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Productivity and Taxes as Drivers of FDI

Foreign direct investment (FDI) is a form of international capital flow. It plays an important role in the general allocation of world capital across countries. It is often portrayed, together with other forms of capital flows, as shifting capital from rich, capital-abundant economies to poor, capital-scarce economies, as a means to close the gap between the rates of return to capital and enhance the efficiency of the worldwide stock of capital. This general portrayal of international capital flows may indeed pertain to FDI flows from developed countries to developing countries, which are almost all net recipients of FDI. However, this portrayal of international capital flows is hardly reminiscent of the FDI flows among developed countries, which are much larger than those from developed to developing countries. Although *net* aggregate FDI flows from, or to, a developed country are typically small, the *gross* flows are quite large.

In this paper we indeed focus on bilateral FDI flows among member countries of the Organization for Economic Cooperation and Development (OECD). We study the effects of two sets of driving forces that affect FDI: productivity and taxation. Specifically, we attempt to shed some light on some key mechanisms though which these sets affect FDI flows.[1] An important feature of our FDI model (which distinguishes FDI flows from portfolio flows) is fixed setup costs of new investments. This introduces two margins of FDI decisions: an intensive margin of determining the magnitude of the flows of FDI, according

Thanks are due to Hui Tong and Thiess Buttner for providing us with some of the data and to Alon Cohen for competent research assistance.

1. Some macroeconomic studies emphasize the effect of FDI on long-run economic growth and cyclical fluctuations. A comprehensive study by Bosworth and Collins (1999) studied a somewhat related effect: that of FDI on growth. They provided evidence on the effect of capital inflows on domestic investment for fifty-eight developed countries during the period 1978 to 1995.

to standard marginal productivity conditions, and also an extensive margin of determining whether to make a new investment at all. Productivity and taxes may affect these two margins in different, possibly conflicting, and crucial ways. The magnitude of the setup costs can well be industry-specific, thereby giving rise to two-way rich-rich, as well as rich-poor, FDI flows.

Also, threshold barriers play an important role in determining the extent of trade-based foreign direct investment;[2] 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, studies have attempted to explain how a source country can export both FDI and goods to the same host country. The explanation essentially rests on productivity heterogeneity within the source country and on differences in setup costs associated with FDI and export of goods. The trade-based literature on FDI is based on a framework of heterogeneous firms.[3] Thus the empirical approach in this trade-based literature focuses on firm-level decisions on exports and FDI in the source country, using microdatasets. Our approach is to analyze aggregate bilateral FDI using countrywide datasets. Note that micro–cross-country panel datasets are not available, so that micro-based empirical studies typically have to be confined to a single source or host country and to extremely short time spans. In contrast, we have data for nineteen OECD countries over a large interval of time (1987–2003).

We first study the role of source country and host country productivities on the twofold FDI decisions. Specifically, we develop a framework in which the host productivity has a positive effect on the *intensive margin* (the size of FDI flows), but an ambiguous effect on the *extensive margin* (the likelihood of FDI flows to occur). The source productivity has a negative effect on the extensive margin. These predictions are tested in the data. We then study the effects of corporate taxation on FDI. Earlier studies have suggested that FDI is sensitive to tax rate differences.[4] Our contribution to this discussion is that the tax rates of the host and source countries may have differential effects on the two margins of FDI decisions. Therefore, the sensitivity of FDI to tax rate differentials may be blurred.[5]

The organization of the paper is as follows. The next section presents an analytical framework with productivity as a driving force of FDI. The third sec-

2. See, for instance, Zhang and Markusen (1999); Carr, Markusen, and Maskus (2001); Helpman, Melitz, and Yeaple (2004).

3. See Melitz (2003).

4. See, for example, Gropp and Kostial (2000); Bénassy-Quéré, Fontagné, and Lahrèche-Révil (2000).

5. See Devereux and Griffith (2003) on the different effects of marginal and average taxes on the investment decisions about location and magnitudes.

tion extends this framework to include corporate taxation as an additional driving force. The fourth section describes our econometric approach. The fifth section describes the data. followed by the presentation of the results of the estimations. The last section concludes.

A Stripped-Down Model of Foreign Direct Investment

Datasets of source-to-host FDI flows typically include many observations with zero flows. This may indicate the existence of fixed setup costs of establishing new FDI, thereby generating two margins for FDI decisions—an extensive margin about whether to invest at all and an intensive margin about how much to invest.

We present in this section a simple, stripped-down model of FDI with fixed setup costs. Consider a pair of countries, *host* and *source*, in a world of free capital mobility that fixes the world rate of interest, denoted by r. We will now describe the host country, whose economic variables will be subscripted by H, and the source country, described by subscript S. Variables with either subscript are not identical for the two countries. There is a representative industry whose product serves for both consumption and investment. Firms last for two periods. In the first period, there is a continuum of N_H firms that differ from each other by an idiosyncratic productivity factor ε**.** The number (N_H) of firms (or entrepreneurs) is fixed. We refer to a firm that has a productivity factor of ε as an ε-*firm.* The cumulative distribution function of ε is denoted by $G(\cdot)$ with a density function $g(\cdot)$. That is, the number of ε-*firms is* $N_H g(\varepsilon)$.

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* ε-*firm* invests I in the first period, it augments its capital stock to $K = K_H^0 + 1$, and its gross output in the second period will be $A_H F(K, L)(1 + \varepsilon)$, where L is the labor input, $F(\cdot)$ is the production function, and A_H is a country(H)-specific aggregate productivity parameter. Note that ε is firm specific, whereas A_H is country specific.

We assume that there is a fixed setup cost of investment, C_H, which is the same for all firms (that is, it is independent of ε). We assume that the fixed cost has two components. One component (denoted by C_{SH}) is borne by the FDI investor in her or his source country. This may involve, for instance, management time and other expenses at the home headquarters of a multinational. The second component is a standard adjustment cost carried out in the host country. We assume that this cost involves labor input L_H^C only. Thus,

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

where w_H is the host country wage rate. We assume that, due to some (suppressed) fixed factor, F is strictly concave, exhibiting diminishing returns to scale and diminishing marginal products of labor and capital. Note that the average cost curve of the firm is U-shaped so that perfect competition, which we assume, can prevail.[6] Consider an ε-firm that invests in the first period an amount $I = K - K_H^0$ to augment its stock of capital to K. Its present value becomes $V^+(A_H, K_H^0, \varepsilon, w_H) - C_H$, where

$$V^+(A_H, K_H^0, \varepsilon, w_H) = \max_{(K,L)} \left\{ \frac{A_H F(K,L)(1+\varepsilon) - wL + (1-\delta)K}{1+r} - K - K_H^0 \right\}, \tag{2}$$

where δ is the rate of physical depreciation and r is the world (fixed) rate of interest.

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

$$A_H F_K(K,L)(1+\varepsilon) = r + \delta \tag{3}$$

and

$$A_H F_L(K,L)(1+\varepsilon) = w_H, \tag{4}$$

where F_K and F_L denote the partial derivatives of F with respect to K and L, respectively. Naturally, ε is bounded from below by –1, so that output is always nonnegative. We denote the upper bound of the productivity factor by $\bar{\varepsilon}$, that is, $G(\bar{\varepsilon}) = 1$. Note, however, that an ε-firm may choose not to invest at all (that is, it may choose to stick to its existing stock of capital, K_H^0) 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

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

The labor demand of such a firm, denoted by $L^-(A_H, K_H^0, \varepsilon, w_H)$, is defined by

6. With constant returns to scale, the fixed cost will entail a diminishing average cost curve, in which case perfect competition cannot be sustained. Were we to assume that entry is free, one could have constant returns to scale at the industry level.

$$A_H F_L(K_H^0, L)(1+\varepsilon) = w_H. \tag{6}$$

A firm will choose to make a new investment if its present value with the investment exceeds its present value without the investment. Naturally, a higher productivity firm (namely, a firm with a higher ε) benefits more from investment; that is, the gap between V^+ and V^- increases with ε.[7]

Therefore, a cutoff level of ε exists, denoted by ε_0, such that an ε-firm will make a new investment if and only 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 of ε as $\varepsilon_0(A_H, C_H, K_H^0, w_H)$. It is defined implicitly by

$$V^+(A_H, K_H^0, \varepsilon_0, w_H) - C_H = V^-(A_H, K_H^0, \varepsilon_0, w_H). \tag{7}$$

That is, the cutoff productivity level is the level at which the firm is just indifferent between making a new investment and incurring the setup cost and sticking to its existing capital stock, thereby avoiding the setup cost.

The wage rate (w_H) is determined in equilibrium by a clearance in the labor market. We assume that labor is confined within national borders. Denoting the country's endowment of labor by $\bar{L}_H^0$, we have the following labor market–clearing equation:

$$\begin{aligned} &N_H \int_{-1}^{\varepsilon_0(A_H, C_H, K_H^0, w_H)} L^-(A_H, K_H^0, \varepsilon, w_H) g(\varepsilon) d\varepsilon \\ &+ N_H \left\{1 - G\left[\varepsilon_0(A_H, C_H, K_H^0, w_H)\right]\right\} L_H^C \\ &+ N_H \int_{\varepsilon_0(A_H, C_H, K_H^0, w_H)}^{\bar{\varepsilon}} L^+(A_H, \varepsilon, w_H) g(\varepsilon) d\varepsilon = \bar{L}_H^0 . \end{aligned} \tag{8}$$

Dividing the latter equation through by N_H yields

$$\begin{aligned} &\int_{-1}^{\varepsilon_0(A_H, C_H, K_H^0, w_H)} L^-(A_H, K_H^0, \varepsilon, w_H) g(\varepsilon) d\varepsilon \\ &+ \left\{1 - G\left[\varepsilon_0(A_H, C_H, K_H^0, w_H)\right]\right\} L_H^C \\ &+ \int_{\varepsilon_0(A_H, C_H, K_H^0, w_H)}^{\bar{\varepsilon}} L^+(A_H, \varepsilon, w_H) g(\varepsilon) d\varepsilon = L_H^0, \end{aligned} \tag{9}$$

7. A formal proof is available in Razin and Sadka (2007).

where $L_H^0 \equiv \bar{L}_H^0/N_H$ is the amount of labor per firm. (Note that there are N_H [1 – $G(\varepsilon_0)$] firms that make new investments, employing an extra fixed input of L_H^C.) Note also that no similar market-clearing equation is specified for capital, because we assume that capital is freely mobile internationally and its rate of return (r) is equalized internationally. The same description with the subscript S replacing H holds for the source country.

