order conditions for profit maximization). Put differently, a typical foreign investment decision is two-fold now: marginal productivity conditions determine how much to invest, whereas a selection condition, based on total profitability, determines whether to invest at all.

Lucas (1990) focuses on capital flows from rich to poor countries. This was the major direction of flows in the era of free capital mobility that preceded World War I[2]. However, the increased mobility of capital that followed World War II, and accelerated with the end of the Cold War, is of a different nature. As Obstfeld and Taylor (op. cit.) note: "Globalized capital markets are back, but with a difference: capital transactions seem to be mostly a rich-rich

Samuelson (1941).

[2]Most notably were the flows of capital from imperialist countries to their colonies.

affair, a process of 'diversification finance' rather than 'development finance'. The creditor-debtor country pairs involve more rich-rich than rich-poor, and today's foreign investment in the poorest developing countries lag far behind the levels attained at the start of the last century".

Threshold barriers play an important role in determining the extent of trade-based foreign direct investment; see, for instance, Zhang and Markusen (1999), Carr, Markusen and Maskus (2001), and Helpman, Melitz and Yeaple (2003). The trade-based literature typically focuses on issues such as the interdependence of FDI and trade in goods and the ensuing industrial structure. For instance, they attempt to explain how a source country can export both FDI and goods to the same host country. The explanation rests on productivity heterogeneity within the source country, and differences in setup costs associated with FDI and export of goods. The trade-based literature on FDI is thus geared towards a *firm-level* decisions on exports and FDI in the source country. Our focus is on *aggregate* bilateral FDI. Thus, trade-based empirical applications typically use micro dataset, whereas we utilize country-wide data set.

The organization of the paper is as follows. Section 2 develops the model. Section 3 demonstrates the conflicting effects of productivity shocks. Section 4 outlines the econometric approach and describes the data. Section 5 presents the empirical findings. Section 6 concludes.

2 The Model

In a nutsheel, the model of FDI works as follows. First, a potential FDI investor decides how much she would like to invest. This decision is governed by the marginal profitability considerations, so as to equate the marginal factor productivity to factor prices (that is, the standard first-order condition). In an econometric terminology, this decision is described by a *flow* (or "gravity") equation. Second, the potential FDI investor must also decide whether to carry out at all new investments, because of fixed costs of new investments. The decision is governed by the total (rather than marginal) profitability of the new investment. In an econometric terminology, such decision is described by the so-called *selection* equation. A productivity shock in the host country may, on the one hand, increase the volume of the desired FDI flows to this country, but, on the other hand, and somewhat counter to conventional thinking, the shock may lower the likelihood of making new FDI flows at all, by the source country. A source-country positive productivity shocks has a negative effect in the likelihood of making a new FDI, but is inconsequential for the flow of FDI. As we focus on *aggregate* bilateral capital flows in the econometric analysis, we specify in the theory background the general productivity level of a country, and ignore for simplicity heterogeneity among firms within a country [3].

Consider a representative industry in a given host country (H) in a world of free capital mobility, which fixes the world rate of interest, denoted by r. As before, there is a single good which serves both for consumption and

[3] For notational simplicity we also set the number of firms in the industry to be equal to one.

investment. In a straightforward extension of the model to more than one industry every country becomes potentially both a source for FDI flows to several host countries, and a host for FDI flows from several source countries. But because of fixed costs, some of the source-host pairs are inactive.

As our focus here is on the country-specific productivity shocks, we would like to reckon with the possibility that a productivity change affects wages. If the setup cost is in part in domestic (host-country) inputs, we have to take into account the indirect effect of a productivity change on the setup cost. Therefore, we assume that the setup cost is of the form

$$C_H = C_{SH} + w_H L_H^C, \tag{1}$$

where C_{SH} is a cost incurred in the source country and L_H^C is a fixed input of domestic labor, proxying other domestic input prices.

Consider a representative firm which does invest in the first period an amount $I = K - K_H^0$ in order to augment its stock of capital to K. Its present value becomes

$$V^+(A_H, C_H, w_H) = \max_{(K,L)} \left\{ \frac{A_H F(K,L) - w_H L + K}{1+r} - [(K - K_H^0) + C_H] \right\}. \tag{2}$$

Input L stands for a variety of domestic inputs, such as labor, land, etc. The demand of the firm for K and L are denoted by $K^+(A_H, w_H)$ and $L^+(A_H, w_H)$, respectively. They are defined by the marginal productivity conditions:

$$A_H F_K(K,L) = r, \tag{3}$$

and

$$A_H F_L(K, L) = w. \tag{4}$$

Note again that the firm may choose not to invest at all (that is, to stick to the existing stock of capital K_H^0) and thereby avoid the lumpy setup cost C_H. In this case its present value is:

$$V^-(A_H, K_H^0, w_H) = \max_L \left\{ \frac{A_H F(K_H^0, L) - w_H L + K_H^0}{1+r} \right\}, \tag{5}$$

and its labor demand, denoted by $L^-(A_H, K_H^0, w_H)$, is given by

$$A_H F_L(K_H^0, L^-(A_H, K_H^0, w_H)) = w_H. \tag{6}$$

The firm will make a new investment if, and only if,

$$V^+(A_H, C_H, w_H) \geq V^-(A_H, K_H^0, w_H). \tag{7}$$

That is, the firm makes the amount of investment that is called for by the marginal productivity conditions, (3) and (4), if and only if, a global *selection* condition (7), is met.

As before, we assume that labor is confined within national borders. Denoting the country's endowment of labor by L_H^0, we have the following labor market clearing equation:

$$\left.\begin{array}{ll} L_H^C + L^+(A_H, w_H) = L_H^0 & \text{if } V^+(A_H, C_H, w_H) \geq V^-(A_H, K_H^0, w_H) \\ L^-(A_H, w_H) = L_H^0 & \text{if } V^+(A_H, C_H, w_H) < V^-(A_H, K_H^0, w_H) \end{array}\right\} \tag{8}$$

This market clearing equation determines the wage rate in the host country, as a function $w_H(A_H)$ of the host-country productivity factor.[4]

3 Conflicting Effects of Productivity Shocks

We now turn to discuss the determinants FDI flows from the source country S to the host country H. We treat as FDI the investment of source-country entrepreneurs in the mergers and acquisitions (M&A) of host-country firms. Suppose that the source-country entrepreneurs are endowed with some "intangible" capital, or know-how, stemming from their specialization or expertise in the industry at hand. We model this comparative advantage by assuming that the lumpy setup cost of investment in the host country, when investment is done by the source country entrepreneurs (FDI investors) is below the lumpy setup cost of investment, if carried out by the host country direct investors. This means that the foreign direct investors can bid up the direct investors of the host country in the acquisition of the investing firms in the host country. The representative firm is purchased at its value which is $V^+[A_H, C_H, w_H(A_H)]$. This essentially assumes that competition among the foreign direct investors pushes the price of the acquired firm to a maximized value. Thus, the FDI investors shift all the gains from their lower setup cost to the host-country original owners of the firm. The new owners also invest an amount $K^+[A_H, w_H(A_H)]$ to expand the capital stock of the acquired the firm. On the other hand, if the selection condition (7) does not hold, then

