NBER WORKING PAPER SERIES

THE ROLE OF INFORMATION IN DRIVING FDI FLOWS: HOST-COUNTRY TRANSPARENCY AND SOURCE-COUNTRY SPECIALIZATION

Ashoka Mody
Assaf Razin
Efraim Sadka

Working Paper 9662
http://www.nber.org/papers/w9662

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 2003

We wish to thank Benjamin Bental, Marc Bils, Richard Baldwin, Richard Cooper, Elhanan Helpman, Lance Lochner, Prakash Loungani, and Dani Rodrik for useful comments and suggestions. Special thanks are due to Ariel Burstein who provided us with an illuminating numerical example. Young Kim provided excellent research assistance. Assaf Razin and Efraim Sadka also acknowledge the sponsorship of the European Commission's RTN project "The Analysis of International Capital Markets: Understanding Europe's Role in the Global Economy." The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research.

The Role of Information in Driving FDI Flows:
Host-Country Transparency and Source Country Specialization
Ashoka Mody, Assaf Razin, and Efraim Sadka
NBER Working Paper No. 9662
April 2003
JEL No. F2

ABSTRACT

We develop a simple information-based model of FDI flows. On the one hand, the abundance of "intangible" capital in specialized industries in the source countries, which presumably generates expertise in screening investment projects in the host countries, enhances FDI flows. On the other hand, host-country corporate-transparency diminishes the value of this expertise, thereby reducing the flow of FDI. Empirical evidence (from a sample of 12 source countries and 45 host countries over the 1980s and 1990s) analyzed in a gravity-equation model, provides support to the theoretical hypotheses.

The model also demonstrates that the gains for the host country from foreign direct investment [over foreign portfolio investment (FPI)] are reflected in a more efficient size of the stock of domestic capital and its allocation across firms. These gains are shown to depend crucially (and positively) on the degree of competition among FDI investors.

Ashoka Mody
International Monetary Fund
amody@imf.org

Assaf Razin
Eitan Berglas School of Economics
Tel Aviv University
Tel Aviv 69978
ISRAEL
and NBER
razin@post.tau.ac.il

Efraim Sadka
Eitan Berglas School of Economics
Tel Aviv University
Tel Aviv 69978
ISRAEL
sadk@post.tau.ac.il

The model also demonstrates that the gains for the host country from foreign direct investment [over foreign portfolio investment (FPI)] are reflected in a more efficient size of the stock of domestic capital and its allocation across firms. These gains are shown to depend crucially (and positively) on the degree of competition among FDI investors.

I. INTRODUCTION

Foreign direct investment (FDI) has been growing faster than world GDP, and is becoming a major component of foreign investment.[2] We usually observe both one-way flows of FDI, from developed to developing economies, and two-way flows among developed economies. The purpose of this paper is to explore some unique features of foreign direct investment (FDI) associated with host-country transparency and source-country specialization, that make this form of foreign investment stand out among the various forms of capital flows, such as foreign portfolio investment (FPI).

From empirical data (a sample of 12 source countries and 45 host countries over the 1980s and the 1990s) we identify two main categories of variables that help explain FDI inflows. First, we uncover a positive correlation between industry specialization in the source countries and FDI flows into the host countries. Second, we find that countries with higher quality of corporate transparencies, and stronger credit-market institutions, attract less FDI inflows.

[2] See the Australian Productivity Commission (2002) for a recent case study.

We incorporate these new theoretical considerations in a gravity model of capital flows. Such models have proved useful in explaining bilateral trade flows and, more recently, cross-border equity flows (Portes and Rey, 2000 and Portes, Rey and Oh, 2001). There have been some initial explorations of the determinants of FDI in gravity models (Wei, 2000), but the focus has not been on the role of corporate-governance information, as we do here.

We first develop a simple information-based model, consistent with the empirical findings concerning specialization and transparency. We interpret the industry specialization in the source country as providing a comparative advantage to the potential foreign direct investors, in eliciting good investment opportunities in the host country, relative to domestic investors and foreign portfolio investors in the host country. The advantage stems, for instance, from the ability of FDI investors to apply better industry-specific micro-management standards (an "intangible capital"). This element is captured in our model by assuming a lower cost for foreign direct investors of cream-skimming high-productivity firms than their domestic counterparts. The advantage of FDI investors in their cream-skimming skills is less pronounced when corporate transparency and capital market institutions are of high quality; in which case FDI inflows are less abundant.[3]

Our model also suggests that the gains from FDI to the host country are reflected in a more efficient size of the stock of domestic capital and its allocation across firms. Domestic firms that are controlled by FDI investors are typically the "cream" (high-productivity firms). The

[3] See also Razin and Sadka (2003).

magnitude of these non-traditional gains from trade that arise in our model depends crucially (and inversely) on the degree of competition among potential FDI investors over the domestic firms. These gains can shrink to zero if there is no such competition altogether. Also, FDI inflows could make the size of the aggregate stock of domestic capital larger than otherwise (under plausible assumptions). This result is consistent with recent empirical evidence. For instance, Borenzstein, De Gregorio and Lee (1998) and Bosworth and Collins (1999) provide such evidence for a sample of developing countries during the period 1978-1995. More recently, in a sample of developing countries, Razin (forthcoming), finds that the effect of FDI inflows on domestic investment is significantly larger than either FPI or loan inflows (Appendix 1, Table 1). He also provides evidence that FDI inflows promote efficiency: The effect of FDI on GDP growth is higher than the effect of other inflows, after controlling for domestic capital accumulation (Appendix 1, Table 2).

The organization of the paper is as follows. Section 2 develops a simple information-based model, which emphasizes the role of host-country transparency and source-country industry specialization in explaining the determinants of FDI and FPI flows. Section 3 compares the benefits for the host-country from receiving FDI inflows instead of FPI inflows. Section 4 confronts the theory with evidence by applying the gravity equation approach. Section 5 concludes.

II. FDI AND SKIMMING HIGH-PRODUCTIVITY FIRMS

Assume a large number (N) of *ex-ante* identical domestic firms in an industry. Each firm employs capital input (K), in the first period, in order to produce a single composite good in the second period. As usual, we assume that capital depreciates at the rate δ *(< 1)*. Output in

the second period is equal to $F(K)(1+\varepsilon)$, where $F(\cdot)$ is a production function, which exhibits diminishing marginal productivity of capital (ε bounded below by -1) so that output is always non-negative. For notational ease we also assume that ε is bounded from above by 1. Suppose that ε is purely idiosyncratic, so that there is no aggregate uncertainty in the model. Consumers-investors are well diversified and will thus behave in a risk-neutral way. We denote by $G(\cdot)$ the cumulative distribution function of ε, and by $g(\cdot) = G'(.)$ the corresponding density function.

At the starting point of the decision process of agents in the first period, the productivity factor (ε) of each firm is not revealed with full accuracy. Rather, each firm receives a signal ε' about its productivity, which is common knowledge.[4] The true ε of the firm is within an interval of $\pm\beta$ around ε'. Formally, given ε' the true value of ε is distributed according to the distribution of the productivity factor, conditional on its being in the interval $(\varepsilon' - \beta, \varepsilon' + \beta)$, the conditional distribution is:

$$\varphi(\varepsilon / \varepsilon') = \frac{G(\varepsilon) - G(\varepsilon' - \beta)}{G(\varepsilon' + \beta) - G(\varepsilon' - \beta)}. \qquad (1)$$

The conditional distribution $\varphi(\varepsilon'|\varepsilon')$ denotes the cumulative distribution function of ε, conditional on the signal ε'. We assume that the signal ε' is distributed according to the distribution function $G(\cdot)$.