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 it is in the source country, that is, $L_H^0 > L_S^0$. In addition, the number of firms in the economy is also a measure of the abundance of entrepreneurship. Thus the abundance (or, respectively, scarcity) of labor is also relative to the scarcity (respectively, abundance) of entrepreneurship. If wages were equal in the two countries, then labor demand per firm would be equal and the market-clearing condition (equation 8) could not hold for both countries. Because of the diminishing marginal product of labor, it follows that wages in the relatively labor-abundant country are lower than that in the relatively labor-scarce country, that is, $w_H < w_S$.[8] Therefore, equal returns to capital (through capital mobility) coexist with unequal wages.[9]

Mergers and Acquisitions FDI

One may think of FDI as the investment of source country entrepreneurs in the acquisition of host country existing firms (whose number is fixed, N_H). We indeed deal initially with this kind of FDI through mergers and acquisitions (M&A). 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 setup cost of investment in the host country, when investment is done by source country entrepreneurs (that is, FDI investors) is only $C_H^* = C_{SH}^* + w_H L_H^{C^*}$ which is less than C_H (the setup cost of investment when carried out by the host country direct investors). 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 firm (that is, each firm whose ε is above

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

9. See also Amiti (2005) who studies the effect of agglomeration on cross-regional wage differences and Melitz (2003) for the role of fixed costs in intra-industry reallocations in reaction to industry-specific productivity shocks.

$\varepsilon_0(A_H, C_H^*, K_H^0, w_H))$ is purchased at its market value, which is $V^+(A_H, K_H^0, \varepsilon, w_H) - C_H^*$. This essentially assumes that competition among the foreign direct investors shifts all the gains from their lower setup cost to the host country original owners of the firm. The new owners also invest an amount, $K^+(A_H, \varepsilon, w_H) - K_H^0$, in the firm.

Thus, the amount of foreign direct investment made in an ε-firm (where $\varepsilon > \varepsilon_0$) is

$$FDI(A_H, C_{SH}^*, K_H^0, \varepsilon, w_H) = V^+(A_H, K_H^0, \varepsilon, w_H) - C_{SH}^* + K^+(A_H, \varepsilon, w_H) - K_H^0 \ . \quad (10)$$

Note that the acquisition price is $V^+ - C_{SH}^* - w_H L^{C^*}_H$, but $w_H L^{C^*}_H$ constitutes part of FDI; therefore only C_{SH}^* is subtracted in equation 10.

Aggregate notional FDI is given by

$$FDI_N(A_H, C_H^*, C_{SH}^*, K_H^0, w_H) = N_H \int_{\varepsilon_0(A_H, C_H^*, K_H^0, w_H)}^{\bar{\varepsilon}} FDI(A_H, C_{SH}^*, K_H^0, w_H, \bar{\varepsilon}) g(\varepsilon) d\varepsilon \ . \quad (11)$$

Note that FDI_N, as defined in equation 11, would be the actual flow of FDI, when $\varepsilon_0(A_H, C_H^*, K_H^0, w_H)$ is below $\bar{\varepsilon}$. That is, FDI_N is the actual FDI only if

$$\varepsilon_0(A_H, C_H^*, K_H^0, w_H) \leq \bar{\varepsilon}. \quad (12)$$

Otherwise, the actual FDI would be zero. For this reason, we refer to FDI_N as the *notional* FDI. The *actual* FDI, denoted by FDI_A, is defined by:

$$FDI_A(A_H, C_H^*, C_{SH}^*, K_H^0, w_H) = \begin{cases} FDI_N(A_H, C_H^*, C_{SH}^*, K_H^0, w_H) & \text{if (12) holds} \\ 0 & \text{otherwise} \end{cases} \quad (13)$$

We refer to equation 12 as the selection-condition equation. It specifies when there will by any FDI flow to the host country. Equation 11, referred to as the flow equation, describes the actual FDI flow only if the selection-condition equation is satisfied.

Aggregate Productivity Shock: Flow and Selection

As described earlier, the parameter A_H is a host country–specific productivity factor that applies to all firms in this country. We examine how a shock to

this factor affects the aggregate level of FDI flowing to the host country. Suppose first that the domestic wage rate (w_H) is fixed. A positive productivity shock has three positive effects on the notional FDI (namely, FDI_N), as specified in equation 11. First, it raises the marginal productivity of capital, thereby increasing the amount of investment that is made by each investing firm (which is acquired by FDI investors). Second, it raises the value of such firms and, consequently, their acquisition price, which constitutes a part of the notional FDI flows. Third, it increases the number of firms purchased by FDI investors (by lowering the threshold productivity level ε_0).[10]

Turning to the selection-condition equation 13, we see that a positive aggregate productivity shock (while still maintaining the wage rate [w_H] constant) increases the profitability of investments and, consequently, reduces the likelihood that no firm will make any investment. Formally, a rise in A_H reduces the likelihood that the threshold idiosyncratic productivity ε_0 exceeds the upper bound on the idiosyncratic productivity $\bar{\varepsilon}$. That is, a positive aggregate productivity shock raises the likelihood of satisfying the selection condition, so that the notional FDI turns out to be realized. Thus a positive aggregate productivity shock, keeping w_H fixed, raises the actual FDI (both through the flow and selection-condition equations).

Now, we drop the supposition that the wage rate (w_H) is fixed. When wages are not fixed (but rather are determined by the labor market–clearing equation 9), then the increase in the demand for labor raises the wage rate (w_H) in the host country (and the fixed setup cost, $w_H L_H^C$), thereby countering the above three effects on the notional 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 the notional FDI still rises. Thus an increase in the host country's aggregate productivity factor (A_H) raises the volume of the notional FDI flows from country *S* to country *H*, which is governed by the flow equation.

Next, consider the effect of an aggregate productivity shock on the selection-condition equation. A rise in A_H increases the value of the domestic component of the setup cost, $w_H L_H^C$. This effect by itself weakens the advantage of carrying out positive FDI flows at all from country *S* to country *H*. In other words, as w_H rises, ε_0 rises, thereby reducing the likelihood of satisfying the selection-condition equation. The follow-up effect that is triggered by a positive aggregate productivity shock works in the opposite direction of the initial effect (when holding w_H constant) and may dominate it.

10. For a formal derivation of the results, see Razin and Sadka (2007). We assume plausibly that the third effect, which represents the marginal investing firm, is rather small relative to the margin of investment of all investing firms (the first effect). We ignore the third effect in the empirical investigation.

To sum up, a positive aggregate productivity shock in the host country raises the observed notional FDI flows in the flow equation and, at the same time, may lower the likelihood of observing positive FDI flows at all. Indeed, this possibility is demonstrated in a recent paper by Razin and Sadka.[11] Also, the source country aggregate productivity factor (A_S) does not affect the flows of M&A FDI from country *S* to country *H*. This is because we assumed free international mobility of portfolio capital, which set a common rate of interest (r) worldwide.

Greenfield FDI

So far, FDI has taken the form of mergers or acquisitions of the N_H existing firms. Consider now the possibility of establishing a new firm (that is, a greenfield FDI, where $K_H^0 = 0$). Suppose that the newcomer entrepreneur does not know in advance the productivity factor (ε) of the potential firm. The entrepreneur therefore takes $G(\cdot)$ as the cumulative probability distribution of the idiosyncratic productivity factor of the new firm. However, we assume that ε is revealed to the entrepreneur, before she or he decides whether or not to make new investment. The expected value of the new firm is therefore:

$$V(A, C_{nH}^*, w) = \int_{-1}^{\bar{\varepsilon}} \max\{V^+(A_H, 0, \varepsilon, w_H) - C_{nH}, 0\} g(\varepsilon) d\varepsilon, \qquad (14)$$

where C_{nH} is the setup cost of greenfield investment. When K_H^0 is equal to zero, only the firms with ε high enough to justify a greenfield investment have a positive value. This explains the max operator in equation 14.

Suppose that greenfield entrepreneurship is in limited capacity. Thus an entrepreneur in a source country (and there are 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. The entrepreneur's decision is naturally determined by which country will produce the higher $V(\cdot)$, as defined in equation 14. The entrepreneur will invest in the host country rather than in the source country if and only if

$$V(A_H, C_{nH}^*, w_H) > V(A_S, C_{nS}^*, w_S) . \qquad (15)$$

(We continue to maintain the assumption that the source country entrepreneurs have a cutting-edge advantage over their counterparts in the host country in estab-

11. Razin and Sadka (2007).

lishing greenfield investments.) This is a selection-condition equation for greenfield FDI. In contrast to the M&A case, the aggregate productivity factor plays a role in the source country (A_S) in Greenfield FDI. A positive shock to A_S increases the likelihood that source country entrepreneurs will stay at home and in turn reduces the likelihood of greenfield FDI flows from country *S* to *H*.

In an example wherein an entrepreneur is deciding in which country among many to invest, an entrepreneur from source country *S* chooses to invest in host country *H* if the latter offers the most profitable investment. Also, the entrepreneur may need to outbid competitors from other source countries (for instance, in the case of acquiring a concession from the host country government to operate something). In this case, $V(A_H', C^*_{nH}', w_H')$ in the selection-condition equation 15 must be the maximum over all $V(A_H, C^*_{nH}, w_H)$ for potential other host countries:

$$V(A_H, C^*_{nH}, w_H) = \arg\max_{H' \in D} V(A_H', C^*_{nH}', w_H') > V(A_S, C^*_S, w_S), \qquad (15')$$

where *D* is the set of potential host countries in which the entrepreneurs of source country *S* can outbid all competing entrepreneurs from other potential source countries.[12] Each entrepreneur in the source country who decides to actually make a greenfield FDI in host country *H* invests according to the marginal productivity conditions. Aggregation over these entrepreneurs from source country *S* provides a flow equation of greenfield FDI from *S* to *H*.

As we have seen, the host country aggregate productivity factor (A_H) affects positively the notional FDI flows from source countries in the case of M&A flows; whereas the source country aggregate productivity factor (A_S) has no effect on these flows. At the same time, a positive shock to A_H may reduce the likelihood of having M&A FDI flows to the host country *H* (because of general equilibrium effects on wages in the host country). Again, A_S has no effects on these flows. In the case of greenfield FDI, a positive shock to A_H has positive effects both on the notional FDI flows to host country *H* and on the likelihood of these flows to actually materialize. A positive shock to A_S does not affect the notional flows to host country *H*, but it reduces the likelihood of such flows to occur at all. Also, the likelihood of having greenfield FDI flows from country *S* to country *H* is negatively affected by positive productivity shocks in all other potential host countries (A_H').[13]

12. Eaton and Kortum (2002) applied the probability theory of extremes to provide a tractable form for a selection-condition equation in a similar context.

13. A comprehensive study of the latter effects (A_H') is not available. We ignore these effects in the empirical investigation.