[4] See Appendix A for a derivation of the partial derivative of FDI with respect to the productivity shock.

there will be no FDI flows from country S to country H. Thus, aggregate foreign direct investment is equal to:

$$FDI = \begin{cases} V^{+}[A_H, C_H, w_H(A_H)] + K^{+}[A_H, w_H(A_H)] - K_H^0 + w_H(A_H)L_H^{*C} \\ \text{if } V^{+}[A_H, C_H, w_H(A_H)] \geq V^{-}[A_H, K_H^0, w_H(A_H)] \\ 0 \\ \text{if } V^{+}[A_H, C_H, w_H(A_H)] < V^{-}[A_H, K_H^0, w_H(A_H)] \end{cases} . \tag{9}$$

The model thus suggests that if the productivity factor (A_H) is sufficiently high, and/or the wage rate (w_H) is sufficiently low, and/or the setup cost $(C_{SH} + w_H L_H^C)$ is sufficiently low, then FDI flows from country S to country H are positive. Otherwise, the flow of FDI from country S to country H must be zero.

As a preamble to our empirical analysis in the next part, recall that the model's special feature is the two-fold mechanism of FDI decisions. First, one decides how much to invest abroad, while ignoring the fixed setup cost. Second, a decision is made whether to invest at all, taking into account this cost. The hallmark of our empirical approach to follow is based on the two equations (conditions) that govern these decisions. The deterministic analogous of the "flow" and the "selection" equations are as follows. First, ignoring the setup cost, the FDI flows from country S to country H (denoted by FDI_{NOF}) is govern by a "notional flow" equation:

$$FDI_{NOF} = V^{+}[A_H, C_H, w_H(A_H)] + K^{+}[A_H, w_H(A_H)] - K_H^0 + w_H(A_H)L_H^C. \tag{10}$$

That is, the quantity of investment (K^+) and the acquisition price (V^+) are govern by the marginal productivity conditions (2) and (3). Second, the question whether FDI flows from country S to country H are at all positive is govern by a "selection" equation (condition):

$$V^+[A_H, C_H, w_H(A_H)] - V^-[A_H, K_H^0, w_H(A_H)] \geqq 0. \tag{11}$$

Consider now the effect of a positive productivity shock which raises the host country's productivity factor, A_H. As before, suppose initially that the wage rate in the host country (w_H) is fixed [that is, ignore the labor market clearing condition in equation (8)]. An increase in A_H raises the quantity of new investment (K^+), if the investment is carried out at all, the acquisition price (V^+) that FDI investors pay, the amount of FDI, and the demand for the labor in the host country. The increase in the demand for labor raise the wage rate (w_H) in the host country (and the fixed setup cost $w_H L_H^{*C}$), thereby countering the above effects on K^+, V^+, and FDI. With a unique equilibrium, the initial effects of the increase in A_H are likely to dominate the subsequent counter effects of the rise in w_H, so that FDI still rises[5].

Thus, an increase in the host country's productivity factor (A_H) raises the volume of FDI flows from country S to country H that is governed by the flow equation. But, at the same time, the rise in A_H increases also the value of the domestic component of the setup cost, $w_H(A_H)L_H^C$. Thus, it may weaken

[5] However, with fixed setup cost the equilibrium need not to be unique, and an increase in A^H may, somewhat counter-intuitively, reduce FDI, possibly even to zero. For a similar phenomenon, see Razin, Sadka and Coury (2003).

the advantage of carrying out positive FDI flows from country S to country H at all. In other words, the gap between V^+ and V^- in the selection equation narrows down. Thus, a positive productivity shock (typically unobserved in the data) raises the observed FDI flows in the flow equation but, at the same time, may lower the likelihood of observing positive FDI flows at all. In other words, the model may generate a *negative* correlation in the data between the residuals of the flow and selection equations.

The productivity level (A_S) in the source country comes into play in the selection decision, when we consider again the limited supply of entrepreneurs in the source country. This consideration is particularly relevant for *greenfield* FDI. A source-country entrepreneur then faces a discrete choice of whether to invest either at home or abroad, but not in both. In this case, in order for her to make greenfield FDI, it no longer suffices that V^+ exceeds V^-; rather V^+ must also exceed the value of alternative direct investment at home. The latter naturally depends on the source-country productivity level, A_S, and we denote it by $B(A_S)$. That is, the selection condition is:

$$V^+[A_H, C_H, w_H(A_H)] > Max\left\{V^-[A_H, K_H^0, w_H(A_H)], B(A_S)\right\}. \qquad (12)$$

Thus, the source-country positive productivity shock affects negatively the selection decision, but it has no bearing on the flow decision.

The FDI flow mechanism works as follows. A comparative advantage for the source country is based on low setup costs of direct investment, relative to setup costs of domestic investors. This allows foreign investors to bid up for investment projects in the host country. An exogenous productivity shock in the host country may affect the decision of the FDI investors whether to invest at all, and how much to invest, in opposite directions. For instance, a positive productivity shock, ceteris paribus, improves both marginal and total profitability of new investment. But, it also raises the demand for labor and consequently wages. The rise in wages, in turn, mitigates the initial rise in the marginal profitability and in the total profitability of the new investment, through its adverse effect on variable costs. However, the increase in wage costs does not completely offset the initial rise in the marginal and total productivity of new investments. As a result, the positive productivity shock implies a net rise in the marginal profitability of new investment. This may not be the case with total profitability. It is adversely affected by the rise in wages not only through the increase in the variable costs, but also through the increase in the wage bill associated with setup costs. Hence, it may well be the case that a positive productivity shock increases the marginal productivity and lowers the total profitability of new investments, at the same time.[6]

4 Data

We consider several potential explanatory variables of the two-fold decisions on FDI flows. These variables include standard "mass" variables (the source and host population sizes); "distance" variables (physical distance between the source and host countries and whether or not the two countries share a

[6] In Appendix B we extend the model to firm level heterogeneity. A productivity shock may alter the composition of high vs low productivity firms that are actively invest. Thus, there is an additional endogenous component to the effect of productivity on FDI.

common language); and "economic" variables (source and host real GDP per capita, source-host differences in average years of schooling, and source and host financial risk rating). We also control for country and time fixed effects. The dependent variable in all the flow (gravity) equations is the log of the FDI flows.

The main variables we employ are: (1) standard country characteristics such as real GDP per-capita, population size, educational attainment (as measured by average years of schooling), and financial risk rating; (2) (s, h) source-host characteristics, such as (s, h) FDI flows, geographical distance, common language (zero-one variable); (3) productivity, i.e., output per worker as measured by PPP-adjusted real GDP per worker. Table 1 summarizes the data sources. Table 2 describes the list of the 62 countries in the sample, and indicates for each country, as a source or a host, whether positive bilateral flows are observed in the sample, at least once. Note that most source countries do not interact more than with few host countries.

FDI data are drawn from the International Direct Investment database (Source OECD), covering the bilateral FDI flows among 62 countries (29 OECD countries and 33 Non-OECD countries) over the period 1987 to 2000. The Source OECD provides FDI in U.S. dollars and we deflate it by the U.S. CPI for urban consumers.