[4] One can think of this signal as sort of encapsulated information, provided by up-to-date financial statements.

The firm chooses the level of the capital stock (and investment), denoted by $K(\varepsilon')$, after the signal ε' is received, so as to maximize its conditional (on ε') expected market value. This maximized value is:

$$V(\varepsilon') = \int_{\varepsilon'-\beta}^{\varepsilon'+\beta} \left\{ \frac{F[K(\varepsilon')](1+\varepsilon) + (1-\delta)K(\varepsilon')}{1+r} - [K(\varepsilon') - (1-\delta)K_0] \right\} d\varphi(\varepsilon / \varepsilon') . \qquad (2)$$

Symbol δ is the rate of depreciation,[5] $(1-\delta)K_0$ is the initial stock of capital, and *r* is the world rate of interest return. The optimal $K(\varepsilon')$ is implicitly defined by the first-order condition:

$$\int_{\varepsilon'-\beta}^{\varepsilon'+\beta} \left[\frac{F'(K)(1+\varepsilon) + (1+\delta)}{1+r} - 1 \right] d\varphi(\varepsilon / \varepsilon') = 0 .$$

This expression can be simplified to:

$$F'[K(\varepsilon')][1 + E(\varepsilon / \varepsilon')] = r + \delta , \qquad (3)$$

where $E(\varepsilon / \varepsilon')$ is the conditional expected value of the productivity factor, given that this factor lies within the interval $(\varepsilon' - \beta, \varepsilon' + \beta)$, that is:

$$E(\varepsilon / \varepsilon') = \int_{\varepsilon'-\beta}^{\varepsilon'+\beta} \varepsilon d\varphi(\varepsilon / \varepsilon') . \qquad (4)$$

Suppose that there is a screening (or search) technology, which, at some fixed cost per firm, can elicit the true value of the productivity factor of the firm, ε. A potential buyer can apply the technology after she acquires the firms and gains control of the domestic firm. We

[5] Because of the assumption that there is a single composite good, which serves both for investment and for consumption, we implicitly allow the optimal *K* to be above $(1-\delta)K_0$.

assume that foreign direct investors have a cutting-edge advantage over domestic investors in extracting information about the true value of the firm. If foreign direct investors acquire a domestic firm, they can apply their superior micro-management skills in order to elicit the true value of ε. This advantage stems from some sort of "intangible capital" (specialized knowledge) in this particular industry. The basic idea is that firms get involved in foreign operations in order to exploit this unique advantage that they have accumulated over time in their source country. The advantage is modeled here by specifying a lower screening cost for foreign direct investors than for domestic investors. Formally, the cost per firm for a foreign direct investor is C_F, which is assumed to be lower than C_D, the corresponding cost for a domestic direct investor (i.e., a domestic investor who gains acquires control of the domestic firm).

If the true value of ε were to be known, then the firm would choose an optimal capital stock, denoted by $K^*(\varepsilon)$, according to the marginal productivity condition:

$$F'\left[K^*(\varepsilon)\right](1+\varepsilon) = r + \delta \tag{5}$$

Given the signal ε', a potential foreign direct investor knows that the true value of ε must lie between $\varepsilon' - \beta$ and $\varepsilon' + \beta$, and that she will be able to elicit the true value of ε if she purchases the firm, at a cost C_F. Therefore, her gross bid price, given the signal ε', is described by:

$$P(\varepsilon') = \int_{\varepsilon'-\beta}^{\varepsilon'+\beta} \left\{ \frac{F\left[K^*(\varepsilon)\right](1+\varepsilon) + (1-\delta)K^*(\varepsilon)}{1+r} - \left[K^*(\varepsilon) - (1-\delta)K_0\right] \right\} d\varphi(\varepsilon/\varepsilon') \,. \tag{6}$$

Her net bid price is $P(\varepsilon') - C_F$. Because C_F is smaller than C_D, the bid price of the foreign direct investor is higher than that of the domestic investor.

Given the signal ε', the value of information to the FDI investor (that is, the value of eliciting the true productivity of the firm) is $P(\varepsilon') - V(\varepsilon')$. The associated cost is C_F. In order to incur this cost, the value of information must exceed this cost. Naturally, one would expect the value of information to rise with ε'. This is because, given the signal ε', the deviations of the productivity–independent $K(\varepsilon')$ over the interval $(\varepsilon' - \beta, \varepsilon' + \beta)$, from the productivity–dependent $K^*(\varepsilon)$ over this interval and, consequently, the deviations of $F(K^*(\varepsilon'))$ from over this interval, are magnified by the productivity factor $1+\varepsilon$. We therefore assume indeed that $P(\varepsilon') - V(\varepsilon')$ rises with ε'.[6] Hence, there exists some cutoff level of the signal, denoted by ε_0', such that for all $\varepsilon' < \varepsilon_0'$, the bid-ask price difference $P(\varepsilon') - C_F - V(\varepsilon')$ is negative, and, similarly, for all $\varepsilon' > \varepsilon_0'$, the bid-ask price difference is positive. Thus, all the firms that receive a low-productivity signal will be retained by the original (domestic) owners, and all the firms that receive a high-productivity signal will be acquired by foreign direct investors, who manage to outbid their domestic counterparts. The cutoff level of the signal depends on the screening cost C and is defined by:

$$P\left[\varepsilon_0'(C)\right] - C = V[\varepsilon_0'(C)] \tag{7}$$

[6] Indeed, Ariel Burstein (2003) provided us with an illuminating numerical example in which the bid–ask price difference rises with ε', as expected.

With FDI investors who can do the screening at a cost C_F per firm, the cutoff level of the signal is a function of $\varepsilon'_{0F} \equiv \varepsilon'_0(C_F)$.

The assumption that $P(\varepsilon') - V(\varepsilon')$ rises with ε' implies also that as the screening cost *(C_F)* of the FDI investors falls, the cutoff productivity level (that is, ε'_{0F}) declines with C_F, as well. This means that with a fall in C_F more firms will be acquired by FDI investors. Therefore, a lower screening cost of FDI investors gives rise to a larger volume of FDI inflows.[7] By the same token, as the signal becomes more accurate (that is, as β becomes smaller), the benefit of the screening technology, which is $P(\varepsilon') - V(\varepsilon')$, declines. We interpret a more accurate signal as an improvement in corporate transparency. The advantage of FDI investors in their cream-skimming skills is less pronounced when host-country corporate transparency improves,[8] and FDI inflows are expected to be less abundant.