Source Country and Host Country Corporate Taxation

The economic literature has dealt extensively with the effects of taxation on investment, going back to the well-known works of Harberger and Hall and Jorgenson.[14] Of particular interest are the effects of international differences in tax rates on foreign direct investment.[15]

In this section we attempt to provide a new look at the mechanisms through which corporate tax rates influence aggregate FDI flows in the setup adopted here of twofold investment decisions in the presence of threshold barriers. In this context, the tax rates of the source country and host country may have different effects on these two decisions (the flow and selection-condition equations).

Consider, for the sake of concreteness, the case of a parent firm that weighs the development of a new product line. We can think of the fixed setup cost as the outlays of developing this product line. The firm may choose to develop the line at home and then produce it at a subsidiary abroad. This choice may be determined by some genuine economic considerations, such as source and host aggregate productivity factors (as discussed in the preceding section) and by tax considerations.

In this context, the issue of double taxation arises. The income of a foreign affiliate is typically taxed by the host country. If the source country taxes this income too, then the combined (double) tax rate may be very high and even could exceed 100 percent.[16] This double taxation is typically relieved at the source country level by either exempting foreign source income altogether or granting tax credits.[17] In the former case, foreign source income is subject to the tax levied by the host country only. When the source country taxes its residents on their worldwide income and grants full credit for foreign taxes (residence taxation), then in principle the foreign source income is taxed at the source country tax rate, so that the host country tax rate becomes irrelevant for investment decisions by the source country residents. But, in practice, foreign source income is far from being taxed at the source country rate. First, there are various reduced tax rates for foreign source income. Second, foreign source income is usually taxed only upon repatriation, thereby effectively reducing the present value of the tax. Thus, in practice, the host country tax rate is very much relevant for

14. Harberger (1962); Hall and Jorgenson (1967).

15. See, for instance, Auerbach and Hassett (1993); Hines (1999); Desai, Foley, and Hines (2004); de Mooij and Ederveen (2001); Devereux and Hubbard (2003).

16. For a succinct review of this issue, see, for example, Hines (2004).

17. This is also the recommendation of the OECD model tax treaty, see OECD (1997). A similar recommendation is made also by the United Nations model tax treaty, see UN (1980).

investment decisions by the parent firm at the source country. The relevance of the host country tax rate intensifies through transfer pricing.[18]

One of the major elements through which corporate taxation affects investment decision is the treatment of depreciation.[19] We denote the true rate of depreciation in host country H by δ_H and the rate allowed for tax purposes by δ'_H. Concentrating for simplicity on M&A FDI, equation 2 becomes in this case

$$V^+(A_H, K_H^0, \tau_H, \varepsilon, w_H) = \max_{(K,L)} \left\{ \frac{[A_H F(K,L)(1+\varepsilon) - w_H L](1-\tau_H) + \tau_H \delta'_H K + (1-\delta_H)K}{1+(1-\tau_H)r} - \left(K - K_H^0\right) \right\}, \quad (16)$$

where τ_H is the host country corporate tax rate. Note that in the presence of taxation, the discount rate is the after-tax rate $(1-\tau_H)r$. (This specification assumes that the subsidiary uses debt in the host country to finance the new investment.) Employing the envelope theorem, it follows from equation 16 that $\partial V^+ / \partial \tau_H < 0$. That is, the present value of the cash flow falls when the corporate tax rate in the host country rises, as it is indeed expected to do. Furthermore, the amount of new investment depends negatively on τ_H. The first-order condition for the stock of capital (equation 3) now becomes

$$A_H F_K(K,L)(1+\varepsilon) = r + \frac{\delta_H - \delta'_H \tau_H}{1-\tau_H}. \quad (17)$$

This latter equation defines (implicitly) an equation for the flow of FDI. As δ'_H is typically smaller than δ_H, it follows that the flow of FDI declines in τ_H.

The source country parent firm will undertake the project if and only if

$$w_H L_H^{C^*}(1-\tau_H) + C_{SH}^*(1-\tau_S) < V^+(A_H, K_H^0, \tau_H, \varepsilon, w_H), \quad (18)$$

where τ_S is the corporate tax rate in the source country. Recall that $w_H L_H^{C^*}$ and C_{SH}^* are, respectively, the host country and source country components of the fixed cost C_H^*.

To sum up, as is evident from selection-condition equation 18, the tax rate in the source country, τ_S, affects positively the decision by a parent firm in country S about whether to carry out a foreign direct investment in country H; under plausible assumptions, the tax rate in the host country, τ_H, has a negative effect on this decision. The tax rate in the source country, τ_S, is irrelevant for the determination of the magnitude of FDI flows, which are negatively affected by τ_H.

18. The U.S. Jobs Creation Act of 2005 allows U.S. companies to pay a tax of merely 5.25 percent on their foreign source income.

19. See, for instance, Auerbach (1983).

As before, there is a cutoff productivity level, denoted by $\varepsilon_0(A_H, C_H, L_H^{C^*}, C_{SH}^*, K_H^0, \tau_H, \tau_S, w_H)$, such that all firms with a firm-specific productivity level above ε_0 will make new investment and be acquired by FDI investors. All other firms will make no new investments and will remain under domestic ownership. The cutoff level of ε_0 is defined implicitly by equation 18 with the inequality sign being replaced by an equality sign. It follows from equation 18 that an increase in the source country corporate tax rate (τ_S) reduces ε_0, so that more firms are purchased by FDI investors. The reason for this is that a rise in τ_S reduces the after-tax source country component of the fixed cost. Note that V^+ declines in τ_H. But a rise in τ_H reduces the after-tax host country component of the fixed cost (namely, $w_H L_H^{C^*}(1 - \tau_H)$). However, if the first effect dominates the second, which is plausible, then an increase in τ_H raises ε_0; that is, an increase in the host country corporate tax rate reduces the number of investing firms (which are purchased by FDI investors).

Similary, as before, aggregate notional FDI is given by

$$FDI_N(A_H, w_H L_H^{C^*}, C_{SH}^*, K_H^0, \tau_H, \tau_S, w_H) = \int_{\varepsilon_0(A_H, w_H L_H^{C^*}, C_{SH}^*, K_H^0, \tau_H, \tau_S, w_H)}^{\bar{\varepsilon}} FDI(A_H, C_{SH}^*, w_H L_H^{C^*}, K_H^0, \tau_H, \tau_S, \varepsilon, w_H) g(\varepsilon) d\varepsilon \tag{19}$$

where, as before,

$$FDI(A_H, C_{SH}^*, w_H L_H^{C^*}, K_H^0, \tau_H, \tau_S, \varepsilon, w_H) = V^+(A_H, K_H^0, \tau_H, \varepsilon, w_H) - C_{SH}^*(1-\tau_S) + K^+(A_H, \tau_H, \varepsilon, w_H) - K_H^0 \ , \tag{20}$$

and where K^+ is implicitly defined by equation 17.

The *actual* FDI will be equal to the notional FDI only when ε_0 is below $\bar{\varepsilon}$:

$$\varepsilon_0(A_H, w_H L_H^{C^*}, C_{SH}^*, K_H^0, \tau_H, \tau_S, w_H) \le \bar{\varepsilon} \ . \tag{21}$$

which is the selection-condition equation. The actual flow of FDI (FDI_H) is thus

$$FDI_A(A_H, w_H L_H^{C^*}, C_{SH}^*, K_H^0, \tau_H, \tau_S, w_H) = \begin{cases} FDI_N(A_H, w_H L_H^{C^*}, C_{SH}^*, K_H^0, \tau_H, \tau_S, w_H) & \text{if condition (21) holds} \\ 0 & \text{otherwise} \end{cases} \tag{22}$$

Note that an increase in the host country corporate tax rate (τ_H) reduces the actual FDI flows from *S* to *H* and the likelihood that such flows will occur. An increase in the source country corporate tax rate (τ_S) increases the likelihood that FDI flows from *S* to *H* will occur.[20]

Econometric Approach

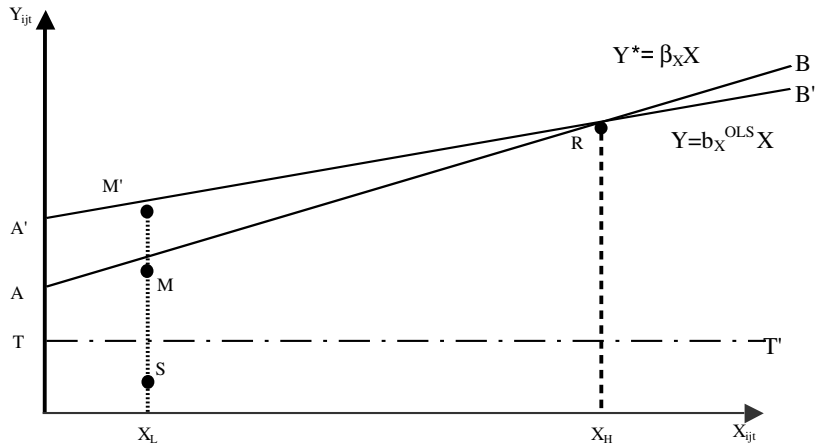
The twofold nature of FDI decision gives rise to many cases of zero actual FDI flows. With *n* countries in a sample, there are potentially $n(n-1)$ pairs of source and host (s,h) countries. In fact, the actual number of (s,h) pairs with observed flows is typically much smaller. Therefore, the selection of the actual number of (s,h) pairs, which is naturally endogenous, cannot be ignored; that is, this selection cannot be taken as exogenous. This feature of FDI decisions lends itself naturally to the application of the Heckman selection model.[21] This selection bias method is adopted to jointly estimate the likelihood of surpassing a certain threshold (the selection-condition equation) and the magnitude of the FDI flow (the flow equation), provided that the threshold is indeed surpassed.

Failing to take into account the selection-condition equation, either by dropping out observations with zero flows or by treating such observations as actually indicating zero flows, results in biased estimates of the coefficients of the flow equation. In addition, the selection-condition equation per se provides meaningful economic information about the determinants of FDI flows through the likelihood of having such flows at all.[22]

Figure 1 explains the intuition for the cause of the bias. Suppose, for instance, that x_{ijt} is an explanatory variable that measures the productivity differential between the *i*-th source country and the potential *j*-th host country in period *t*, holding all other explanatory variables constant. Our theory predicts that the parameter β_x is positive. This is shown by the upward sloping line *AB*. Note that the slope is an estimate of the "true" marginal effect of x_{ijt} on Y^*_{ijt}, the latent variable denoting the flow of notional FDI from the source country *i* to host country *j* in period *t*. But recall that flows could also be equal to zero, if the setup costs are sufficiently high. A threshold, which is derived from the setup costs, is shown as the curve *TT'* in figure 1. However, if we discard observations with actual zero FDI flows, the remaining subsample is no longer random.

20. As before, we ignore the extensive margin effect of τ_S in the flow equation.
21. Heckman (1974, 1979).
22. For a more detailed analysis, see Razin and Sadka (2007, chapter 7).