5 Empirical Evidence

Our economic approach is based on Razin, Rubinstein and Sadka (2004), where attention is paid to the problems that arise when FDI flows are "lumpy": FDI flows are actually observed only when their profitability exceeds a certain (unobserved) threshold. There are indeed around 62% host-source pairs for which no FDI flows appear in our data. This probably indicates that the FDI flows called for by the standard marginal productivity conditions are not large enough to surpass a certain threshold level, rather than that the desired flows, in the absence of a threshold, are actually zero. Therefore, the Heckman selection method is adopted to jointly estimate the likelihood of surpassing this threshold (the "selection" equation) and the magnitude of the FDI flow, provided that the threshold is indeed surpassed (the "flow" equation). [7]

We jointly estimate the maximum likelihood of the flow (gravity) equation and the selection equation. We estimate the model under several alternative assumptions concerning the missing observations on non OECD FDI outflows to non OECD countries: we ignore these observations and alternatively we treat them as "zeros".[8] We also use two alternatives for the data smoothing: (1) unfiltered annual data, and (2) two-year averages. In addition, we present the estimation with and without instrumenting the potentially endogenous output per worker variable. The estimation results are presented in Tables 3-7.

[7]The traditional Ordinary Least Squares (OLS) methods treat the no-flow observations as either literally indicating zero flows, and assign a value of zero for the FDI in these observations, or discard these observations altogether. In both cases the OLS estimates are biased.

[8]The Source OECD dataset reports FDI outflows from OECD countries to OECD and non OECD countries, as well as FDI outflows from non OECD countries to OECD countries. However, it does not report FDI outflows from non OECD to non OECD countries.

Table 3 presents the estimation of the equations for bilateral FDI flow and selection (ignoring missing observations on non OECD to non OECD outflows, and using annual data).The effect of the education variable, namely the source-host difference in education levels, on the extensive margin (selection) is significant and negative, but not so on the intensive margin (flow), across different alternative versions of the productivity variable. Host-country financial risk ratings is important in all models; but we find no evidence for the importance of the source on bilateral FDI flows, neither on the intensive or extensive margins.[9] Host GDP per capita is important in the intensive margin only. As expected, and consistent with previous "gravity" literature, we find that common language raises, and distance reduces the volume of FDI flows. Host population size has a significant coefficient in the flow equation but not in the selection equation. Source population size is insignificant in either equation. The existence of past FDI relations is positive and significant in the selection equation, as it may help to reduce the setup costs of establishing a new FDI flow. Most importantly as a "smoking gun" for the existence of fixed costs in the data, we note that:the correlation between the error terms in the flow and the selection equations is negative and significant.

We turn now to the variables at the focus of the investigation, output per worker. In Panel A the host output per worker has a positive effect on the intensive margin and negative effect on the extensive margin. Both coefficients are significant. Source-country output per worker has a negative and significant effect on the extensive margin, but has no significant effect on the

[9]The financial risk rating ranges from 0 to 100, with higher index implying lower financial risk.

intensive margin. In Panel B, with the productivity variables instrumented by capital per worker and education attainment, the host output per worker still significantly affects the extensive margin but is now insignificant in the flow equation. The source instrumented output per worker negatively affects both the intensive and the extensive margins. The past FDI dummy is used as an exclusion restriction variable. The positive coefficient is interpreted as an indication for a lower threshold barrier for pairs of countries that had positive FDI flows in the past.

In Table 4 we present the estimation of the equation for bilateral FDI flow and selection (ignoring missing observations on non OECD to non OECD outflows, and 2 year averages to smooth the data). In Table 5 we present the estimation of the equations for bilateral FDI flows and selection (treating missing observations on non OECD to non OECD outflows as "zeros"). In Table 6, likewise, we present the estimation of the equations for bilateral FDI flow and selection (treating missing observations on non OECD to non OECD outflows as "zeros", and smoothed data). Results are broadly similar to Table 3, and provide evidence consistent with the key hypotheses about the conflicting effects of productivity changes.[10]

Note that the relationship in the selection equation between the probability (P) of making a new FDI and the explanatory variables (including productivity) is not linear. It is rather given by

[10] Table 7 describes the auxiliary equation from which we derive the instrumented output per worker variable.

$$P(prod_H) = \int_{-\infty}^{\alpha+\beta prod_H} (2\pi)^{-1/2} \exp(-y^2/2)dy, \tag{13}$$

where α represents the effect of all the other explanatory variables (held fixed at their sample averages), including country and time fixed effects, and β is the coefficient of $prod_H$ (output per worker in host country) in the selection equation. Note also that the estimate of β is negative and statistically significant. The marginal effect of $prod_H$ on P is

$$\partial P/\partial prod_H = \beta(2\pi)^{-1/2} \exp[-(\alpha + \beta prod_H)^2/2] < 0.^{11} \tag{14}$$

Moreover, the expected value of FDI flow is

$$E\,[FDI] = P(prod_H) \exp(\delta + \gamma prod_H) + (1 - P(prod_H)) \cdot 0 \tag{15}$$

where δ represents the effect of all the other explanatory variables (held fixed at their sample averages), and γ is the coefficient of $prod_H$ in the flow equation. Note that we use $\exp(\delta + \gamma prod_H)$ for the observed FDI flow in that our dependent variable in the flow equation is the log of FDI. Therefore, the marginal effect of $prod_H$ on expected bilateral FDI flows, normalized by $\exp(\delta + \gamma prod_H)P(prod_H)$, is:

$$\frac{1}{\exp(\delta + \gamma prod_H)P(prod_H)} \frac{dE\,[FDI]}{dprod_H} = \frac{dP(prod_H)}{P(prod_H)dprod_H} + \gamma \tag{16}$$

The first component, $\frac{dP(prod_H)}{P(prod_H)dprod_H}$, is negative, while the second component, γ, is positive (see Panel A in Table 3). The net effect depends on which

[11] To complete the picture, note also that $P(prod)$ has an inflection point at $prod = -\alpha/\beta$.

component is the dominant force. Figure 1 depicts this normalized marginal effect for the U.S. as a source country, with all variables except $prod_H$ fixed at their sample average (based on Panel A in Table 3). Figure 1 clearly shows that as productivity increases, its marginal impact decreases nonlinearly.[12] Expected FDI flows decline in the level of host country productivity .That is, holding constant US productivity as a source country, the effect of an increase in the host country productivity depends crucially on the initial value of the productivity parameter.