After the signals are revealed, then a firm with a signal ε', below ε'_{0F}, actually adjusts its capital stock to the signal-dependent, productivity-independent level $K(\varepsilon)$. But a firm, which receives a signal ε' above ε'_{0F}, expects to adjust its capital stock to a productivity-dependent level $K^*(\varepsilon)$ with a cumulative distributionfunction $\varphi(\varepsilon / \varepsilon')$. The expected value of its capital stock, denoted by $E[K^*(\varepsilon) / \varepsilon']$ is given by:

---

[7] We refer to the sum of the acquisition price of the firm and the investment in its capacity (that is financed by the FDI owner) as FDI inflows.

[8] Indeed, these results also hold in Burstein's (2003) example, albeit with a different stochastic specification.

$$E[K^*(\varepsilon)/\varepsilon'] = \int_{\varepsilon'-\beta}^{\varepsilon'+\beta} K^*(\varepsilon)d\varphi(\varepsilon/\varepsilon') \ . \tag{8}$$

Thus, the total expected value of the stock of capital (before signals are revealed) is:

$$K^F = \int_{-1}^{\varepsilon'_{0F}} K(\varepsilon')dG(\varepsilon') + \int_{\varepsilon'_{0F}}^{1} E[K^*(\varepsilon)/\varepsilon']dG(\varepsilon') \tag{9}$$

This is our measure of the size of domestic capital.

III. FPI INFLOWS VERSUS FDI INFLOWS

To understand the unique role of FDI, suppose now that instead of FDI inflows there are only FPI inflows. That is, assume that the world rate of interest (rate of return) continues to prevail in the home country. Management under FDI ownership, however, may be plagued by the notorious "free-rider" problem. As noted succinctly by Oliver Hart (2000), "If the shareholder does something to improve the quality of management, then the benefits will be enjoyed by all shareholders. Unless the shareholder is altruistic, she will ignore this beneficial impact on other shareholders and so will under-invest in the activity of monitoring or improving management." To capture this argument in our case, we simply assume that FPI buyers will not be willing to incur the cost of eliciting the true productivity of the firm whose equity they purchase.[9]

In this case, direct domestic investors acquire and gain control of the firms with high-productivity signals. Domestic and FPI investors will be forced to acquire all the other firms with low-productivity signals. The cutoff level of the signal in this case is $\varepsilon'_{0D} \equiv \varepsilon'_0(C_D)$.

[9] In this paper we do not distinguish between foreign and domestic portfolio investors. For an analysis of information asymmetry between these two types of investors, which leads to the home-bias phenomenon in portfolio investment, see Razin, Sadka, and Yuen (1998).

Because $C_D > C_F$, it follows that $\varepsilon'_{0F} < \varepsilon'_{0D}$ [recall that $P(\varepsilon') - V(\varepsilon')$ is increasing in ε', by assumption, and see equation (7)]. Thus, the difference in investment in capacity between the two regimes lies only in the range of signals between ε'_{0F} and ε'_{0D}. The capital stock of a firm with a signal below ε'_{0F} is the same in the two regimes. The expected capital stock of a firm with a signal above ε'_{0D} will also be the same in the two regimes. But a firm, which receives a signal ε' in-between these two cutoff levels, will invest a signal-dependent $K(\varepsilon')$ in the foreign portfolio-investment regime compared to a productivity-dependent schedule, $K^*(\varepsilon)$, with a cumulative distribution $\varphi(\varepsilon / \varepsilon')$, in the FDI regime. Naturally, the latter is more efficient, in the sense that it yields a higher expected return.[10]

A. Gains to the Host Country

The economic gains from FDI, relative to FPI inflows, consist of the efficiency of investment and the lower screening cost of FDI investors. Note that because the same world interest rate, *r,* prevails in the home country in the two regimes, it follows that the gains from FDI in our case do not include the traditional gains from opening up the domestic capital market to foreign capital inflows. (Evidently, these traditional gains are present also in the portfolio regime.) In the FDI-flow regime the firms with signals above the cutoff signal ε'_{0F} are screened; whereas in the FPI-flow regime a smaller set of firms, namely only the firms with

[10] We have assumed that the only advantage of FDI investors over direct domestic investors lies in the search/screening cost. Naturally, if we were to assume that FDI investors can also obtain better information about the true ε (we have assumed that both can accurately elicit ε), then the difference between the two regimes expands to the entire range of [-1, 1] of signals.

signals above ε'_{0D} are screened (recall that $\varepsilon'_{0D} > \varepsilon'_{0F}$. Therefore, the gains to the host country stemming from the efficiency of investment is:

$$GAIN_E = \int_{\varepsilon'_{0F}}^{\varepsilon'_{0D}} \left[P(\varepsilon') - C_F - V(\varepsilon')\right] dG(\varepsilon') . \qquad (10)$$

In addition, for the firms that are screened in the two regimes (that is, the firms with signals above ε'_{0D}, the screening cost is lower under the FDI regime than under the portfolio flow regime. This gives rise to further gains from FDI, which are:

$$GAIN_C = (C_D - C_F)[1 - G(\varepsilon'_{0D})] . \qquad (11)$$

Observe that the entire gain, attributable to the lower screening cost of FDI investors is captured by the host country because of the assumed perfect competition among the FDI investors over the domestic firms. This is because competition among FDI investors must drive up the price they pay for a domestic firm to their net bid-price [that is, $P(\varepsilon') - C_F$], which exceeds the ask-price of the domestic owners [that is, $V(\varepsilon')$]; except for the cutoff firm (for which the bid price and ask price are equal to each other). Thus, the total gain to the host country from FDI is

$$\begin{aligned} GAIN_E + GAIN_C = & \int_{\varepsilon'_{OF}}^{\varepsilon'_{0D}} [P(\varepsilon') - C_F - V(\varepsilon')]\, dG(\varepsilon') \\ & + (C_D - C_F)[1 - G(\varepsilon'_{OD})] \end{aligned} \qquad (12)$$

Note, however, that in the extreme opposite case of a single FDI investor, a monopoly, she will never offer a price for a domestic firm above the price that will be offered by domestic investors, which is $P(\varepsilon') - C_D$, as long as this price is above, or equal, to the ask price of the

domestic owner, which is $V(\varepsilon')$. Thus, the price at which the foreign direct investor buys a domestic firm with a signal ε' is $Max[P(\varepsilon') - C_D, V(\varepsilon')]$. Because $P(\varepsilon'_{0D}) - C_D = V(\varepsilon'_{0D})$, it follows that $P(\varepsilon') - C_D < V(\varepsilon')$ in the interval $(\varepsilon'_{0F}, \varepsilon'_{0D})$. This means that in this interval the domestic firms are purchased by the foreign direct investor at the ask price $V(\varepsilon')$. Hence, the efficiency gain of investment, $GAIN_E$, vanishes. Similarly, firms in the interval $[\varepsilon'_{OD}, 1]$ must be purchased at the price $P(\varepsilon') - C_D$ [rather than $P(\varepsilon') - C_F$ in the competitive case]. Hence, $GAIN_C$ vanishes as well. Thus, as expected, the entire gain from FDI accrues to the single FDI investor. To retain some of the gains of FDI a possible remedy for the host country is to impose some sort of a floor to the sale prices of domestic firms. Another partial remedy for the host country is to impose a (source-based) capital gains tax on FDI investors. In the intermediate case of imperfect competition among a few FDI investors but not a strict monopoly, the gains from FDI are split between the host country and the FDI investors[11].