Figure 1. Biased OLS Estimates of the Flow Equation



To illustrate in figure 1, suppose that for high values of x_{ijt} (say, X_H), (i,j) pair-wise FDI flows are all positive. That is, for all pairs of countries in the subsample, the threshold is surpassed and the observed average of notional FDI flows for $x_{ijt} = X^H$ is also equal to the conditional population average for FDI flows, which is point R on line AB. However, suppose that this does not hold for low values of x_{ijt} (say, X_L). For these (i,j) pairs, we observe positive values of Y_{ijt}, the observed actual flow of FDI, only for a subset of country pairs in the population.[23] Point S is, for instance, excluded from the subsample of positive FDI flows. Consequently, for low values of x_{ijt}, we observe only flows between country pairs with low setup costs. As a result, the observed average of the FDI flows is at point M', whereas the "true" average is at point M. As seen in figure 1, the ordinary least squares (OLS) regression line for the subsample is therefore the $A'B'$ line, which underestimates the effect of productivity differentials on bilateral FDI flows. If we do not discard the zero FDI flow observations, the OLS estimates of β are still biased, because they are based on observations on Y, the actual FDI, rather than on Y^*, the notional FDI.

Data and Descriptive Statistics

We consider several potential explanatory variables of the twofold decisions on FDI flows. As in another paper by Razin and Sadka, these variables include

23. This indeed will be the case when the residuals in the flow and selection-condition equations are positively correlated. An opposite bias occurs in the case of a negative correlation.

standard *mass* variables (the population sizes of the source country and host country), *distance* variables (physical distance between the source and the host countries and whether or not the two countries share a common language), and *economic* variables (source country and host country real GDP per capita, differences in average years of schooling between the source and the host countries, and source and host financial risk ratings).[24] We also control for country and time fixed effects. The dependent variable in the flow equation is the log of the FDI flows. (The flow equation is also known as the *gravity* equation.)

The main variables are grouped as follows:

—Standard country characteristics, such as real GDP per capita, population size, educational attainment (as measured by average years of schooling), and financial soundness rating (the inverse of financial risk rating)

—Source and host (*s*,*h*) characteristics, such as (*s*,*h*) FDI flows, geographical distance, and common language (variable with a value of either zero or one)

—Productivity

—Corporate tax rates

Productivity is approximated by labor productivity, that is, output per worker, as measured by purchasing power parity–adjusted real GDP per worker. This variable is at times instrumented by the capital-to-labor ratio and years of schooling. Corporate taxes are measured by the statutory rates or by the effective average rates, as compiled by Devereux, Griffith, and Klemm.[25] The effective rates are at times instrumented by the statutory corporate tax rates and GDP per capita.

Table 1 summarizes the data sources. Table A-1 describes the list of the countries in the sample and indicates for each source-host pair the (time) average of FDI flows as percentages of the source and host GDPs. Some source countries interact with only a few host countries. We do not smooth the data by taking multiyear averages but rather employ unfiltered annual data. This enables us to investigate the effects of the explanatory variables over the business cycle. We present in table 2 some aggregate statistics of the detailed country-pair data of table A-2. Specifically, we consider all the EU countries, except the United Kingdom and Ireland, as one block of countries. We then present (time) average flows among this block, the United Kingdom, the United States, Ireland, Australia, and Japan as percentages of the GDP of the source and host countrys or the block of countries. This underscores the prominence of the United States as a source of FDI and the United Kingdom, Ireland, and Japan as recip-

24. Razin and Sadka (2007).

25. Devereux, Griffith, and Klemm (2002).

Table 1. Data Sources

Variable	*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 website: www.haas.berkeley.edu/~arose
Common language	Andrew Rose website: www.haas.berkeley.edu/~arose
Education attainment	Barro-Lee dataset: www.nber.org/pub/barro.lee/
International Country Risk Guide (ICRG) index of financial soundness rating (the inverse of financial risk rating)	Political Risk Services (PRS) Group
Capital stock	Francesco Caselli website: http://personal.lse.ac.uk/casellif
Effective tax rates	Devereux, Griffith, and Klemm (2002)

ients of FDI. Note that the EU block (which excludes the United Kingdom and Ireland) plays a relatively small role either as a source or as a host of FDI.

Data on FDI flows are drawn from the International Direct Investment (IDI) dataset, covering the bilateral FDI flows among eighteen OECD countries during the period 1987 to 2003.[26] The dataset reports FDI flows from OECD countries to OECD and non-OECD countries, as well as FDI flows from non-OECD countries to OECD countries. However, it does not report FDI flows from non-OECD to non-OECD countries. This is why we employ in our sample OECD countries only. The IDI dataset provides data on FDI flows in U.S. dollars, and we deflate the dollars by the U.S. consumer price index for urban consumers.

Empirical Evidence

As was mentioned before, productivity is taken as one of the drivers of FDI, which in our study is measured by labor productivity. However, because labor productivity and FDI flows are both affected by other variables that are not controlled for in the regression, such as business cycle variables (for example, interest rates and unemployment rates), we present alternatives in our results. In the first regression we simply employ labor productivity. In the second

26. The International Direct Investment dataset is available through OECD's website, SourceOECD (www.sourceoecd.org). Razin and Sadka (2007) use also samples containing both OECD and non-OECD countries.

Table 2. Time Average of FDI Flows[a]

	Source country											
	11 EU members[b]		*United States*		*United Kingdom*		*Japan*		*Ireland*		*Australia*	
Host country	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*
11 EU members[b]			0.313	0.179	2.377	0.213	0.145	0.043	3.054	0.017	0.134	0.004
United States	25.610	0.448			2.113	0.331	0.436	0.228	2.288	0.022	0.627	0.029
United Kingdom	0.159	1.776	0.228	1.457			0.136	0.453	0.801	0.049	0.429	0.128
Japan	0.016	0.053	0.046	0.087	0.061	0.018			0.189	0.003	0.016	0.001
Ireland	0.033	5.963	0.042	4.397	0.130	2.125	0.007	0.387			0.019	0.091
Australia	0.013	0.470	0.034	0.721	0.134	0.449	0.044	0.495	0.066	0.013		

Source: Authors' calculations.
a. As a percentage of the source and host countries' GDP
b. Austria, Belgium, Finland, France, Germany, Greece, Italy, Netherlands, Spain, Sweden, and Portugal.

Table 3. Predicted Effect of Shocks on FDI

	M&A		*Greenfield*	
	Flow	*Selection*	*Flow*	*Selection*
Productivity increase, fixed host wages				
Host	+	+	+	+
Source	0	0	0	–
Productivity increase, flexible host wages				
Host	+	amb.	+	+
Source	0	0	0	–
Tax increase				
Host	–	–		
Source	0	+		

FDI = foreign direct investment; M&A = mergers and acquisitions.
+ : positive effect
– : negative effect
amb: ambiguous effect
0: no effect

regression, we instrument the labor productivity variable by the capital-to-labor ratio, years of schooling, and country fixed effects.

As for the tax variables, we employ first the statutory tax rates. Another alternative is the effective tax rates as compiled by Devereux, Griffith, and Klemm.[27] Their rates measure the gap between the cost of capital in the corporate sector (that is, the required rate of return on an investment) and the tax-free interest rate. For the same reasons as in the case of productivity, we also use the statutory corporate tax rates, GDP per capita, and country fixed effects as instruments to generate fitted values for the effective tax rates. Table 3 summarizes the predicted effects generated by our theoretical framework.

Table A-2 presents the instrumented productivity and tax equations. As expected, the coefficients of the capital-to-labor ratio and years of schooling are positive and significant in the instrumented productivity equation. Similarly, the statutory tax rate and GDP per capita are positive and significant in the instrumented tax equation. R^2 is very high, close to one, in both equations.

Consider, first, productivity as a driver of FDI flows. The estimation results are described in table 4. Column 1 refers to the uninstrumented productivities, whereas column 2 considers fitted productivities. The first four variables are for productivity or instrumented productivity for the source and the host countries, followed by the coefficients of the other variables. Source GDP per capita has a positive and significant effect on the flows of FDI in both columns. Host GDP per capita has a positive and significant effect on the flow of FDI in column 2 only. Neither source nor host GDP per capita is significant in the selection

27. Devereux, Griffith, and Klemm (2002).

Table 4. Bilateral FDI Flows and Selection Equations: Productivity Effect[a]

	Uninstrumented productivities		*Fitted productivities*	
Variable	*Flow*	*Selection*	*Flow*	*Selection*
Productivity–source	–0.066	–0.059		
	(0.018)**	(0.024)*		
Productivity–host	0.042	0.014		
	(0.018)*	(0.028)		
Instrumented productivity–source			–0.080	–0.136
			(0.033)*	(0.052)**
Instrumented productivity–host			–0.012	0.047
			(0.036)	(0.046)
ln GDP per capita–source	5.812	2.150	3.515	0.996
	(0.837)**	(1.124)	(0.621)**	(0.667)
ln GDP per capita–host	1.437	–1.532	3.955	–1.452
	(0.853)	(1.204)	(0.607)**	(0.797)
Schooling difference	0.093	–0.053	0.002	0.022
	(0.063)	(0.069)	(0.070)	(0.081)
Common language	0.516	–0.179	0.497	–0.089
	(0.090)**	(0.118)	(0.106)**	(0.148)
ln Distance	–1.013	–0.305	–1.081	–0.388
	(0.044)**	(0.074)**	(0.048)**	(0.088)**
ln Population–source	0.754	–3.889	–1.363	–7.880
	(1.739)	(2.554)	(2.081)	(2.972)**
ln Population–host	–2.764	–5.529	–0.217	–9.043
	(1.463)	(2.597)*	(1.683)	(3.040)**
Financial risk–source	–0.03	0.023	–0.017	0.009
	(0.012)*	(0.019)	(0.014)	(0.025)
Financial risk–host	–0.015	–0.029	–0.019	–0.016
	(0.011)	(0.017)	(0.013)	(0.020)
Previous FDI dummy (1 if yes)		1.538		1.5
		(0.085)**		(0.093)**
Observations	4,702	4,702	3,833	3,833

Source: Authors' calculations.
*Significant at the 5 percent level; **significant at the 1 percent level.
a. Country and time fixed effects are accounted for; robust standard errors are in parentheses.

equation. In contrast, the host population size has a negative and significant effect in the selection equation only, for both columns. The source population follows a similar pattern but is significant only in column 2. As expected, the physical distance variable has a negative and significant effect in both equations and in both columns. Common language has a positive and significant effect in both columns, but only in the flow equation. Turning to the financial soundness rating variable, it is only the source variable that has a negative (as expected) and significant effect and only in the flow equation of column 1. The source-host schooling gap is not significant throughout. The existence of pre-

vious FDI (a dummy variable) may be indicative of low setup costs. We therefore employ it as an exclusion restriction variable in the selection equation. Indeed, its coefficient is found to be significant and positive.