6 Conclusion

The paper is motivated by the well-known fact that most of FDI occurs between a handful of countries. That is, bilateral FDI flows between most countries is in fact zero. The theoretical model highlights a possible channel through which zeroes might be common in the data. The FDI flow mechanism works as follows. A comparative advantage for the source country is based on low setup costs of direct investment, relative to setup costs of domestic investors. This allows foreign investors to bid up for investment projects in the host country. An exogenous productivity shock in the host country may affect the decision of the FDI investors whether to invest at all, and how much to invest, in opposite directions. For instance, a positive productivity shock, ceteris paribus, improves both marginal and total profitability of new investment. But, it also raises the demand for labor and consequently wages. The rise in wages, in turn, mitigates the initial rise in the marginal

[12] In our data sample, output per worker in host countries ranges from 2.45 to 86.6.

profitability and in the total profitability of the new investment, through its adverse effect on variable costs. However, the increase in wage costs does not completely offset the initial rise in the marginal and total productivity of new investments. As a result, the positive productivity shock implies a net rise in the marginal profitability of new investment. This may not be the case with total profitability. It is adversely affected by the rise in wages not only through the increase in the variable costs, but also through the increase in the wage bill associated with setup costs. Hence, it may well be the case that a positive productivity shock increases the marginal productivity and lowers the total profitability of new investments, at the same time.

The concrete prediction that we take to the data is about the conflicting effects of productivity changes on FDI flows: A positive productivity shock in the host country typically increases the volume of the desired FDI flows to the host country, through the standard marginal profitability effect. But, at the same time, the same shock may lower the likelihood of making any new FDI flows by the source country, through a total profitability effect, derived from the a general-equilibrium increase in wages and other input prices. Using a sample of 62 OECD and Non-OECD countries, over the period 1987-2000, we provide supporting evidence for the existence of such effects of productivity changes on bilateral FDI flow and the selection equations. That is, the empirical findings is that productivity would affect the aggregate flows of FDI in one way and the likelihood of positive FDI flows in another.

Finally, we mention a potential caveat. The predictions from the model with fixed costs are predictions related to investment in capacity, but the FDI flow data captures financial flows associated with such investment. A fraction of FDI investment is often financed in an affiliate's host country, coming from host country sources. To the extent that this fraction is not correlated with the productivity shocks, the empirical predictions though are not biased.

References

[1] Amiti, Mary (1998), "Inter-Industry Trade in Manufactures: Does Country Size Matter?", *Journal of International Economics.*

[2] Broner, Fernando, A., Guido Lorenzoni, and Sergio L. Schmukler (2003), "Why Do Emerging Markets Borrow Short Term?" Princeton University, http://www.princeton.edu/~guido/shortterm.pdf, July.

[3] Caballero, Ricardo and Eduardo Engel (1999), "Explaining Investment Dynamics in US Manufacturing: A Generalized (S;s) Approach," **Econometrica**, July, 741-82.

[4] ____________________ (2000), "Lumpy Adjustment and Aggregate Investment Equations: A "Simple" Approach Relying on Cash Flow "Information," mimeo.

[5] Carr, David L., Markusen, James R. and Keith E. Maskus (2001), "Estimating the Knowledge-Capital Model of the Multinational Enterprise," **American-Economic-Review**. 91(3): 693-708.

[6] Cecchini, Paolo (1988), **The European Challenge 1992: The Benefits of a Single Market**, "The Cecchhini Report", Wilwood House.

[7] Eaton, Jonathan, and Akiko Tamura (1994), "Bi-lateralism and Regionalism in Japanese and U.S. Trade and Direct Foreign Investment," **The Journal of The Japanese and International Economies**, Vol. 8, pp.478-510.

[8] Eichengreen, Barry, and Douglas Irwin, (1998), "The Role of History in Bilateral Trade Flows," in Jeffrey Frankel (ed.), **The Regionalization of the World Economy**, (Chicago and London: University of Chicago Press).

[9] Ghironi, Fabio and Marc J. Melitz (2004), "International Trade and Macroeconomic Dynamics with Heterogenous Firms," NBER Working Paper 10540.

[10] Heckman, James, J. (1979), "Sample Selection Bias as a Specification Error", **Econometrica** 42: 153-168.

[11] Helpman, Elhanan, Mark Melitz, and Steve Yeaple (2004), "Exports vs FDI with Heterogeneous Firms," **American Economic Review**, 94 (1):

[12] Helpman, Elhanan, Mark Melitz, and Yona Rubinstein. (2004), "Trading Partners and Trading Volumes," Harvard University, 2004.

[13] Kyriazidou, Ekaterini (1996), "Estimation of a Panel Data Sample Selection Model," **Econometrica** 65 (6): 1335-1364.

[14] Loungani, Prakash, Ashoka Mody, and Assaf Razin (2002), "The Global Disconnect: The Role of Transactional Distance and Scale Economies

in Gravity Equations," **Scottish Journal of Political Economy**, 49 (5): 526-543.

[15] Lucas, Robert E. (1990), "Why Doesn't Capital Flow from Rich to Poor Countries?", *American Economic Review: Papers and Proceedings*, 80(2), 92-96.

[16] Melitz, Marc, J. (2003), "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71(6), pp. 1695-1725.

[17] Obstfeld, Maurice and Alan M. Taylor (2003), "Globalization and Capital Markets," in Bordo, Michael D., Alan M. Taylor, and Jeffrey G. Williamson (editors), *Globalization in Historical Perspective*, University of Chicago Press.

[18] Razin, Assaf, Efraim Sadka, and Tarek Coury (2003), "Trade Openness, Investment Instability, and Terms-of-Trade Volatility," **Journal of International Economics**, 59 (2): .

[19] Razin, Assaf, Yona Rubinstein, and Efraim Sadka (2003), "Which Countries Export FDI, and How Much?", NBER Working Paper No. 10145, December.

[20] Santos Silva, J. M. C., and Tenreyro Silvana (2003), "Gravity-defying trade," Working Papers 03-1, Federal Reserve Bank of Boston.

[21] Smanzyska, Beata K. and Shang-Jin Wei (2001), "Corruption and Cross-Border Investment," NBER Working Paper 8465.

[22] Stopler, Wolfgang and Paul A. Samuelson (1941), "Protection and Real Wages," *The Review of Economic Studies*, 9: 56-73.

[23] Tinbergen, Jan (1962), **The World Economy.: Suggestions for an International Economic Policy**. New York, NY: Twentieth Century Fund.

[24] Tobin, J. (1958), "Estimation of Relationships for Limited Dependent Variables", **Econometrica** 26, 24-36.

[25] Zhang, Kevin Honglin and Markusen, James R. "Vertical Multinationals and Host- Country Characteristics." **Journal of Development Economics**, August 1999, 59 (2), pp.

6.0.1 Appendix A: Partial Equilibrium Effect of A Productivity Shock on FDI

For a fixed wage rate w_H, it follows from equation (8), for the case of positive FDI flows, that

$$\frac{\partial(FDI)}{\partial A_H} = \frac{\partial V^+}{\partial A_H} + \frac{\partial K^+}{\partial A_H}. \tag{A1}$$

Using the envelope theorem, it follows from equation (1) that

$$\frac{\partial V^+}{\partial A_H} = \frac{F(K,L)}{1+r} > 0. \tag{A2}$$

Total differentiation of equations (2) and (3) with respect to A_H (while still maintaining w_H constant) yields:

$$\frac{\partial K^+}{\partial A_H} = \frac{-F_K F_{LL} + F_L F_{KL}}{A_H(F_{KK}F_{LL} - F_{KL}^2)} > 0 \tag{A3}$$

and

$$\frac{\partial L^+}{\partial A} = \frac{-F_L F_{KK} + F_K F_{KL}}{A_H(F_{KK}F_{LL} - F_{KL}^2)} > 0, \tag{A4}$$

In equations (A3) and (A4) we assume that capital and labor are substitute to each other in the production function, namely that $F_{KL} > 0$. (Recall also that $F_{KK}F_{LL} - F_{KL}^2 > 0$, $F_{KK} < 0$, and $F_{LL} < 0$, by the concavity of F.) Equations (A1) - (A3) imply that $\partial(FDI)/\partial A_H > 0$.