B. The Size of Investment in Capacity in the Host Country

We have already established that the allocation of the capital stock (its aggregate level and distribution over firms) is more efficient in the FDI regime than in the portfolio regime. Is the capital stock also larger in the FDI regime than in the FPI regime? Recall that the fundamental difference between the two regimes is the screening cost *C*. Therefore, rephrasing the question one can ask whether a decline in the search cost increases the

[11] Evidently this is an extreme case. If there is an additional domestic input, say labor, the host country still gains, even in the case of a single FDI investor, through infra-marginal gains to domestic labor. However, these gains are sharply smaller than what they could have been in the case of competitive FDI investors.

aggregate stock of capital. In order to answer the question, we write the aggregate stock of capital as a function of *C*, as follows [see equation (9)]:

$$\bar{K}(C) = \int_{-1}^{\varepsilon_0'(C)} K(\varepsilon')dG(\varepsilon') + \int_{\varepsilon_o'(C)}^{1} E[K^*(\varepsilon)/\varepsilon']dG(\varepsilon'), \qquad (13)$$

where $\varepsilon_0'(C)$, $K(\varepsilon')$ and $E[K^*(\varepsilon)/\varepsilon']$ are defined by equations (7), (3) and (8), respectively. Now, differentiate $\bar{K}(C)$, with respect to *C,* to get:

$$\frac{d\,\bar{K}(C)}{dC} = \{K[\varepsilon_0'(C)] - E[K^*(\varepsilon)/\varepsilon_0'(C)]\}g[\varepsilon_0'(C)]\frac{d\varepsilon_0'(C)}{dC} \qquad (14)$$

From equations (3) and (5) we can conclude that:

$$K[\varepsilon_0'(C)] = H\{E[\varepsilon/\varepsilon_0'(C)]\}, \qquad (15)$$

and

$$K^*(\varepsilon) = H(\varepsilon).$$

The function H(·) is defined by:

$$H(x) = (F')^{-1}\left(\frac{r+\delta}{1-x}\right).$$

The function $(F')^{-1}$ denotes the inverse of F'. Thus, we can rewrite equation (14) as:

$$\frac{d\,\bar{K}}{dC} = (H\{E[\varepsilon/\varepsilon_0'(C)]\} - E[H(\varepsilon)/\varepsilon_0'(C)])\; g[\varepsilon_0'(C)]\frac{d\varepsilon_0'(C)}{dC} \qquad (16)$$

If $H(\cdot)$ is convex, then it follows from Jensen's inequality that $d\bar{K}/dC$ is negative (because $d\varepsilon_0'/dC > 0$). Indeed, one may plausibly assume that *H* is convex (for instance, this is the

case with a Cobb-Douglas production function), in which case $d\bar{K}/dC < 0$. That is: The size of investment in capacity is larger under the regime of FDI inflows than under the regime of FPI inflows.

IV. EVIDENCE FROM A GRAVITY MODEL

In this section we confront our theoretical findings with evidence provided by a gravity model of bilateral FDI and FPI flows. The econometric model attempts to explain the determinants of the mobility of FDI and FPI across countries. We use a gravity model as a "platform" to test the role of information in attracting FDI from a source country to the host country.

Gravity models postulate that bilateral international flows (goods, FDI, etc.) between any two economies are positively related to the size of the two economies (e.g., population, GDP), and negatively to the distance (physical or other such as tariffs, information asymmetries, etc.) between them.[12]

The "gravity" control variables we use are: source and host country populations as measures of country scale, source and host country per capita incomes to represent their level of economic development, distance as a proxy for transportation costs (and, possibly "cultural distance"), and an instrumented measure of bilateral telephone traffic to represent bilateral

[12] For instance, using population as the size variable, Loungani, Mody and Razin (2002) find that imports are less than proportionately related to the host country population, while they are close to proportionately related to the source country population. Correspondingly, FDI flows increase by more than proportionately with both the source and the host-country populations.

communication capability. The volume of international trade in goods and services can naturally be associated with FDI flows (and perhaps also with FPI flows). For instance, vertical FDI flows by multinationals are usually related to more trade in intermediate goods; similarly, horizontal FDI flows are typically related to less trade in final goods. Therefore, we introduce goods trade into the FDI and FPI equations.

To the traditional gravity variables, we add variables suggested by our theory. Recall that the theory we develop suggests that, although the lack of transparency hurts investment in a country, nevertheless foreign direct investors may be able to overcome, and even gain from this disadvantage, on account of their superior ability to screen and monitor the acquired firm and, thereby, making efficient investments. These theoretical considerations lead us to search for variables that are available in the data and could also serve as proxies for host country corporate transparency and source country industry specialization. Consider each in turn.

A. Corporate Transparency in the Host Country

Our theory suggests that foreign investment will depend on the accuracy of the productivity signals in the host countries. The more accurate are the signals, the less pronounced is the advantage of FDI investors, and the less abundant are FDI flows to the host countries. This explanatory variable is represented in the gravity regression by two measures.

The first is a measure of creditor rights taken from La Porta et al (2000). What we want to represent is the degree of corporate transparency that diminishes the power of the insiders (in eliciting the true productivity factor of the firm and employing a productivity-dependent

investment strategy). We employ a measure of creditor rights (on a scale of one to five). We conjecture that such rights go hand-in-hand with corporate transparency. Our presumption is that creditors are on the frontline with respect to borrowers and, hence, are most influential in establishing borrower transparency. Accordingly, a regime of strong creditor rights will be associated with greater transparency.[13] To exercise their rights, creditors need to be able to monitor borrowers in good times and be able to assess their claims when the borrower goes into bankruptcy. How might we expect creditor rights to influence international trade and FDI? Where superior creditor rights exist, they should boost international goods trading activity to the extent it relies on trade credit; in other words, where an importer is extended credit by its foreign supplier, the presence of strong creditor rights will enhance international trade in goods. In contrast, our theoretical model predicts exactly the opposite for FDI. Because strong creditor rights are likely to be associated with greater transparency of information, they will tend to reduce the advantage foreign investors enjoy on account of their superior inside information; stronger creditor rights tend also reduce the advantage enjoyed by foreign investors in financing the necessary acquisitions and new investments through their internal sources of funds. As creditor rights deteriorate, FDI would substitute for goods trade.

---

[13] Others have used credit-based measures to infer transparency (or its opposite, opaqueness). Morgan (1999) suggests that the opaqueness of a firm is related to the extent to which rating agencies disagree on its credit rating (split rating). Bonaccorsi and Dell'Ariccia (forthcoming) investigate the effects of competition in the financial sector on the creation of firms in the non-financial sector. Inter alia, they bring evidence that the quality of borrowers' collateral is negatively related to opaqueness (as proxied by split-rating). At the same time borrowers' collaterals are correlated with the debt-equity ratio in financing their productive activities.

As a second measure of transparency, we construct the corporate sector's debt-equity ratio in the host country, represented here by the median debt-equity ratio for the sample of firms covered by Worldscope. This debt-equity ratio measure has the advantage of changing over time, unlike the creditor rights' variable that is unchanging. A higher debt equity ratio can be expected once again to reflect a stronger credit culture and hence represent another dimension of corporate transparency.