We turn now to the first four variables, which are at the focus of the investigation: the source and host productivity factors, as approximated by outputs per worker. In column 1 of table 4, the host country output per worker has a positive effect in both the flow and selection equations, but it is significant only in the flow equation. Source country output per worker has a negative and significant effect on the selection mechanism. This result is consistent with the analytical framework developed earlier. Noteworthy, the source country output per worker has also a negative and significant effect on the flow of FDI. In column 2 of table 4, with the productivity variables instrumented by capital per worker and education attainment, the host productivity coefficient is negative in the flow equation yet positive in the selection equation; however, neither displays significance. The source instrumented productivity has a negative and significant effect in the flow and selection equations. All in all, the estimation results are consistent with the prediction of our theory that the source productivity has a negative effect on the likelihood of the occurrence of FDI, but that the host productivity has an ambiguous effect on this likelihood.

The effect of productivity on the flow and selection of FDI are depicted in figures 2 and 3. Figure 2 depicts the effect of productivity in five host countries (the United Kingdom, Ireland, France, Germany, and Japan) on the flow of FDI from the United States. Throughout, all the explanatory variables, except the productivities in these host countries, are held constant at their sample averages. The estimated coefficient of the host productivity (which is positive) is used to draw the graphs. The shaded areas describe the frequencies of the productivities in all of these five host countries in the sample. The United Kingdom exhibits a high sensitivity of the FDI flows from the United States to its productivity, relative to the other countries in the relevant range (where the sample observations are concentrated). In figure 3, we depict the effect of U.S. productivity on the likelihood of generating FDI from the United States to each one of the aforementioned five host countries. This effect is negative, but relatively weak in the relevant range.

We next consider the tax variables. The estimation results are presented in the first three columns of table 5. The first column refers to the statutory tax rates, the second to the effective tax rates, and the third to the fitted effective tax rates. As expected, and also as predicted by our theory, the host tax rate has a negative and significant effect on the flow of FDI in the flow equation in all three columns. This negative effect rises in magnitude when moving from the

Figure 2. The Flow Equation: The Effect of Host-Country Productivity

Source Country: U.S.
Host Countries: France, Germany, Ireland, Japan, U.K.
FDI Flows in 1982–84 Billion U.S. Dollars

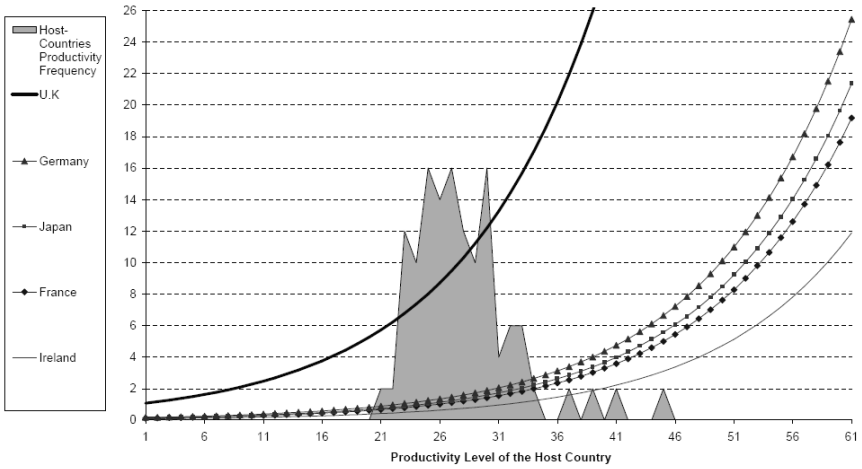
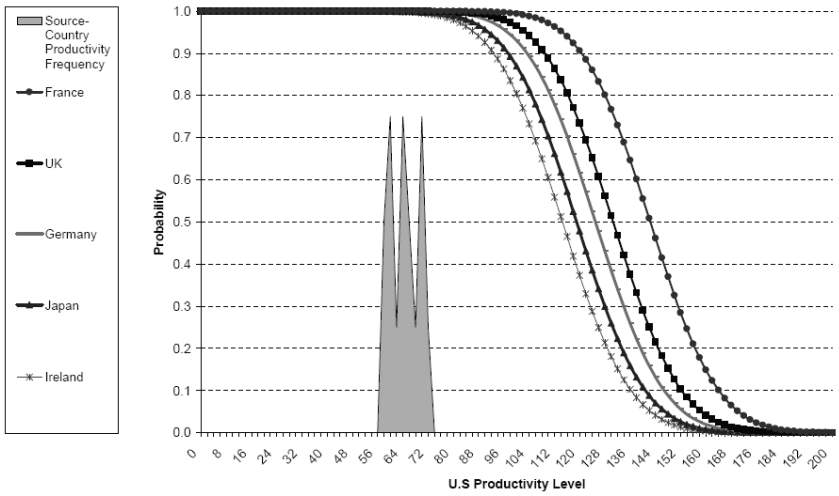


Figure 3. The Selection Equation: The Effect of Host-Country Productivity

Source Country: U.S.
Host Countries: France, Germany, Ireland, Japan, U.K.



statutory to the effective and to the fitted effective tax rates. Noteworthy, the source tax rate follows exactly the same pattern of the magnitude of the effect rising when moving from the statutory to the effective and to the fitted effective rate; however, it has a positive and significant effect in the flow equation in all three columns. This result may allude to the existence of source residence taxation in the source countries: as the source country taxes its residents on their income in the host country, the source country tax has a positive effect on their investment abroad. The source tax rate has a positive and significant effect on the selection mechanism, as predicted by our theory, but only in column 1. However, this effect intensifies and becomes even more significant, when we consider in column 4 a larger set of countries (for which we had data on the statutory rates only).

The effect of the statutory tax rates on the flow and selection of FDI are depicted in figures 4 and 5. Figure 4 depicts the effect of corporate taxes in the aforementioned five host countries on the flow of FDI from the United States. Throughout, all the explanatory variables, except the tax rates in these host countries, are held constant at their sample averages. The estimated coefficient of the host tax (which is negative) is used to draw the graphs. As before, the shaded areas describe the frequencies of the productivities in all of these five host countries in the sample. The United Kingdom exhibits a high sensitivity of the FDI flows from the United States to its tax rate, relative to the other countries in the relevant range (where the sample observations are concentrated). In figure 5, we depict the effect of the U.S. tax rate on the likelihood of generating FDI from the United States to each one of the aforementioned host countries. This effect is positive and relatively strong for Ireland and Japan.

Apparently, when we look at the two sets of drivers (productivity and taxation) together, some multicolinearity problems arise. As a result, the estimated results do not change much in sign, but their statistical significance weakens. We present these results in table A-3.

Concluding Remarks

We study the role of productivity and corporate taxation as driving forces of FDI among OECD countries in the presence of threshold barriers, which generate two margins for FDI decisions. An important feature of our FDI model (which distinguishes FDI flows from portfolio flows) is fixed setup costs of new investments. As usual, FDI flows come in two main forms: M&A and greenfield flows. In our setup, the key difference between these two forms is that the

Table 5. Bilateral FDI Flows and Selection Equations: Tax Effect[a]

	Statutory tax rates		*Effective tax rates*		*Fitted effective tax rates*		*Corporate tax rate[b]*	
	Flow	*Selection*	*Flow*	*Selection*	*Flow*	*Selection*	*Flow*	*Selection*
Tax rate–source	1.795	1.656					–0.131	2.418
	(0.579)**	(0.759)*					(0.652)	(0.904)**
Tax rate–host	–2.955	–0.504					–1.963	–1.063
	(0.621)**	(0.694)					(0.734)**	(0.900)
Effective tax rate–source			2.383	1.331				
			(0.790)**	(1.051)				
Effective tax rate–host			–3.096	0.124				
			(0.841)**	(1.031)				
Instrumented effective tax rate–source					2.400	2.047		
					(0.912)**	(1.193)		
Instrumented effective tax rate–host					–4.536	–0.778		
					(0.974)**	(1.093)		
ln GDP per capita–source	2.961	–0.498	2.928	–0.443	2.841	–0.581	1.867	–0.053
	(0.490)**	(0.505)	(0.494)**	(0.511)	(0.507)**	(0.524)	(0.519)**	(0.543)
ln GDP per capita–host	3.235	–0.798	3.186	–0.860	3.493	–0.747	1.814	–0.701
	(0.460)**	(0.580)	(0.460)**	(0.588)	(0.470)**	(0.595)	(0.495)**	(0.603)
Schooling difference	0.197	–0.045	0.1740	–0.075	0.185	–0.054	-0.068	–0.151
	(0.065)**	(0.070)	(0.065)**	(0.069)	(0.065)**	(0.069)	(0.070)	(0.078)
Common language	0.516	–0.192	0.518	–0.189	0.517	–0.192	0.609	0.088
	(0.087)**	(0.114)	(0.087)**	(0.114)	(0.087)**	(0.114)	(0.103)**	(0.130)
ln Distance	–1.005	–0.248	–1.003	–0.246	–1.004	–0.248	–0.97	–0.457
	(0.043)**	(0.070)**	(0.043)**	(0.070)**	(0.043)**	(0.070)**	(0.046)**	(0.071)**

ln Population–source	–0.114	–4.395	–0.563	–5.064	–0.06	-4.433	–1.364	–1.312
	(1.588)	(2.220)*	(1.604)	(2.276)*	(1.594)	(2.223)*	(1.599)	(1.813)
ln Population–host	–2.032	–2.845	–1.662	–2.922	–1.906	–2.822	–1.94	–0.466
	(1.315)	(2.323)	(1.348)	(2.366)	(1.320)	(2.324)	(1.232)	(1.721)
Financial risk–source	–0.022	0.023	–0.023	0.025	–0.023	0.023	0.002	0.019
	(0.011)*	(0.018)	(0.011)*	(0.018)	(0.011)*	(0.018)	(0.013)	(0.014)
Financial risk–host	–0.015	–0.031	–0.017	–0.032	–0.015	–0.032	–0.008	–0.021
	(0.011)	(0.016)	(0.011)	(0.016)*	(0.011)	(0.016)*	(0.011)	(0.015)
Previous FDI dummy (1 if yes)		1.622		1.626		1.624		0.86
		(0.083)**		(0.083)**		(0.083)**		(0.108)**
Observations	4,974	4,974	4,974	4,974	4,974	4,974	3,210	3,210

Source: Authors' calculations.

*Significant at the 5 percent level; **significant at the 1 percent level.

a. Country and time fixed effects are accounted for; robust standard errors are in parentheses.

b. This column relates to a corporate tax rate (without local taxes) for an additional five OECD countries: Denmark, Korea, Mexico, New Zealand, and Turkey. Observations are smoothed over a two- to three-year period.