Thus, for a given w_H, an increase in A_H raises FDI, and K^+ and V^+.

However, when new investment is made, equation (A4) implies that a rise in A_H increases the demand for labor. When no new investment is made, it follows from equation (4), for a given w_H, that

$$\frac{\partial L^-}{\partial A_H} = -\frac{F_L}{AF_{LL}} > 0.$$

Thus, the demand for labor rises in this case as well.

6.1 Appendix B: Firm-Level Heterogeneity

Consider a pair of countries, "host" and "source", in a world of free capital mobility which fixes the world rate of interest, denoted by r. We will now describe the host country, whose economic variables will be subscripted by "H". The description of the source country is similar with a subscript "S". Variables with neither H nor S subscript are identical for the two countries. There is a representative industry whose product serves both for consumption and investment. For simplicity suppose that existing firms will last for two periods. In the first period there exists a continuum of N_H firms which differ from each other by a productivity index ε. We refer to a firm which has a productivity index of ε as an $\varepsilon-$firm. The cumulative distribution function of ε is denoted by $G(.)$, with a density function $g(.)$.

We assume for simplicity that the initial net capital stock of each firm is the same and denote it by K_H^0. If an $\varepsilon-$firm invests I in the first period, it augments its capital stock to $K = K_H^0 + I$, and its gross output in the second period will be $A_H F(K, L)(1 + \varepsilon)$, where L is the labor input (in effective units) and A_H is a country (H) - specific productivity parameter. Note that ε is firm-specific, whereas A_H is country-specific.

We assume that there exists a fixed setup cost of investment, C_H, which is the same for all firms (that is, independent of ε). We assume that, due to some (suppressed) fixed factor, F is strictly concave, exhibiting diminishing returns to scale in K and L. Note that the average cost curve of the firm is U-shaped, so that perfect competition, which we assume, can prevail. Consider an ε-firm which does invest in the first period an amount $I = K - K_H^0$ in order to augment its stock of capital to K. Its present value becomes:

$$V^{+}(A_H, C_H, K_H^0, \varepsilon, w_H) = \max_{(K,L)} \left\{ \frac{A_H F(K,L)(1+\varepsilon) - wL + K}{1+r} - (K - K_H^0 + C_H) \right\}, \quad \text{((B1))}$$

where we assume for notational simplicity that capital does not depreciate.

The demands of such a firm for K and L are denoted by $K^{+}(A_H, \varepsilon, w_H)$ and $L^{+}(A_H, \varepsilon, w_H)$. They are given by the marginal productivity conditions:

$$A_H F_K(K,L)(1+\varepsilon) = r, \quad \text{((B2))}$$

and

$$A_H F_L(K,L)(1+\varepsilon) = w_H, \quad \text{((B3))}$$

where F_K and F_L denote the partial derivatives of F with respect to K and L, respectively. We assume that ε is bounded away from -1 by some $\varepsilon > -1$, so that $K^{+}(A_H, \varepsilon, w_H) > K_H^O$ for all ε.

Note, however, that an ε-firm may chose not to invest at all [that is, to stick to its existing stock of capital (K_H^O)] and avoid the lumpy setup cost C_H. Naturally, a firm with a low ε may not find it worthwhile to incur the setup cost C_H. In this case, its present value is:

$$V^{-}(A_H, K_H^0, \varepsilon, w_H) = \max_{L} \left\{ \frac{A_H F(K_H^0, L)(1+\varepsilon) - w_H L + K_H^0}{1+r} \right\}. \quad \text{((B4))}$$

The labor demand of such firm, denoted by $L^{-}(A_H, K_H^O, \varepsilon, w_H)$, is defined by:

$$A_H F_L(K_H^O, L)(1+\varepsilon) = w_H. \tag{(B5)}$$

It is straightforward to show that $(\partial V^+/\partial\varepsilon) - (\partial V^-/\partial\varepsilon) > 0$ (see Appendix 2B). Therefore, there exists a cutoff level of ε, denoted by ε_0, such that an ε-firm will make a new investment, if $\varepsilon > \varepsilon_0$. This cutoff level of ε depends on A_H, C_H, K_H^0, and w_H. We write the cutoff ε as $\varepsilon_0(A_H, C_H, K_H^0, w_H)$. It is defined implicitly by:

$$V^+(A_H, C_H, K_H^0, \varepsilon_0, w_H) = V^-(A_H, K_H^0, \varepsilon_0, w_H). \tag{(B6)}$$

We assume that labor is confined within national borders. Denoting the country's endowment of labor in effective units by $\tilde{L}_H^0$, we have the following labor market-clearing equation:

$$N_H \int_{\underline{\varepsilon}}^{\varepsilon_0(A_H,C_H,K_H^0,w_H)} L^-(A_H, K_H^0, \varepsilon, w_H) g(\varepsilon) d\varepsilon + N_H \int_{\varepsilon_0(A_H,C_H,K_H^0,w_H)}^{\bar{\varepsilon}} L^+(A_H, \varepsilon, w_H) g(\varepsilon) d\varepsilon = \tilde{L}_H^0, \tag{(B7)}$$

where $\bar{\varepsilon}$ is the upper productivity level. Dividing the latter equation through by N_H, yields:

$$\int_{\underline{\varepsilon}}^{\varepsilon_0(A_H,C_H,K_H^0,w_H)} L^-(A_H, K_H^0, \varepsilon, w_H) g(\varepsilon) d\varepsilon + \int_{\varepsilon_0(A_H,C_H,K_H^0,w_H)}^{\bar{\varepsilon}} L^+(A_H, \varepsilon, w_H) g(\varepsilon) d\varepsilon = L_H^0, \tag{(B8)}$$

where $L_H^0 \equiv \tilde{L}_H^0 / N_H$ is the effective labor per firm.

Note that so similar market-clearing equation is specified for capital, because we assume that capital is freely mobile internationally, and its rate of return is equalized internationally. The same description with the subscript "S" replacing "H" holds for the source country.

Note that differences in labor abundance between the two countries are manifested in the wage differences. To see this, suppose that the two countries are identical, except that effective labor per firm is more abundant in the host country than in the source country, that is: $L_H^0 > L_S^0$. If wages were equal in the two countries, then effective labor demand per firm were equal and the market-clearing condition [equation (B.8)] could not hold for both countries. Because of the diminishing marginal product of labor, it follows that the wage in the relatively labor-abundant country is lower than in the relatively labor-scarce country, that is: $w_H < w_S$[13]. Thus, equal returns to capital (through capital mobility coexist with unequal wages, as in Lucas (1990)[14].