B. Industry Specialization in the Source Country

A second key determinant of FDI flows in our theory is the skimming cost advantage of FDI investors over other foreign investors, which stems from "intangible capital" accumulated through industry (or niche) specialization in the source countries. The basic idea is that countries with a high degree of specialization are assumed to have high levels of intangible capital (specialized knowledge) by virtue of the fact that the productive energies of the source countries' firms have been focused on a smaller number of activities/industries (niches), thereby better exploiting the "learning-by-doing" effects. Hence a higher degree of specialization in the source countries increases the cost advantage of FDI investors and is expected to generate more FDI flows to the host economies. We therefore include a measure of industry specialization (a proxy for intangible capital) in the source countries as an explanatory variable. Our measure of country specialization is the degree of concentration in the sectoral composition of a country's exports. An important question is: how good is our measure of specialization in capturing our theoretical construct. In other words, is there any reason to believe that countries with a high degree of specialization in exports have also an advantage in directly investing in foreign countries abroad in the sectors they specialize in?

To answer this question, we compared the sectoral distribution of a country's exports with the sectoral distribution FDI. We find that the null hypothesis, that the two distributions are the same, is almost never rejected (see Appendix II). The implication is the country's trade specialization leverages the specialized skills that arise from those production and trade activities into outward foreign direct investment.

C. Findings

We begin with a gravity equation for international trade in goods and services to provide a benchmark. We then contrast those findings to those for FDI flows, which, in turn, are contrasted with those for FPI flows. The dependent variable for the goods trade equation is the log of imports of goods and services into the host country.

Three-year averages are used to smooth out idiosyncratic variations in the annual data. For each country pair, we have, in principle, three observations for trade and FDI inflows and two for equity inflows for that decade of the 1990s. Country coverage and data sources are detailed in Table 1. A random effects model is estimated. In our robustness tests, we confirm the validity of our results by, including time dummies, among other things.

Table 1. Source and Host Country Coverage and Sub-Periods

Panel A: List of Source Countries

Australia	Japan
Canada	Netherlands
France	United Kingdom
Germany	United States
Italy	

Panel B: List of Host Countries

For FDI and Import Regressions:	*For Equity Flow Regressions:*
Australia	Australia
Canada	Canada
France	France
Germany	Germany
Hong Kong	Italy
Italy	Japan
Japan	Netherlands
Netherlands	United Kingdom
Singapore	United States
Spain	
Switzerland	
United Kingdom	
United States	

Panel C: Sub-periods

For FDI and Import Regressions:	*For Equity Flow Regressions:*
1990-1992	1991-1993
1993-1995	1994-1996
1996-1998	

Panel D: Data Sources

Variables:	*Source:*
Import of Goods	*Direction of Trade Statistics* , IMF
FDI Inflows	*International Direct Investment Database* , OECD
Equity Flows	*CrossBorder Analysis,* Baring Securities
Unit Value of Manufactured Exports	*World Economic Outlook* , IMF
Population	*International Financial Statistics,* IMF
GDP	*World Development Indicators,* World Bank
Distance	Shang Jin Wei's Website: www.nber.org/~wei
Bilateral Telephone Traffic	*Direction of Traffic: Trends in International Telephone Tariffs,* International Telecommunications Union
Export Concentration Index	*Handbook of international trade and development statistics(2000/1 edition CD-ROM),* UNCTAD
Host Debt-Equity Ratio	Worldscope
Host Creditor Rights	La Porta, Rafael; Lopez-de-Silanes, Florencio; and Shleifer, Andrei (1998).

A.1 Baseline Results

Table 2 presents the baseline results for goods trade, FDI and FPI.[14] For FDI, we specify the association with goods trade by dividing the investment inflows from a source into each host country with the goods imports from the same source country. Our dependent variable, therefore, is the log of the FDI to imports ratio. The available FPI flows variable is a measure of gross transactions by residents of country A in the equity markets of country B (see Portes and Rey (2000), who first used this variable).[15] Once again, we take into account the possible association with goods trade by dividing the FPI flows with goods imports and by taking the logarithm of the ratio.[16] Larger country populations and per capita incomes increase import volumes. Host country population size and per capita incomes do not have a significant further effect on FDI and FPI—the coefficients for these variables in FDI/trade and FPI/trade equations are statistically insignificant. In contrast, larger source populations are associated with more FDI and FPI relative to trade. And, increased source per capita incomes result in a large increase in FDI relative to trade. A possible interpretation for this last finding is that a greater knowledge gap and/or access to deeper financial markets, proxied by differences in per capita income spurs FDI.

---

[14] As expected, the results for the goods trade are in line with the literature. See, for instance, Eaton and Tamura (1994), and Eichengreen and Irwin (1998).

[15] Interestingly, the effects of distance on the volumes of FDI and FPI can be seen in Table 4.

[16] See subsection IV C.1 where the goods trade variable appears as an explicit explanatory variable in the FDI and FPI equations.

Table 2. Gravity Equations for Goods Trade, FDI and Equity Flows

	Imports of Goods		FDI/Trade		Equity/Trade	
	(1)	(2)	(3)	(4)	(5)	(6)
Host Population	0.742	0.883	0.417	0.279	0.995	0.857
	(3.98)**	(5.29)**	(1.52)	(1.14)	(3.09)**	(2.32)*
Source Population	0.976	0.976	0.793	0.791	0.983	0.988
	(13.25)**	(13.24)**	(3.04)**	(3.02)**	(3.49)**	(3.56)**
Host GDP Per Capita	0.643	0.725	-0.881	-1.105	1.630	1.215
	(2.05)*	(2.38)*	(1.17)	(1.63)	(1.72)	(1.12)
Source GDP Per Capita	0.914	0.889	5.150	5.163	1.230	1.222
	(3.99)**	(3.89)**	(6.47)**	(6.51)**	(1.43)	(1.44)
Distance	-0.742	-0.747	0.513	0.503	1.088	1.074
	(11.89)**	(11.99)**	(2.40)*	(2.37)*	(5.81)**	(5.78)**
Instrumented Telephone Traffic	0.544	0.526	2.468	2.407	6.355	6.294
	(1.88)	(1.82)	(2.46)*	(2.42)*	(4.46)**	(4.46)**
Source Export Concentration	4.192	4.092	55.032	55.387	5.285	6.072
	(0.77)	(0.75)	(2.86)**	(2.88)**	(0.25)	(0.29)
(Source GDP) X (Source Export Concentration)	-0.163	-0.137	-9.778	-9.831	-2.539	-2.636
	(0.20)	(0.17)	(3.38)**	(3.39)**	(0.81)	(0.85)
Host Debt-Equity Ratio	0.000	0.002	-0.010	-0.019	-0.007	-0.011
	(0.05)	(0.73)	(1.47)	(2.84)**	(0.86)	(1.15)
Host Creditor Rights		0.581		-0.676		-0.505
		(3.62)**		(3.27)**		(1.54)
Constant	1.558	-0.480	-29.332	-25.710	-47.756	-44.241
	(0.75)	(0.22)	(4.18)**	(3.63)**	(5.38)**	(4.87)**
Number of Observations	324	324	324	324	207	207
R2 Within	0.884	0.884	0.155	0.154	0.285	0.286
R2 Between	0.413	0.587	0.245	0.490	0.375	0.507
R2 Overall	0.583	0.697	0.187	0.297	0.315	0.392

Note: Values of t-statistics in parentheses; * significant at 5 percent; ** significant at 1 percent.