Figure 4. The Flow Equation: The Effect of Host-Country Tax Rate

Source Country: U.S.
Host Countries: France, Germany, Ireland, Japan, U.K.
FDI Flows in 1982–84 Billion U.S. Dollars

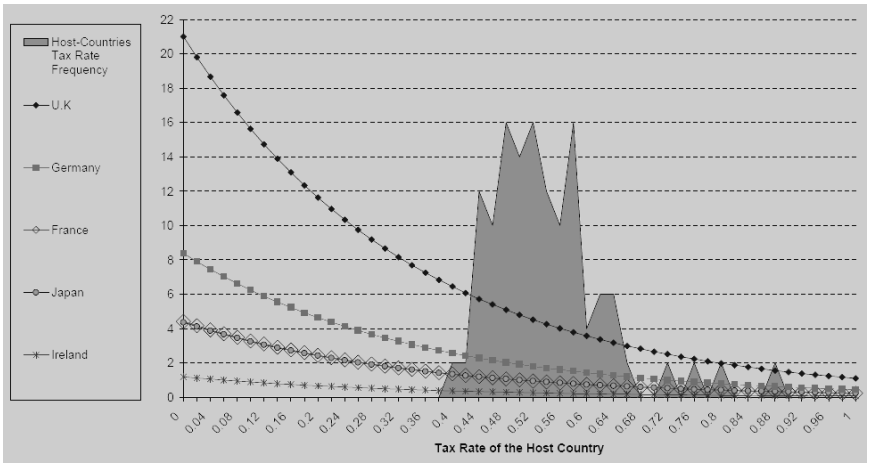
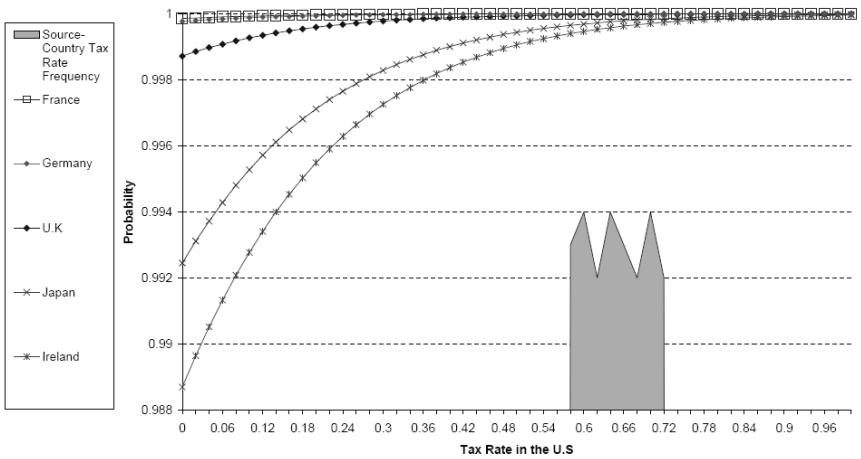


Figure 5. The Selection Equation: The Effect of Host-Country Tax Rate

Source Country: U.S.
Host Countries: France, Germany, Ireland, Japan, U.K.



former is not restricted by the limited supply of entrepreneurial capacity in source countries. Thus the alternative investment opportunities in the source countries do not affect the flow of M&A FDI into a host country, as long as the world capital market can offer unlimited investment funds to this country. In contrast, greenfield FDI in a host country must compete with greenfield investment in the source countries for the limited supply of entrepreneurs in these countries.

We considered first the effect of aggregate productivity shocks on M&A FDI. Suppose initially that the host country wage rate is fixed. A positive productivity shock has three positive effects on the notional flow of FDI, which is the flow of FDI that would have occurred in the absence of fixed costs. First, it raises the marginal productivity of capital, thereby increasing the amount of investment that is made by each investing firm (which is acquired by FDI investors). Second, it raises the value of such firms and, consequently, their acquisition price. Third, it increases the number of firms purchased by FDI investors. Turning to the selection-condition equation, which governs the decision on whether to make an FDI at all, a positive aggregate productivity shock (while still maintaining the wage rate constant) increases the profitability of investments, so that the notional FDI turns out to be realized.

Then, we dropped the supposition that the wage rate is fixed. When wages are not fixed, then the increase in the demand for labor raises the wage rate in the host country and, consequently, the domestic component of the fixed costs, thereby mitigating, but not eliminating, the above three effects on the notional FDI. But with respect to the selection-condition equation, a positive aggregate productivity shock in the host country equation may raise the domestic component of the setup cost to such an extent so as to reduce the likelihood of positive FDI flows to occur. Note, however, that a source country aggregate productivity shock does not affect the flows of M&A FDI.

Next we considered the effect of aggregate productivity shocks on greenfield FDI. On the one hand, a positive host country productivity shock has positive effects both on the notional FDI flows and on the likelihood of these flows to actually materialize. On the other hand, a positive source country productivity shock does not affect the notional flows of FDI, but it reduces the likelihood of such flows to occur at all.

The main empirical findings concerning productivity and taxes as drivers of FDI show that the host output per worker has a positive effect in both the flow and selection equations, but it is significant only in the flow equation. Source country output per worker has a negative and significant effect on the selection mechanism. These results are fairly robust.

The host tax rate has a negative and significant effect on the flow of FDI in the flow equation. This negative effect rises in magnitude when moving from the statutory rate to the effective rate and the instrumented effective tax rate. Noteworthy, the source tax rate follows exactly the same pattern: it has a positive and significant effect in the flow equation, with the magnitude of the effect rising when moving from the statutory to the effective rate and to the fitted effective rate. (This result may allude to the existence of source residence taxation in the source countries: as the source country taxes its residents on their income in the host country, the source country tax has a depressing effect on their investment abroad.) These results are fairly robust. The source tax rate has a positive and significant effect on the selection mechanism. This effect intensifies and becomes even more significant, a larger set of countries (for which we had data on the statutory rates only).

Some simulations, based on the estimation results, suggest that there are marked differences in the sensitivity of FDI flows from the United States to productivity and taxes in OECD countries. The sensitivity of these flows to productivity in the United Kingdom is positive and high, relative to other EU countries and Japan. Similarly, the sensitivity of these flows to taxes in the United Kingdom is negative and high, relative to the other countries.

Table A-1. Time Average of FDI Flows[a]

	Source country							
	United States		*United Kingdom*		*Austria*		*Belgium*	
Host country	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*
United States			2.1131	0.3307	0.0503	0.0013	0.1445	0.0043
United Kingdom	0.2281	1.4574			0.0927	0.0147		
Austria	0.0055	0.2196	0.0220	0.1385				
Belgium	0.0239	0.8078						
France	0.0338	0.1940	0.2495	0.2242	0.0268	0.0038		
Germany	0.0520	0.2055	1.0118	0.6259	0.1957	0.0192		
Italy	0.0257	0.1779	0.0494	0.0535	0.0415	0.0071		
Netherlands	0.1082	11.3238	0.5877	9.6242	0.0610	0.1589		
Norway	0.0089	0.4769	0.0504	0.4230	0.0023	0.0030	0.3661	0.5807
Sweden	0.0361	0.0361	0.2852	0.0446	0.0286	0.0007		
Switzerland	0.0615	1.8512	0.2500	1.1770	0.0554	0.0415	0.2872	0.2558
Canada	0.1084	1.3516	0.1219	0.2378	0.0122	0.0038	0.1877	0.0693
Japan	0.0455	0.0870	0.0605	0.0181	0.0018	0.0001	0.1545	0.0087
Finland	0.0020	0.1291	0.0158	0.1573	0.0032	0.0050		
Greece	0.0008	0.0571	0.0252	0.2841	0.0023	0.0040		
Ireland	0.0420	4.3968	0.1297	2.1247	0.0237	0.0616		
Portugal	0.0032	0.2551	0.0281	0.3522	0.0084	0.0167		
Spain	0.0217	0.3015	0.1019	0.2216	0.0192	0.0067		
Australia	0.0338	0.7209	0.1344	0.4491	0.0266	0.0141	0.0737	0.0466

	France		*Germany*		*Italy*		*Netherlands*	
	Source	*Host*	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*
United States	0.6661	0.1160	0.6503	0.1645	0.0721	0.0104	10.5764	0.1011
United Kingdom	0.5726	0.6370	0.3348	0.5412	0.0892	0.0824	4.3388	0.2649
Austria	0.0133	0.0931	0.0830	0.8442	0.0069	0.0400	0.4940	0.1898
Belgium								
France			0.1645	0.2390	0.0850	0.0706	2.3512	0.1291
Germany	0.3326	0.2289			0.0397	0.0227	2.8226	0.1066
Italy	0.1155	0.1391	0.0617	0.1081			0.8949	0.0592
Netherlands	0.2632	4.7957	0.1077	2.8523	0.1717	2.5967		
Norway	0.0196	0.1824	0.0056	0.0757	0.0007	0.0055	0.1956	0.1001
Sweden	0.0378	0.0066	0.0581	0.0147	0.0046	0.0007	0.7326	0.0070
Switzerland	0.1070	0.5603	0.0572	0.4354	0.0231	0.1004	1.7004	0.4889
Canada	0.1582	0.3433	0.0236	0.0743	0.0041	0.0073	0.6300	0.0751
Japan	0.0537	0.0179	0.0288	0.0139	0.0084	0.0023	0.2918	0.0053
Finland	0.0041	0.0455	0.0091	0.1457	0.0012	0.0112	0.2061	0.1250
Greece	0.0058	0.0722	0.0077	0.1395	0.0036	0.0373	0.3343	0.2297
Ireland	0.0588	1.0710	0.0669	1.7706	0.0266	0.4026	1.3414	1.3414
Portugal	0.0174	0.2429	0.0143	0.2889	0.0082	0.0943	0.2017	0.1542
Spain	0.1129	0.2731	0.0563	0.1978	0.0339	0.0681	1.3620	0.1809
Australia	0.0225	0.0836	0.0196	0.1056	0.0046	0.0142	0.7249	0.1479

Table A-1 (continued). Time Average of FDI Flows[a]