One may think of FDI as the investment of source-country entrepreneurs in the acquisition of host-country firms. Suppose that the source-country entrepreneurs are endowed with some "intangible" capital, or known-how, stemming from their specialization or expertise in the industry at hand. We model this comparative advantage by assuming that the setup cost of investment in the host country, when investment is done by source-country entrepreneurs (FDI investors) is only C_H^*, which is below C_H (the setup cost of investment when carried out by the host country direct investors). One

[13]The equilibrium wage gap implies that the host country employs more workers per firm than the source country. Thus, even though the productivity distribution across firms is assumed equal, the source country is effectively more productive in equilibrium.

[14]See also Amiti (1998) who studies the effect of agglomeration on cross-regional wage differences. See also Melitz (2003) for the role of fixed costs in intra-industry reallocations in reaction to industry-specific productivity shocks.

may think of C^*_H as the research and development cost of a new product line which is carried out by a parent firm in the source country. This cost advantage implies that the foreign investors can bid up the direct investors of the host country in the purchase of the investing firms in the host country. Each such firms [that is, each firm whose ε is above $\varepsilon_0(A_H, C^*_H, K^0_H, w_H)$] is purchased at its market value, which is $V^+(A_H, C^*_H, K^0_H, \varepsilon, w_H)$. This essentially assumes that competition among the foreign direct investors shift all the gains from their lower setup cost to the host-country original owners of the firm. The new owners also invest an amount $K^+(A_H, \varepsilon, w_H) - K^0_H$ in the firm. Thus, the amount of foreign direct investment made in an $\varepsilon-$firm (where $\varepsilon > \varepsilon_0$) is:

$$FDI(A_H, C^*_H, K^0_H, \varepsilon, w_H) = V^+(A_H, C^*_H, K^0_H, \varepsilon, w_H) + K^+(A_H, \varepsilon, w_H) - K^0_H. \tag{(B9)}$$

This specification assumes that the setup cost C^*_H is incurred in the source country and does not therefore constitute a part of the definition of FDI. It conforms with the notion that C^*_H represents, for instance, R&D of a new product line carried out by the parent firm in the source country.[15] Aggregate FDI is given by

[15] Whether we interpret C^*_H as being carried out in the source country or in the host country, and accordingly whether we exclude it or include it in the definition of FDI does not alter our qualitative results.

$$\overline{FDI}(A_H, C_H^*, K_H^0, w_H) = \int\limits_{\varepsilon_0(A_H, C_H^*, K_H^0, w_H)}^{\bar{\varepsilon}} FDI(A_H, C_H^*, K_H^0, \varepsilon, w_H) g(\varepsilon) d\varepsilon \tag{(B10)}$$

Suppose first that w_H is fixed. Note that it follows from equation (B.1) that $\partial V^+/\partial K_H^0 = 1$, by the envelope theorem. Therefore, $\partial(FDI)/\partial K_H^0 = 0$, by equation (B1). Thus, the amount of FDI in a firm whose ε is above ε_0 does not depend on the initial capital stock, K_H^0: an increase of \$ 1 in the initial stock of capital of such a firm increases the value of the firm by 1\$, but decreases the required new investment by the same amount, so that FDI does not change[16]. However, the aggregate amount of FDI diminishes, when the initial stock of capital (K_H^0) rises. This is because fewer firms will make new investment and be purchased by foreign direct investors, that is, the cutoff ε_0 rises, when K_H^0 rises. To see this, differentiate equation (B10) with respect to K_H^0 to get :

$$\frac{\partial \overline{FDI}}{\partial K_H^0} = -FDI(A_H, C_H^*, K_H^0, \varepsilon_0, w_H) g(\varepsilon_0) \frac{\partial \varepsilon_0}{\partial K_H^0} < 0, \tag{(B11)}$$

because $\frac{\partial \varepsilon_0}{\partial K_H^0} > 0$.

Similarly, it follows from equation (B11) that:

$$\frac{\partial \overline{FDI}}{\partial C_H^*} = \left(\frac{\partial V^+}{\partial C_H^*} \right) [G(\bar{\varepsilon}) - G(\varepsilon_0)] - FDI(A_H, C_H^*, K_H^0, \varepsilon_0, w_H) g(\varepsilon_0) \frac{\partial \varepsilon_0}{\partial C_H^*}. \tag{(B12)}$$

[16] This is because, in the absence of a marginal adjustment cost of investment, the marginal Tobin's q is identically equal to one.

Note that $\frac{\partial V^{+}}{\partial C_{H}^{*}} = -1$, by equation (B1), and that $\frac{\partial \varepsilon_0}{\partial C_{H}^{*}} > 0$. Hence, it follows that $\frac{\partial \overline{FDI}}{\partial C_{H}^{*}} < 0$.

It also follows from equation (B10) that

$$\frac{\partial \overline{FDI}}{\partial A_H} = \left[\frac{F(K^{+}, L^{+})}{1+r} + \frac{\partial K^{+}}{\partial A_H}\right][G(\overline{\varepsilon}) - G(\varepsilon_0)] - FDI(A_H, C_{H}^{*}, K_{H}^{0}, \varepsilon_0, w_H) g(\varepsilon_0) \frac{\partial \varepsilon_0}{\partial A_H} > 0, \tag{(B13)}$$

because $\frac{\partial K^{+}}{\partial A_H} > 0$ and $\frac{\partial \varepsilon_0}{\partial A_H} < 0$.

Thus, a lower level of the initial stock of capital in the host country attracts more foreign direct investment. Similarly, a lower level of the setup cost of investment in the host country for the FDI investors from the source country promotes more FDI[17]. Also, a higher country-specific productivity factor in the host country promotes more FDI. These conclusions were drawn under the assumption that the wage (w_H) in the host country is fixed. When it is not fixed, then lower K_{H}^{0} and /or C_{H}^{*} attract more FDI and push the wage rate upward, thereby mitigating the initial increase in FDI, but not eliminating it altogether.

Observe that FDI flows constitute only a fraction of the international capital transactions between the host and source countries. In a globalized world capital market, where the world rate of interest is given to our pair of countries, domestic saving and domestic investment are not equal to each other and FDI is not equal to either saving or investment.

So far, FDI took the form of mergers or acquisitions of existing firms.

[17]Interestingly, a decline in the setup cost affects the average recorded productivity, because the cutoff ε changes. The new spectrum of investing firms is accordingly adjusted. A similar endogenous-productivity mechanism features in Ghironi and Melitz (2004).

Consider now the possibility of establishing a new firm (that is, a greenfield FDI, where $K^0 = 0$). Suppose that the newcomer entrepreneur does not know in advance the productivity factor (ε) of the potential firm. The entrepreneur therefore takes G(.) as the cumulative probability distribution of the productivity factor of the new firm. However, we assume that ε is revealed to the entrepreneur, before she decides whether or not to make new investment. The expected value of the new firm is therefore:

$$V(A, C, w, r) = \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} Max\left\{V^{+}(A, C, \varepsilon, w), 0\right\} g(\varepsilon)d\varepsilon. \qquad \text{((B14))}$$

Note that if K^0 is equal to zero, only the firms with an ε high enough to justify a greenfield investment have a positive value. This explains equation (B.14).