The coefficient of the distance variable is negative in the goods trade equation, as expected. This may also explain why the distance variable has a positive coefficient in the FDI and FPI equations. Recall that the dependent variables in these equations are, respectively, the ratio of FDI flows to goods trade and FPI flows to goods trade.[17] Finally, our telephone traffic variable, which proxies for the communications capability between the host and source

[17] The effect of distance on the volumes of FDI and FPI flows can be seen in Table 4.

countries, is extremely important in the FDI and FPI equations, suggesting that both FDI and FPI enhanced by the availability of communications.[18]

Consider, then, the new variables that we include in the gravity equations that our theory suggests. Creditor rights in the host country has a positive and significant sign in the goods trade equation, implying that better creditor rights enhance goods trade by improving the transparency of the importers/borrowers and by providing greater security for the credit transactions that normally accompany goods trade. In sharp contrast, the host-country creditors' rights variable enters with a negative and significant sign in the FDI equation. This is consistent with an important prediction of our model. Where creditors' rights are weak, the ability of domestic lenders and investors to form informed judgments about the value of a company is likely to be circumscribed. In such a situation, foreign investors with their specialized knowledge and internal sources of funding will enjoy a unique advantage. Similarly, the other measure of host-country transparency, a high debt-equity ratio reduces FDI. In contrast, FPI flows are not significantly influenced by creditor rights or by the debt-equity ratio. To wit, that our model makes no prediction about the relationship between host-country transparency and FPI flows.[19].

---

[18] Portes and Rey (2000) also used a telephone traffic variable in their estimations. However, traffic is likely to be endogenous and, as we discuss in Loungani, Mody, and Razin (2002), consideration of that endogeneity is important to assessing the relative influences of physical and "informational" distance.

[19] However, a micro-data based study by Gelos and Wei (2002) finds evidence that international funds (an analogue of our FPI) invests less in less transparent countries; they use their own measure of transparency. This finding may also be interpreted as evidence for home bias in portfolio investment.

Finally, higher source country specialization has a significant positive influence on FDI. This is consistent with another important prediction of our model, that source-country specialization yields advantage in eliciting good FDI opportunities in the host country. Note, however, that the term that interacts source country specialization and source country GDP is negative. A possible interpretation of this finding is that the advantage of specialization is mitigated as the size of the source country increases. It appears that for a given degree of specialization, as size increases, domestic (in the source country) direct investment opportunities hold back foreign investment.

C.2. Robustness

How robust are these results? We begin with three alternative specifications (Table 3). First, there may be some time-specific effects. This is relevant in general but more so because the data for FPI flows is available for only two time points, whereas for FDI it is available for three time points in the 1990s. We thus added time dummies to the baseline equations, with the rest of the specification as before. The results remain unchanged. Second, the debt-equity ratio variable used in the estimations could have two problems. It could be measured with

Table 3. Gravity Equations for FDI and Equity Flows

	FDI/Trade			Equity/Trade		
	(1)	(2) 1/	(3) 2/	(4)	(5) 2/	(6) 3/
Host Population	0.382	0.341	-0.017	0.922	0.946	0.485
	(1.52)	(1.36)	(-0.09)	(2.18)*	(2.70)**	(2.14)*
Source Population	0.805	0.777	0.801	1.008	0.996	0.917
	(3.08)**	(2.94)**	(2.63)**	(3.65)**	(3.56)**	(2.80)**
Host GDP Per Capita	-0.498	-1.079	-0.741	1.643	1.318	1.881
	(0.66)	(1.56)	(-1.82)	(1.19)	(1.28)	(5.04)**
Source GDP Per Capita	5.711	5.215	5.614	1.433	1.313	1.263
	(6.72)**	(6.50)**	(6.18)**	(1.64)	(1.53)	(1.35)
Distance	0.619	0.571	0.856	1.118	1.104	1.369
	(2.80)**	(2.68)**	(3.79)**	(5.85)**	(5.93)**	(7.21)**
Instrumented Telephone Traffic	2.941	2.670	2.754	6.637	6.499	5.943
	(2.84)**	(2.66)**	(2.54)*	(4.60)**	(4.58)**	(3.87)**
Source Export Concentration	57.175	53.308	53.388	6.542	5.789	2.553
	(2.97)**	(2.74)**	(2.40)*	(0.32)	(0.28)	(0.10)
(Source GDP) X (Source Export Concentration)	-10.306	-9.602	-10.843	-2.798	-2.633	-3.430
	(3.55)**	(3.28)**	(-3.23)**	(0.91)	(0.84)	(-0.94)
Host Debt-Equity Ratio	-0.019	-0.010	-0.023	-0.012	0.001	-0.018
	(2.89)**	(0.74)	(-6.40)**	(1.13)	(0.09)	(-5.60)**
Host Creditor Rights	-0.639		-0.299	-0.497		-0.196
	(3.07)**		(-2.59)**	(1.31)		(-1.92)
Dummy for 1993-1995 4/	-0.359			-0.185		
	(-1.51)			(0.95)		
Dummy for 1996-1998	-0.462			.		
	(-1.74)			.		
Constant	-31.769	-30.561	-30.321	-47.585	-48.058	-45.149
	(-4.04)**	(4.34)**	(-3.90)**	(4.78)**	(5.37)**	(-4.92)**
Number of Observations	324	324	270	207	207	175
R2 Within	0.167	0.154	0.183	0.288	0.287	0.299
R2 Between	0.267	0.197	0.799	0.530	0.356	0.843
R2 Overall	0.202	0.168	0.405	0.407	0.289	0.546

1/ Regression with fitted value of Host Debt-Equity ratio.

2/ Regression with fitted value of Trade.

3/ The time period for for Equity/Trade regression is actually 1994-1996.

4/ Values of t-statistics in parentheses; * significant at 5 percent; ** significant at 1 percent.

error, because it is not based on consistently chosen sample of firms across countries and over time. There may also be reverse causation if FDI and FPI flows have a bearing on the domestic debt-equity ratios. We therefore instrumented the debt-equity ratio using the La Porta et al (2000) measure of creditors' rights.[20] The results remain robust. Finally, we used a fitted value of goods trade in our dependent variables, the ratios FDI/Trade and Equity/Trade, using as an instrument a measure of restrictions on the current account. Again the results remain robust.[21]

In Table 4, we further examine the robustness of the specification of the functional forms of the FDI and FPI equations. Instead of looking at the ratios of FDI and FPI flows to goods trade flows, as dependent variables, we consider now the FDI and FPI flows themselves, as dependent variables. The goods trade flows are now taken as an independent variable. The results regarding the unique variables of our model—transparency and specialization—essentially do not change. Note also that the informational distance (as proxied by the negative of instrumental telephone traffic) has a negative and significant effect on FDI and FPI, but a statistically insignificant effect on goods trade (see Columns (1) and (2) of Table

[20] The Host Debt-Equity Ratio fitted values were calculated after running the regression with: Host GDP Per Capita, Host Creditor Rights, and Host Country dummies.