	Source country							
	Norway		*Sweden*		*Switzerland*		*Canada*	
	Source	*Host*	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*
United States	0.2470	0.0046	0.0226	0.0226	1.8723	0.0622	1.2120	0.0972
United Kingdom	0.3060	0.0365	0.0184	0.1177	0.8926	0.1896	0.2792	0.1431
Austria	0.0304	0.0228	0.0004	0.0162	0.0988	0.1320	0.0034	0.0108
Belgium	0.4630	0.2918			0.3193	0.3584		
France	0.0928	0.0100	0.0089	0.0512	0.2122	0.0405	0.0837	0.0386
Germany	0.3041	0.0224	0.0137	0.0543	0.5071	0.0666	0.0289	0.0092
Italy	0.0237	0.0031	0.0052	0.0359	0.3404	0.0783	0.0083	0.0046
Netherlands	0.1770	0.3457	0.0158	1.6565	0.3684	1.2814	0.2184	1.8333
Norway			0.0128	0.6853	0.0980	0.1746	0.0016	0.0070
Sweden	0.4273	0.0080			0.1303	0.0043	0.0287	0.0023
Switzerland	0.0111	0.0062	0.0035	0.1050			0.0867	0.2093
Canada	0.0939	0.0218	0.0012	0.0153	0.1250	0.0518		
Japan	0.0019	0.0001	0.0004	0.0007	0.0876	0.0056	0.1048	0.0161
Finland	0.0725	0.0859	0.0308	1.9554	0.0305	0.0644	0.0024	0.0122
Greece	0.0027	0.0036		0.0022	0.0439	0.1050	0.0024	0.0138
Ireland	0.1090	0.2128	0.0086	0.8952	0.1486	0.5169	0.0086	0.0723
Portugal	0.0058	0.0087	0.0005	0.0366	0.0654	0.1738	0.0218	0.1401
Spain	0.0594	0.0154	0.0017	0.0237	0.1786	0.0825	0.0239	0.0266
Australia	0.0102	0.0040	0.0005	0.0108	0.1026	0.0728	0.0783	0.1341

	Japan		*Finland*		*Greece*		*Ireland*	
	Source	*Host*	*Source*	*Host*	*Source*	*Host*	*Source*	*Host*
United States	0.4363	0.2283	0.7384	0.0116	0.0517	0.0007	2.2877	0.0219
United Kingdom	0.1355	0.4533	0.2971	0.0299	0.0912	0.0081	0.8013	0.0489
Austria	0.0009	0.0197	0.0273	0.0173	0.0009	0.0005	0.0022	0.0008
Belgium	0.0115	0.2039						
France	0.0246	0.0739	0.2059	0.0186	0.0063	0.0005	0.4087	0.0224
Germany	0.0168	0.0348	0.6342	0.0395	0.0153	0.0008	0.5556	0.021
Italy	0.0038	0.0136	0.0683	0.0074	0.0023	0.0002	0.1225	0.0081
Netherlands	0.0775	4.2425	0.8166	1.347	0.0071	0.0104	1.3921	1.3921
Norway	0.0024	0.0663	0.4541	0.3836	0.0004	0.0003	0.0083	0.0042
Sweden	0.0018	0.001	1.6341	0.0258	0.0015	0.0000	0.0285	0.0003
Switzerland	0.0049	0.0765	0.5742	0.2723	0.0040	0.0017		
Canada	0.018	0.1174	0.0888	0.0175	0.0048	0.0008		
Japan			0.0384	0.0012	0.0006	0.0000	0.1893	0.0035
Finland	0.0013	0.0424			0.0004	0.0004	0.057	0.0346
Greece	0.0000	0.0012	0.0045	0.0051			0.0035	0.0024
Ireland	0.0071	0.3873	0.0765	0.1262	0.01	0.0145		
Portugal	0.0006	0.0242	0.019	0.0239	0.0043	0.0048	0.0906	0.0693
Spain	0.0058	0.0422	0.0457	0.0100	0.0044	0.0009	0.3936	0.0523
Australia	0.0443	0.4954	0.0376	0.0127	0.0008	0.0002	0.0657	0.0134

Table A-1 (continued). Time Average of FDI Flows[a]

	Source country					
	Portugal		*Spain*		*Australia*	
	Source	*Host*	*Source*	*Host*	*Source*	*Host*
United States	0.0387	0.0005	0.2079	0.015	0.6272	0.0294
United Kingdom	0.0714	0.0057	0.1613	0.0742	0.4286	0.1283
Austria	0.0210	0.0106	0.0133	0.0385	0.0003	0.0006
Belgium					0.0144	0.0228
France	0.0497	0.0036	0.0977	0.0404	0.01	0.0027
Germany	0.0150	0.0007	0.2154	0.0613	0.0168	0.0031
Italy	0.0321	0.0028	0.0896	0.0446	0.0128	0.0041
Netherlands	0.5102	0.6675	0.1753	1.3203	0.0747	0.366
Norway	0.0001	0.0001	0.0035	0.0135	0.0004	0.001
Sweden	0.0003	0.0000	0.0101	0.0007	0.0023	0.0001
Switzerland	0.0092	0.0035	0.1071	0.2319	0.0048	0.0067
Canada	0.0038	0.0006	0.0135	0.0121	0.0524	0.0306
Japan	0.0000	0.0000	0.0208	0.0029	0.0164	0.0015
Finland	0.0000	0.0000	0.0046	0.0211	0.0003	0.0008
Greece	0.0059	0.0053	0.0087	0.0448	0.0000	0.0000
Ireland	0.0653	0.0854	0.0259	0.1947	0.0186	0.0911
Portugal			0.1373	0.7905	0.0001	0.0002
Spain	0.653	0.1135			0.0025	0.0016
Australia	0.0007	0.0002	0.0220	0.0339		

Source: Authors' calculations.
a. As a percentage of the source and host countries' GDP.

Table A-2. Instrumented Equations for Productivity and Effective Tax Rates[a]

Variable	*Productivity*	*Effective tax rate*
Capital-labor ratio	0.0001808	
	(6.09e-06)**	
Years of schooling	1.262	
	(0.092)**	
Tax rate		0.642
		(0.005)**
GDP per capita		0.00000319
		(1.5e-07)**
Observations	4,279	5,414
R^2	0.958	0.962

Source: Authors' calculations.
a. Standard errors are in parentheses.
**Significant at the 1 percent level.

Table A-3. Bilateral FDI Flows and Selection Equations: Productivity and Tax Effects[a]

	Productivity effect		*Tax effect*	
Variable	*Flow*	*Selection*	*Flow*	*Selection*
Productivity–source	–0.06	–0.051		
	(0.020)**	(0.026)		
Productivity–host	0.018	0.006		
	(0.018)	(0.031)		
Instrumented productivity–source			–0.089	–0.135
			(0.033)**	(0.054)*
Instrumented productivity–host			–0.039	0.040
			(0.036)	(0.046)
Tax rate–source	1.036	1.212		
	(0.652)	(0.826)		
Tax rate–host	–2.747	–0.612		
	(0.655)**	(0.787)		
Instrumented effective tax rate–source			1.473	0.924
			(1.036)	(1.375)
Instrumented effective tax rate–host			–5.388	–1.489
			(1.115)**	(1.244)
ln GDP per capita–source	5.419	1.666	3.383	0.895
	(0.949)**	(1.222)	(0.657)**	(0.725)
ln GDP per capita–host	2.766	–1.152	4.890	–1.192
	(0.878)**	(1.342)	(0.624)**	(0.834)
Schooling difference	0.174	–0.019	0.104	0.053
	(0.066)**	(0.073)	(0.074)	(0.083)
Common language	0.513	–0.182	0.495	–0.094
	(0.090)**	(0.118)	(0.106)**	(0.148)
ln Distance	–1.015	–0.306	–1.082	–0.393
	(0.044)**	(0.074)**	(0.048)**	(0.089)**
ln Population–source	0.712	–3.860	–1.006	–7.596
	(1.788)	(2.556)	(2.058)	(2.986)*
ln Population–host	–1.738	–5.398	–0.081	–8.931
	(1.493)	(2.633)*	(1.689)	(3.023)**
Financial risk–source	–0.026	0.023	–0.012	0.011
	(0.012)*	(0.019)	(0.014)	(0.025)
Financial risk–host	–0.02	-0.027	–0.029	–0.015
	(0.011)	(0.017)	(0.013)*	(0.02)
Previous FDI dummy (1 if yes)		1.534		1.501
		(0.085)**		(0.093)**
Observations	4,702	4,702	3,833	3,833

Source: Authors' calculations.
*Significant at the 5 percent level; **significant at the 1 percent level.
a. Country and time fixed effects are accounted for; robust standard errors are in parentheses.

Comments

Mihir A. Desai: Assaf Razin and Efram Sadka have synthesized some of their recent work on productivity, taxes, and foreign direct investment (FDI) in this welcome contribution. Their theoretical work emphasizes how setup costs at home and in the host country can drive a wedge between marginal and total profit conditions. This insight combines with a description of FDI decisionmaking that separates the decisionmaking process into two parts: whether to invest and how much to invest. Their theory leads to some intriguing results on the relationship between productivity, taxes, and FDI, and their empirical work provides some support for their theoretical results.

In the Razin and Sadka setup, setup costs at home (the source country) and in the host country are critical and lead to the curious results they present. For example, they argue that a positive productivity shock in the host country can deter entry of multinational firms. The productivity shock bids up wages and, because host country setup costs are entirely based on wage costs, the total profit conditions that dictate entry now are tilted toward not entering. Setup costs, and their deductible nature, also influence the role of taxes. In particular, tax rate increases at home can lead to increased outbound FDI because the value of the deductions for setup costs borne at home goes up.

Setup costs are surely important to the spread of multinational firms. But such counterintuitive results demand some motivation for the underlying mechanism. For example, what are these sizable wage-driven setup costs that are so critical to the model? Little motivation is provided for these costs and, while the results are all derived nicely, it is hard to know what to make of their importance without such motivation. I confess to having a hard time deriving any intuition or examples for such costs other than the fees paid to investment bankers and consultants upon entry in a country. I find it hard to believe that such costs are meaningful relative to the scale of the projects under consideration.

It is also not clear that such setup costs in the host country, and particularly at home, are the same every time a multinational enters a new country. When General Electric sets up operations in the *n*th country that they operate in, are we to believe that they bear considerable setup costs at home or, even for that matter, that the costs they bear in the *n*th country are the same as the costs borne when they first became a multinational firm? These costs would also seem to bear some relationship to market size, which are not developed in the model. Similarly, it is also not clear why firms are choosing among projects in an exclusive scenario, which presumably reflects some hidden financing constraints. Finally, the treatment of taxes, particularly home country taxes, is somewhat primitive since the rich interactions of home country and host country regimes that have been shown to be so important to patterns of multinational firm activity are neglected in the model.

The paper takes these intuitions from the theory and attempts to apply them to bilateral FDI flows within the Organization for Economic Cooperation and Development (OECD). Given the interest in the separability of the decision into whether to invest and how much to invest, it would seem that it would be useful to look for data sources outside of the OECD in which "zeros" (that is, bilateral pairs where there is no FDI) are more likely to be prevalent. I was also puzzled by the treatment of Europe in some of the tables, as the authors appear to not examine any FDI flows within Europe. Nonetheless, the authors report results on productivity shocks at home and taxes at home that conform to the theory's predictions.