Now suppose that greenfield entrepreneurship is in limited supply and capacity. An entrepreneur in a source country (and there is a limited number of them) may have to decide whether to establish a new firm at home (the source country) or abroad (the host country), but not in both. Her decision is naturally determined by where V(.), as defined in equation (B14), is higher. She will invest in the host country rather than in the source country if, and only if,

$$V(A_H, C_H^{*}, w_H) > V(A_S, C_S^{*}, w_S). \qquad \text{((B15))}$$

Naturally, the lower wage rate in the host country works as a pull factor for that country, that is, it works in the direction of satisfying condition (B.15). Thus, the lower wage rate in the host country attracts greenfield FDI. On the other hand, if the total factor productivity in the source country (namely, A_S) is higher than its counterpart in the host country (namely, A_H), this discourages FDI. Assuming that the wage differential dominates the total factor productivity differential, the host country attracts greenfield FDI from the source country.

Assuming that newcomer entrepreneurs evolve gradually over time and that technology spillover equates total factor productivity, eventually this process may end up with full factor price equalization. Naturally, the capital-labor ratios and $L \equiv \widetilde{L}/N$ are equalized in such long-run steady state. This all happens even though labor is not internationally mobile. The establishment of new firms in the global economy may be an engine for FDI flows by multinationals.

Our two-country model, which generates capital flows from the source to the host country, can be extended in a straightforward manner to explain two-way FDI flows. By assuming more than one industry, the extension allows two-way flows between two rich countries, when each country has a setup cost advantage in a different industry.

Table 1: DATA SOURCE

Variables:	**Source:**
FDI Flows	International Direct Investment Database (OECD)
GDP	World Economic Indicators
Population	World Economic Indicators
Number of Workers	World Economic Indicators
Distance	Andrew Rose's website: www.haas.berkeley.edu/~arose
Common Language	Andrew Rose's website: www.haas.berkeley.edu/~arose
Education Attainment	Barro-Lee Dataset, http://www.nber.org/pub/barro.lee/
ICRG Index of Financial Risk Rating	PRS Group
Capital Stock	Francesco Caselli's website: http://personal.lse.ac.uk/casellif

Table 2: FREQUENCY OF SOURCE-HOST INTERACTIONS BY COUNTRIES

Country	Source	Host	Country	Source	Host
Algeria	0.02	0.04	Korea	0.45	0.31
Argentina	0.16	0.37	Kuwait	0.04	0.00
Australia	0.24	0.32	Libya	0.02	0.02
Austria	0.42	0.19	Malaysia	0.17	0.32
Belgium	0.00	0.00	Mexico	0.05	0.38
Brazil	0.18	0.37	Morocco	0.07	0.17
Bulgaria	0.06	0.19	Netherlands	0.52	0.34
Canada	0.22	0.23	Netherlands Antilles	0.07	0.03
Chile	0.07	0.32	New Zealand	0.16	0.19
China	0.24	0.40	Norway	0.28	0.19
Chinese Taipei	0.24	0.29	Panama	0.06	0.06
Colombia	0.08	0.18	Philippines	0.10	0.31
Costa Rica	0.03	0.02	Poland	0.12	0.30
Czech Republic	0.06	0.16	Portugal	0.25	0.30
Czechoslovakia	0.02	0.02	Romania	0.07	0.20
Denmark	0.36	0.23	Russia	0.15	0.27
Egypt	0.06	0.21	Saudi Arabia	0.07	0.06
Finland	0.38	0.18	Singapore	0.29	0.37
France	0.75	0.62	Slovak Republic	0.02	0.08
Germany	0.65	0.47	Slovenia	0.05	0.12
Greece	0.07	0.17	South Africa	0.15	0.24
Hong Kong (China)	0.34	0.37	Spain	0.49	0.47
Hungary	0.08	0.20	Sweden	0.42	0.28
Iceland	0.14	0.09	Switzerland	0.46	0.22
India	0.15	0.36	Thailand	0.10	0.35
Indonesia	0.12	0.30	Turkey	0.10	0.20
Iran	0.10	0.07	Ukraine	0.05	0.13
Ireland	0.20	0.24	United Arab Emirates	0.03	0.04
Israel	0.24	0.22	United Kingdom	0.60	0.41
Italy	0.52	0.36	United States	0.63	0.47
Japan	0.64	0.32	Venezuela	0.13	0.21

Table 3: Bilateral FDI Flows and Selection Equations
(Observations on Non-OECD to Non-OECD FDI are excluded)

	Panel A		Panel B	
	Flow	Selection	Flow	Selection
Host-Output per worker	**0.037**	**-0.026**		
	(0.012)**	**(0.010)****		
Host-Instrumented output per worker			-0.020	**-0.038**
			(0.016)	**(0.012)****
Source-Output per worker	0.002	**-0.025**		
	(0.014)	**(0.009)****		
Source-Instrumented output per worker			**-0.078**	-0.023
			(0.016)**	(0.013)
GDP per capita - host^	**1.373**	0.345	**2.192**	0.163
	(0.345)**	(0.250)	**(0.289)****	(0.218)
GDP per capita - source^	**1.839**	**0.609**	**2.181**	0.326
	(0.431)**	**(0.276)***	**(0.339)****	(0.226)
Difference between schooling (source – host)	0.038	**-0.097**	0.058	**-0.106**
	(0.042)	**(0.032)****	(0.044)	**(0.034)****
Common language	**0.728**	**0.323**	**0.727**	**0.321**
	(0.066)**	**(0.055)****	**(0.066)****	**(0.055)****
Distance (in Logs)	**-0.982**	**-0.534**	**-0.984**	**-0.535**
	(0.027)**	**(0.030)****	**(0.027)****	**(0.030)****
Population-host^	**-1.536**	-0.483	**-1.687**	-0.303
	(0.771)*	(0.613)	**(0.773)***	(0.606)
Population-source^	-1.332	0.708	-1.411	1.014
	(0.912)	(0.649)	(0.909)	(0.642)
Financial risk rating - source	0.003	0.001	-0.001	0.002
	(0.007)	(0.005)	(0.007)	(0.005)
Financial risk rating - host	**0.018**	**0.013**	0.011	**0.011**
	(0.006)**	**(0.005)****	(0.006)	**(0.005)***
FDI flows from i to j a year ago (=1 if yes)		**1.599**		**1.602**
		(0.038)**		**(0.038)****
Correlation (Ui,j, Vi,j)	**-0.064**		**-0.059**	
	(0.028)*		**(0.028)***	
Inverse Mills ratio	**-0.092**		**-0.084**	
	(0.041)*		**(0.040)***	
Observations	17656			
Censored observations	10906			
Uncensored observations	6750			

Note: ^ in logs; Country and time fixed effects are included; Robust standard errors in parentheses;
* significant at 5%; ** significant at 1%

Table 4: Bilateral FDI Flows and Selection Equations
(Observations on Non-OECD to Non-OECD FDI are excluded;
Two-year smoothing)