[21] For the fitted values of goods trade, we run the basic gravity equation for imports of goods plus the current account restriction. So, the explanatory variables are: Host Population, Source Population, Host GDP Per Capita, Source GDP Per Capita, Distance, Instrumented Telephone Traffic, Source Export Concentration, Interaction between Export Concentration and Source GDP, Host Debt-Equity Ratio and Current Account Restriction. The Current Account Restriction measure is the Dennis Quinn Measure of Current Account Restriction. It is based on a 0-8 Scale with higher number indicating less restriction. Finally, instead of normalizing FDI and Equity by Trade, we also estimated equations without the normalization and included trade as a right-hand side variable. The likely endogeneity problems here are severe; but our results of interest do not change.

2). The goods trade variable has a positive and significant effect on the volume of FDI (but not on the volume of FPI). This may suggest the existence of some sort of vertical FDI.

Table 4. Gravity Equations for Inward FDI and FPI Flows

	FDI		FPI	
	(1)	(2)	(3)	(4)
Host population	0.862	0.692	1.659	1.598
	(3.16)**	(2.41)*	(7.19)**	(5.78)**
Source population	1.432	1.326	1.796	1.756
	(4.53)**	(4.16)**	(6.23)**	(5.87)**
Host GDP per capita	-0.293	-0.611	2.934	2.751
	(0.43)	(0.84)	(5.68)**	(4.10)**
Source GDP per capita	5.864	5.765	2.17	2.085
	(6.83)**	(6.77)**	(2.65)**	(2.52)*
Distance	0.02	0.086	0.555	0.555
	(0.08)	(0.34)	(3.01)**	(2.83)**
Instrumented telephone traffic	2.707	2.548	7.46	7.29
	(2.51)*	(2.39)*	(5.62)**	(5.39)**
Source export concentration	59.175	59.624	7.856	8.458
	(2.86)**	(2.89)**	(0.39)	(0.42)
(Source GDP) X (source export concentration)	-10.202	-10.316	-2.601	-2.671
	(3.28)**	(3.32)**	(0.87)	(0.89)
Trade	0.395	0.509	0.201	0.237
	(2.53)*	(3.06)**	(2.05)*	(1.80)
Host debt-equity ratio	-0.013	-0.017	-0.01	-0.01
	(2.11)*	(2.75)**	(2.49)*	(1.65)
Host creditor rights		-0.362		-0.024
		(1.54)		(0.12)
Constant	-28.908	-26.519	-52.001	-50.694
	(3.87)**	(3.50)**	(6.46)**	(6.06)**
Number of observations	324	324	207	207

Note: t-statistics are in parentheses; * significant at 5 percent; ** significant at 1 percent.

V. CONCLUDING REMARKS

We develop a model in which foreign direct investors are better equipped, due to rich experience in the skimming of "good" firms than their direct domestic and portfolio counterparts. Employing this advantage, foreign direct investors are able to outbid direct domestic and portfolio investors for the good firms. We emphasize this feature of FDI, which is better hands-on management standards, that entails a cutting-edge advantage over portfolio investors in reacting in real time to a changing business environment. This feature is naturally more pronounced in high-productivity firms, resulting in "cream-skimming" of domestic firms by FDI investors. Note that this mechanism applies both to mergers and acquisitions and to green-field investments. The productivity signal, though, is likely to be coarser in the latter, conveying less information about the true productivity. This makes the FDI investors' advantage over their domestic direct investors counterparts even more pronounced in the case of green-field investment.

We view FDI as distinct from FPI investment with respect to the quality of monitoring the management. Foreign direct investors, by definition, acquire some significant control over the firm they invest in, whereas portfolio investors, plagued by free-rider problems, have no control. Consequently, they can apply hands-on management (or micro-management) standards that would enable them to react in real time to changing economic environments. This feature may stem from "intangible capital" accumulated through a specialization by the

foreign direct investors in a certain niche.[22] Indeed, there is some micro evidence in support of our theory. For example, Djankov and Hoekman (2000) report that foreign direct investors pick the high-productivity firms in transition economies. Similarly, Griffith and Simpson (2003) find that foreign-owned manufacturing establishments in Britain, over the period 1980 to 1996, have significantly higher labor productivity than those that remain under domestic ownership. In addition, labor productivity improves faster over time and faster with age in foreign-owned establishments.

To bring the model to the data we employ the gravity-equation approach. Indeed, we find that the abundance of "intangible" capital in specialized industries in the source countries (as proxied by export commodity concentration, shown also to mirror outward FDI industry specialization) is positively correlated with FDI flows to the host countries. Also, the degree of corporate transparency (as proxied by creditor rights and debt-equity ratio), in the host countries, is negatively correlated with FDI flows.

[22] See Gopinath (2001) for a different application of a search model for a study of FDI flows into developing economies.

Table 1. Macroeconomic Determinants of Domestic Investment

	OLS	TSLS
Foreign direct investment (FDI)	0.13	0.23
	(5.5)	(6.8)
Loan Inflows (L)	0.14	0.12
	(4.0)	(3.0)
Portfolio Inflows (P)	0.02	0.18
	(0.3)	(2.0)
Lagged (one year) Domestic Investment	0.83	0.66
	(99.7)	(51.2)
GNP Growth	0.2	0.15
	(15.1)	(10.9)
Lagged (one year) GNP growth	0.04	0.06
	(2.8)	(4.6)
Government Expenditure	0.03	0.01
	(2.7)	(0.5)
Long-Run Effect of Foreign Direct Investment	0.76**	0.68**
Long-Run Effect of L	0.82**	0.35**
Long-Run Effect of P	0.12*	0.53*

Notes:

1. Except for GNP growth rates, all other variables are measured as percentages of GNP.
2. Sources: Razin (forthcoming).
3. The second column of coefficients (TSLS) reports the estimation of one equation of a four-equation system; other endogenous variables are FDI, L, and P.
4. A double asterisk stands for statistical significance (at the one-percent level).
5. A single asterisk stands for statistical insignificance (at the five-percent level).

Table 2. Macroeconomic Determinants of GDP Growth

	OLS	TSLS
Foreign Direct Investment (FDI)	0.09	0.2
	(3.01)	(6.02)
Loan Inflows (L)	0.01	0.02
	(0.24)	(0.39)
Portfolio Inflows (P)	0.05	0.10
	(0.62)	(1.0)
Lagged (one-year) GDP Growth	0.12	0.12
	(7.68)	(6.90)
Domestic Investment	0.27	0.24
	(14.40)	(11.38)
Lagged (one-year) Domestic Investment	-0.22	-0.18
	(-12.08)	(-9.11)
Government Expenditures	-0.019	-0.019
	(-8.39)	(-7.92)
Initial GDP	-0.01	-0.004
	(3.27)	(-1.45)
Long-Run Effect of FDI	0.10**	0.23**
Long-Run Effect of L	0.01*	0.01*
Long-Run Effect of P	0.06*	0.07*

Notes:
1. Except for GNP growth rates, all other variables are measured as percentages of GNP.
2. Sources: Razin (forthcoming).
3. The second column of coefficients (TSLS) reports the estimation of one equation of a four-equation system; other endogenous variables are FDI, L, and P.
4. A double asterisk stands for statistical significance (at the one-percent level).
5. A single asterisk stands for statistical insignificance (at the five-percent level).