Of course, it is always possible to come up with alternative explanations for such results. For example, the result that increases in the source country tax rate lead to more outbound FDI because of the increased value of the deductions of the setup costs could have a simpler interpretation. The more naïve interpretation of that result is that when the source country tax rate goes up, the multinational has an incentive to go abroad with real activity to facilitate profit relocations. This alternative explanation and others like it are hard to disentangle in this empirical setting. It would be nice for the authors to attempt to take their intuitions to microdata on multinational firms as this is where their predictions would seem to have the most purchase and where the focus of most of the recent literature on multinational firms is now.

This fine paper pushes the scholarly community to take setup costs seriously in their consideration of FDI. This is surely a welcome direction for scholarship as the recent work on firm heterogeneity and patterns of trade and FDI has suggested. I look forward to further work by these scholars as they elaborate these mechanisms and provide more empirical evidence of their relevance.

Deborah Swenson: Recent work on foreign direct investment (FDI) has shifted focus from a framework in which an anonymous river of capital flows internationally to a framework in which trade and investment are conducted by a diverse group of traders. Naturally, recognition of traders brings with it an enriched setting in which heterogeneous traders make a wide range of decisions as they balance their individual opportunities against transaction costs. In adopting this new approach, Razin and Sadka highlight how productivity and tax factors influence foreign investment in a world that is populated by heterogeneous firms distinguished by their differing levels of productivity.

A key insight of this approach is the recognition that investment decision-making includes an extensive margin, for which firms decide whether or not to invest in foreign markets, and for firms that do invest, the intensive margin, which involves the choice of investment volume. This recognition of firm heterogeneity enables Razin and Sadka to bring forward a number of interesting insights. First, unlike a homogenous world in which profit maximization implies that all firms should make the same decision, recognition of heterogeneity explains the coexistence of firms' differing strategies in the organization of their resources and, with it, the potential for firms' heterogeneous responses to changes in the tax environment. In addition, firm heterogeneity brings with it the implication that changes in underlying conditions may have unexpected effects, as these changes will influence the selection into investment as well as the desired level of investment by those firms that do invest. In this regard, I think Razin and Sadka's paper does an excellent job of describing these issues in a way that clarifies the effects of productivity and taxes on the levels of foreign investment via greenfield or acquisition investment.

Nonetheless, I think there are still a number of avenues that remain to be analyzed as this line of research moves forward. First is the question of how to characterize productivity at a national level. Do firms experience productivity that is based on the national location of their headquarters, or does engagement in international markets change their productivity opportunities? This question is potentially most salient in the case of foreign investment via acquisition. For example, when the Chinese company Lenovo purchases IBM's ThinkPad laptop assets, does Lenovo continue to experience productivity tied to its base in China, or is its productivity altered by its purchase of U.S assets? The second practical question is how we can apply models such as those of Razin and Sadka to the data. Since their work has different predictions regarding greenfield versus acquisition FDI, we have to wonder what the aggregate prediction is for a world where both are relevant and large. The *World Investment Report* reported that 18.8 percent of FDI value in 2005 was due to mergers

and acquisitions (M&A) activities, and in many developed countries within the Organization for Economic Cooperation and Development (OECD), the percentage was much larger![1] A third practical question is whether one should think of investment choices as a choice of home or foreign investment, or whether one should consider instead the alternative problem facing multinationals that have decided to move abroad but have yet to decide the county or countries where they will place their overseas operations. Such interdependencies seem particularly relevant, given the empirical findings by Blonigen and others (2007) or Swenson (1998, 2006) that show how conditions in neighboring or competitor locations affect foreign investment or foreign assembly decisions, while noting that the attractiveness of one country or state jurisdiction often appears to be affected by conditions in neighboring locations.[2] Nonetheless, while these topics remain to be explored in future research, Razin and Sadka's paper discusses the important implication that tax policy may influence aggregate levels of economic activity, since changes in policy may influence the scale and population of investing firms.

Razin and Sadka follow their theoretical discussion with an empirical exercise that examines data on foreign investment flows among OECD countries. Since Razin and Sadka's theoretical model involves foreign investment changes on the extensive and the intensive margins, identification of the model's predictions is based on the pattern of investment and noninvestment in the data and on the levels of foreign investment in the cases in which investment occurs. Although this exercise is straightforward in concept, I am concerned that the OECD data on aggregate investment flows between bilateral country pairs are not well suited to the task.

First, although the model is straightforward and makes compelling arguments for the effects on the extensive and intensive margins, it is difficult to know how these aspects will play out when foreign investment data combine greenfield and acquisition investments, since the predicted effects of productivity or taxes on the incentive to undertake foreign greenfield or merger investment differ. My second and bigger concern is that this dataset offers too little variation to identify the extensive margin. Ideally, for example, one could identify extensive margin effects of taxes on investment if a country´s tax reform caused an investment transition from no investment to positive investment. However, while the population of investing firms changes from year to year, there will be far fewer transitions between zero and positive investment

1. See the United Nations Conference on Trade and Development website to view this series and the database (www.unctad.org/wir).

2. Blonigen and others (2007); Swenson (1998, 2006).

at a national level for most OECD country pairs. This is because large investor countries such as the United States, the United Kingdom, or the Netherlands have positive investment in almost all OECD countries in every year of the panel, even if the number of investing firms changes from year to year. Similarly, Razin and Sadka's dataset includes some country pairs that experience no investment during the sample period. Although it is easy to imagine reasons for the complete absence of investment by Australian firms in Greece or Portuguese firms in Japan or Finland, the omnipresence of zero investment for these country pairs means that they fail to provide any information on selection. Thus identification of the selection equation in this project relies on the limited set of country-pairs that experienced transitions between years of investment and no investment. Although the paper does not provide enough information to determine which country pairs experienced transitions in the empirical exercise, or to determine the frequency of transitions, it is my sense that transitions at this aggregate level were few and far between in aggregate OECD investment relations. For this reason, aggregate investment by OECD nations can only provide minimal information on the extensive margin, even though changes in taxes or productivity conditions are likely to change the number of investing companies from year to year. Although the influence of the extensive margin is important and interesting, I look forward to future quantification of these effects based on industry- or firm-level data that track the foreign investment decisions of multinational firms.

Even if the OECD data provide limited information on selection, as I believe, Razin and Sadka are right in arguing that the extensive margin plays an important role in shaping the frequency and size of foreign investments between countries. To begin, the relevance of the extensive margin is apparent in Muendler and Becker's discovery that German firms' investment involves adjustment on the extensive and intensive margins.[3] Similarly, when Mutti and Grubert studied microdata on U.S. firms, they found that the likelihood of a firm locating in a given host country is influenced by taxes and that investment geared toward export markets is particularly sensitive to host country taxation.[4] In addition, Mutti and Grubert found that tax sensitivity appears to be greater in developing countries than in developed countries and that tax sensitivity is growing over time.

The subtle question raised by this paper is that if firm heterogeneity influences how firms respond to international tax differentials, should tax policy be modified to reflect this element of the international economy? While the answer

3. Muendler and Becker (2006).
4. Mutti and Grubert (2004).

may ultimately be yes, the practical answer is: not yet. To effectively bring this issue to policy, policymakers must have a better sense of the margins on which firms operate, since multinational firms make decisions along many different dimensions, many of which are influenced by tax policy. These decisions include whether to export or conduct FDI as noted in Devereux and Griffith, the decision to undertake merger or greenfield FDI as shown in Scholes and Wolfson and in Swenson, as well as the apparent differences between the effects on vertical and horizontal foreign investment found in Mutti and Grubert.[5] Thus the large number of margins for multinational decisionmaking leaves me skeptical that tax policy can be easily designed to encompass issues related to heterogeneity. Nonetheless, Razin and Sadka's work makes apparent a deeper point: since tax policy has the potential to influence which firms decide to do foreign investment, policymakers need to be aware that tax policy may influence average firm productivity at the national level.

The more direct policy question is whether international tax differentials exert a large influence on the level of foreign investment a country ultimately receives. While tax differentials create clear investment incentives in a stripped-down model of foreign investment, many practical considerations may blunt their ultimate influence. To begin, as Altshuler and Grubert showed, firms have many tax planning avenues, such as the creation of financial structures that may enable firms to reduce their repatriation taxes.[6] In fact, they provided evidence that these financial choices are a salient feature of U.S. multinational activity. Along related lines, Koncz and Yorgason noted the dramatic increase in the use of foreign holding companies.[7] In particular, the share of U.S. foreign affiliate activity conducted through holding companies rose from 9 percent in 1982 to 30 percent in 2005. Although holding companies may be formed for reasons other than tax planning, the dramatic change in the organization of multinational activity suggests that multinational firms may be able to blunt the effects of international tax differentials, thus obviating the real investment incentives that are noted in most models of foreign investment.

Nonetheless, there is still anecdotal evidence that taxes influence firm investment decisions. One striking example was the Jobs Creation Act of 2004 that enabled U.S. firms to repatriate their foreign earnings in 2005 at a *temporarily* lowered tax rate. Since Koncz and Yorgason showed that the percentage increase in U.S. direct investment abroad in 2005 was smaller than it had been in any year since 1982, while financial repatriations were large, it appears that

5. Devereux and Griffith (1998); Scholes and Wolfson (1990); Swenson (1994); Mutti and Grubert (2004).

6. Altshuler and Grubert (2003).

7. Koncz and Yorgason (2006).

tax incentives, at least in some cases, influence firm decisions regarding foreign investment.[8] For this reason, while governments may be concerned about the revenue implications of multinational firm activity, it appears that international tax differentials still shape the incentives of multinational firms in the fashion suggested by the theory.[9]

The income and jobs brought to host countries by foreign affiliates of multinational firms ensure that countries will continue to be concerned about the effects of their tax policy environment on foreign firms.[10] This concern is apparent as tax policies enacted in neighboring or competitor countries are consciously noted during policy debates, which is manifested in the reductions of many countries' corporate tax rates in recent years. Nonetheless, Altshuler and Grubert offered the intriguing hypothesis that the race to the bottom may be stemmed in part because of the avenues for financial planning that governments make available to multinational firms.[11] In particular, by reducing the effects of international tax differentials on multinational firms, countries may retain the substantial benefits conferred by the economic activities of their growing multinational firms.

8. Koncz and Yorgason (2006).

9. Even when tax planning techniques reduce the effects of taxes on real investment, it is important to remember that such avenues are not costless, since planning techniques require firms to expend resources that might otherwise be used in productive activities.

10. For example, Mataloni and Yorgason (2006) noted that in 2004 the value added generated by the foreign affiliates of U.S. multinational firms contributed on average 2.8 percent of all GDP in the fifty-one countries that hosted the largest U.S. foreign affiliate activity, as measured by foreign affiliate value added at the national level.

11. Altshuler and Grubert (2005).

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