	Panel A		Panel B	
	Flow	Selection	Flow	Selection
Host-Output per worker	**0.032**	-0.004		
	(0.015)**	(0.012)		
Host-Instrumented output per worker			-0.032	-0.021
			(0.020)	(0.018)
Source-Output per worker	-0.007	-0.018		
	(0.016)	(0.012)		
Source-Instrumented output per worker			**-0.101**	-0.015
			(0.020)**	(0.018)
GDP per capita - host^	**1.371**	0.216	**2.234**	0.260
	(0.473)**	(0.367)	**(0.380)****	(0.307)
GDP per capita - source^	**1.595**	0.291	**1.771**	0.041
	(0.509)**	(0.404)	**(0.396)****	(0.321)
Difference between schooling (source – host)	0.024	-0.081	0.045	-0.084
	(0.053)	(0.044)	(0.055)	(0.046)
Common language	**0.778**	**0.299**	**0.779**	**0.298**
	(0.081)**	**(0.072)****	**(0.081)****	**(0.072)****
Distance (in Logs)	**-1.042**	**-0.591**	**-1.046**	**-0.592**
	(0.034)**	**(0.042)****	**(0.034)****	**(0.042)****
Population-host^	-0.830	**-1.721**	-0.750	**-1.729**
	(0.944)	**(0.858)***	(0.948)	**(0.853)***
Population-source^	0.375	-0.588	0.516	-0.359
	(1.096)	(0.847)	(1.097)	(0.850)
Financial risk rating - source	-0.009	-0.006	-0.015	-0.005
	(0.009)	(0.007)	(0.009)	(0.007)
Financial risk rating - host	0.013	**0.014**	0.004	0.012
	(0.008)	**(0.007)***	(0.008)	(0.007)
FDI flows from i to j a year ago (=1 if yes)		**1.405**		**1.406**
		(0.050)**		**(0.050)****
Correlation (Ui,j, Vi,j)	-0.061		-0.056	
	(0.034)		(0.034)	
Inverse Mills ratio	-0.085		-0.079	
	(0.048)		(0.047)	
Observations	9689			
Censored observations	5410			
Uncensored observations	4279			

Note: ^ in logs; Country and time fixed effects are included; Robust standard errors in parentheses;
* significant at 5%; ** significant at 1%

Table 5: Bilateral FDI Flows and Selection Equations
(Observations on Non-OECD to Non-OECD FDI are included)

	Panel A		Panel B	
	Flow	Selection	Flow	Selection
Host-Output per worker	**0.037**	**-0.026**		
	(0.012)**	**(0.009)****		
Host-Instrumented output per worker			-0.019	**-0.040**
			(0.016)	**(0.012)****
Source-Output per worker	0.001	**-0.023**		
	(0.014)	**(0.009)****		
Source-Instrumented output per worker			**-0.078**	**-0.025**
			(0.016)**	**(0.012)***
GDP per capita - host^	**1.374**	0.277	**2.193**	0.126
	(0.345)**	(0.228)	**(0.289)****	(0.204)
GDP per capita - source^	**1.845**	**0.527**	**2.185**	0.312
	(0.431)**	**(0.257)***	**(0.339)****	(0.214)
Difference between schooling (source – host)	0.037	**-0.091**	0.058	**-0.098**
	(0.042)	**(0.031)****	(0.044)	**(0.033)****
Common language	**0.730**	**0.294**	**0.729**	**0.291**
	(0.066)**	**(0.051)****	**(0.066)****	**(0.051)****
Distance (in Logs)	**-0.986**	**-0.385**	**-0.988**	**-0.387**
	(0.027)**	**(0.023)****	**(0.027)****	**(0.024)****
Population-host^	**-1.549**	-0.733	**-1.698**	-0.512
	(0.771)*	(0.558)	**(0.773)***	(0.554)
Population-source^	-1.316	0.385	-1.395	0.709
	(0.912)	(0.599)	(0.909)	(0.595)
Financial risk rating - source	0.003	0.000	-0.001	0.000
	(0.007)	(0.005)	(0.007)	(0.005)
Financial risk rating - host	**0.018**	0.009	0.011	0.008
	(0.006)**	(0.005)	(0.006)	(0.005)
FDI flows from i to j a year ago (=1 if yes)		**1.691**		**1.694**
		(0.037)**		**(0.037)****
Correlation (Ui,j, Vi,j)	**-0.058**		-0.052	
	(0.027)*		(0.027)	
Inverse Mills ratio	**-0.083**		-0.075	
	(0.039)*		(0.039)	
Observations	21406			
Censored observations	14656			
Uncensored observations	6750			

Note: ^ in logs; Country and time fixed effects are included; Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Table 6: Bilateral FDI Flows and Selection Equations (Observations on Non-OECD to Non-OECD FDI are included; Two-year smoothing)

	Panel A		Panel B	
	Flow	Selection	Flow	Selection
Host-Output per worker	**0.032**	-0.004		
	(0.015)**	(0.012)		
Host-Instrumented output per worker			-0.032	-0.018
			(0.020)	(0.017)
Source-Output per worker	-0.007	-0.014		
	(0.016)	(0.011)		
Source-Instrumented output per worker			**-0.101**	-0.018
			(0.020)**	(0.017)
GDP per capita - host^	**1.369**	0.103	**2.233**	0.155
	(0.473)**	(0.329)	**(0.380)****	(0.285)
GDP per capita - source^	**1.602**	0.194	**1.773**	0.062
	(0.509)**	(0.371)	**(0.396)****	(0.301)
Difference between schooling (source – host)	0.024	-0.069	0.045	-0.069
	(0.053)	(0.041)	(0.055)	(0.044)
Common language	**0.781**	**0.257**	**0.781**	**0.256**
	(0.081)**	**(0.066)****	**(0.081)****	**(0.066)****
Distance (in Logs)	**-1.047**	**-0.398**	**-1.050**	**-0.399**
	(0.034)**	**(0.031)****	**(0.034)****	**(0.031)****
Population-host^	-0.851	**-2.409**	-0.767	**-2.354**
	(0.940)	**(0.781)****	(0.944)	**(0.784)****
Population-source^	0.385	-0.791	0.527	-0.566
	(1.096)	(0.776)	(1.096)	(0.786)
Financial risk rating - source	-0.009	-0.007	-0.015	-0.007
	(0.009)	(0.007)	(0.009)	(0.007)
Financial risk rating - host	0.013	**0.014**	0.004	0.012
	(0.008)	**(0.006)***	(0.008)	(0.007)
FDI flows from i to j a year ago (=1 if yes)		**1.517**		**1.518**
		(0.049)**		**(0.049)****
Correlation (Ui,j, Vi,j)	-0.050		-0.045	
	(0.033)		(0.033)	
Inverse Mills ratio	-0.071		-0.063	
	(0.047)		(0.046)	
Observations	11828			
Censored observations	7549			
Uncensored observations	4279			

Note: ^ in logs; Country and time fixed effects are included; Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Table 7: The Instrumented Productivity Equation

Capital over labor ratio	**2.33** **(0.09)****
Years of schooling	**0.66** **(0.19)****
Observations	879
R-squared	0.99

Note: Country and time fixed effects are included;
Standard errors in parentheses; ** significant at 1%

Figure 1: The Marginal Effect of Productivity Shock on Expected Bilateral FDI Flow