Appendix A: A Specialization Measure

Our measure of specialization estimates the extent of concentration in a country's export composition. In this appendix, we bring evidence that specialization in a certain export industry is indeed associated with specialization in outward foreign direct investment in that sector. Using information on 239 sectors, the United Nations Conference on Trade and Development (UNCTAD) estimates export specialization as:

$$Hi = \frac{\sqrt{\sum_{i=1}^{239}\left(\frac{E_{ij}}{E_{i.}}\right)^2} - \sqrt{\frac{1}{239}}}{1 - \sqrt{\frac{1}{239}}}$$

H_i = the value of the concentration index of country-i.
E_{ij} = the value of exports/imports between country-j and country-i.
$E_{i.} = \sum_{j=1}^{239} Eij$.

Underlying the empirical approach adopted in this paper is the presumption that countries that specialize in particular sectors develop intangible capital in those sectors and such capital is then leveraged to invest abroad. A question of some empirical interest then is whether the specialization that we observe in exporting activities is mirrored also in FDI activities. In verifying if this is the case, we are restricted by the limitation of refinement in sectoral breakdowns available for FDI data. We were able to allocate activities into twelve comparable categories for exports and FDI for four major countries. The twelve categories are: agriculture, chemical products, construction, extraction of petroleum and gas, financial services, food products, machinery and transport equipment, mining and quarrying (without fuel), other manufactured goods, residual services, telecommunications, and total transport.

The four countries are: France, Germany, the United Kingdom, and the United States. The question of interest then is: do the distributions of exports match the distribution of outward FDI across these 12 categories.

In Table B1 below, we use two measures to judge how close these two distributions are. First, we use an informal approach. We obtain the absolute value of the difference between the share of sector i's exports in total exports and the share of the same sector in the FDI originating from a source country. We then average these differences over the 11 sectors. Note that this average can vary between 0 and approximately 20 percent. It would be zero if there is perfect congruence in the sectoral distributions. It would be about 20, if one set of sectors had zero share in one of the distributions and the set of all other sectors had zero share in the other distribution. The table shows that the average difference between sectoral shares has varied between 6 and 11 percent. It has been at the lower end for Germany and France and at the higher end for the United States. For a more formal test of the differences in distributions, we use the Kolmogorov-Smirinov statistic, which is based on extreme differences between the two distributions. The results show that the null hypothesis that the two distributions are the same is almost never rejected.

Table B1. Testing Equality of the Sectoral Distribution of Country Exports and Outward FDI

	France	Germany	United Kingdom	United States
Average absolute difference[1]				
1985-1988	8.67	6.44	6.52	11.12
1989-1993	7.54	8.20	9.29	10.20
1994-1998	11.00	10.01	9.02	10.11
Average Kolmogorov-Smirnov Test P-value				
1985-1988	0.64	0.58	0.56	0.39
1989-1993	0.86	0.56	0.51	0.58
1994-1998	0.61	0.27	0.87	0.85

[1] Average absolute difference=$\frac{1}{12}\sum_{i=1}^{12}\left|F_i - E_i\right|$, $F =$ share of sector i in outward FDI; $E_i =$ share of sector in total exports.

References

Bonaccorsi, and Giovanni Dell'Ariccia (forthcoming), "Bank Competition and Firm Creation," *Journal of Money Credit, and Banking*.

Borenzstein, Eduardo, Jose De Gregorio, and J. W. Lee, 1998, "How Does Foreign Direct Investment Affect Economic Growth?," *Journal of International Economics*, Vol. 45 (June), pp. 115–35.

Bosworth, Barry, and Susan Collins, 1999, "Capital Flows to Developing Economies: Implications for Saving and Investment," Brookings Papers on Economic Activity, Vol. 1, pp. 143–69.

Burstein, Ariel, 2003, Discussion of Ashoka Mody, Assaf Razin, and Efraim Sadka 2003, "The Role of Information in Driving FDI Flows: Host-Country Transparency and Source-Country Specialization," The North American Meeting of the Econometric Society, Washington D.C (January).

Djankov, Simeon, and Bernard Hoekman, 2000, "Foreign Investment and Productivity Growth in Czech Enterprises," *The World Bank Economic Review*, Vol. 14 (1), pp. 49-64.

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, 478–510.

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).

Gelos, Gaston R., and Shang-Jin Wei, 2002, "Transparency and International Investors' Behavior," NBER Working Paper No. 9260, October.

Gopinath, Gita, 2001, "Lending Booms, Sharp Reversals and the Real Exchange Dynamics," (University of Chicago, GSB, mimeo).

Griffith, Rachel and Helen Simpson (2003), "Characteristics of Foreign-Owned Firms in British Manufacturing," NBER Working Paper No. 9573, March.

Hart, Oliver, 2001, "Financial Contracting," The 2001 Nancy L. Schwartz Lecture, Kellogg Graduate School of Management, Northwestern University.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny, 1997, "Legal Determinants of External Finance," *Journal of Finance*, Vol. 52, pp. 1131-1150.

———, Florencio Lopez-de-Silanes, and Andrei Shleifer, 1998, "Law and Finance," *Journal of Political Economy*, Vol. 106 (December), pp. 1113–55.

———, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny, 2000, "Investor Protection: Origins, Consequences, and Reform," *Journal of Financial Economics* (October).

Loungani, Prakash, Ashoka Mody, and Assaf Razin, 2002, "The Global Disconnect: Transactional Distance and Scale Economies," (International Monetary Fund, mimeo).

Morgan, Donald P., 2002, "Rating Banks: Risk and Uncertainty in an Opaque Industry, "*American Economic Review*, Vol. 92(4), (September), pp. 874–88.

Portes, Richard, and Helene Rey, 2000, "The Determinants of Cross-Border Equity Flows: The Geography of Information," (London Business School, mimeo). Revised version of the CEPR Discussion Paper 2225.

———, Helene Rey, and Yonghyup Oh, 2001, "Information and Capital Flows: The Determinants of Transactions in Financial Assets," *European Economic Review*, pp. 783–96.

Productivity Commission, 2002, Offshore Investment by Australian Firms: Survey Evidence, Commission Research Paper, AsyInfo, Canberra, Australia.

Razin, Assaf, "FDI Contribution to Capital Flows and Investment in Capacity," in: Ito, Takatoshi and Andrew Rose (eds.), Productivity, East Asia Seminar on Economics (EASE), Vol. 13 (Chicago: University of Chicago Press, forthcoming).

Razin, Assaf, and Efraim Sadka, 2003, "Gains from FDI Inflows with Incomplete Information," *Economics Letters*, Vol. 78, pp. 71-77.

———, Efraim Sadka, and Chi-Wa Yuen, 1998, "A Pecking Order Theory of Capital Flows and International Tax Principles," *Journal of International Economics*, Vol. 44(1), pp. 45–68).

Wei, Shang-Jin, 2000, "How Taxing is Corruption on International Investors," *Review of Economics and Statistics*, No. 1 (February), pp. 1–11.