A Pecking Order Among Foreign Direct Investment, Debt and Portfolio Equity Flows*

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Abstract

The paper develops an international macroeconomic model of FDI flows with two characteristics: a dominant technology for eliciting "good" firms and a hand-on management ability to react in real time to a changing economic environment. Employing a skimming technology, foreign direct investors can outbid portfolio investors for the top productivity firms. We establish a pecking order among capital flows: FDI, debt and portfolio equity. The gains from FDI to the host country stem from its informational value.

1 Introduction

In a perfect capital market (with full information), all forms of capital flows (FDI, debt and portfolio equity) are indistinguishable. In the presence of information asymmetry between a firm's "insiders" and "outsiders" and the related conflict of interest between owners and managers, however, a well-defined distinction among these flows can be established. We view FDI as having two important characteristics in this context: first, foreign

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direct investors are better equiped and experienced in eliciting "good" firms; second, they can apply a hand-on management standards that enable them to react in real time to a changing business environment.[1] Also, under asymmetric information, the equity market may be plagued by Akerlof's (1970) "lemons" problem, whereas the debt market by possibilities of default.

In such a context, we can endogenously determine the co-existence of four groups of firms even in the presence of free capital mobility:[2] firms that are "raided" by foreign direct investors, firms which finance new investment by debt issue either at home or abroad, firms which finance new investment by equity issue to portfolio investors either at home or abroad, and firms that choose to abstain from making new investment. As FDI is driven by some sort of a skimming technology, we study the channels through which the host country benefits from FDI.

The organization of the paper is as follows. Section 2 develops an analytical framework in which all forms of capital flows are endogenously determined and co-exist in equilibrium. Section 3 discusses the determination of real investments and the ranking of their magnitude among the aforementioned four groups of firms. Section 4 focuses on the determination of the aggregate capital flows. Section 5 studies the gains from FDI. Section 6 develops a concept of constrained efficiency and employs it to examine the efficient policy towards FDI. Section 7 concludes.

2 Analytical Framework

Suppose there is a very large number (N) of *ex ante* identical domestic firms. Each firm employs capital input (K) in the first period in order to produce a single composite good in the second period. We assume that capital depreciates at the rate $\delta(< 1)$. Output in the second period is equal to $F(K)(1+\varepsilon)$, where $F(\cdot)$ is a production function exhibiting diminishing marginal productivity of capital and ε is a random productivity factor. The latter has zero mean and is independent across all firms. Naturally, ε is bounded below by -1, so that output is always non-negative; and for notation ease we assume that ε is bounded from above by 1. We assume that ε is purely

[1] See Gopinath (2001) for an interesting application of a search model for FDI determination.

[2] Other models that attempt to rank capital flows [e.g. Gordon and Bovenberg (1996), Razin, Sadka and Yuen (1998, 1999)] assumed segmented markets both across FDI, debt and portfolio equity and across countries. In these models there is an information asymmetry between domestic and foreign investors, which leads to a home bias in portfolio equity investment. An interesting empirical study of these asymmetry and bias is provided in Portes and Rey (1999).

idiosyncratic, so that there is no aggregate uncertainty.[3] Consumer-investors will thus behave in a risk-neutral way. We denote by $G(\cdot)$ the cumulative distribution function of ε and by $g(\cdot) = G'(\cdot)$ the corresponding density function.

At the starting point of the decision process of agents (firm owners, firm managers, portfolio investors, foreign direct investors, etc.) in the first period, the random productivity factor (ε) is revealed to no one. However, there exists some crude skimming technology that can elicit the group of "good" (high-ε) firms. Specifically, this technology can, for some thresdhold parameter value (say, ε_1), elicit all the firms whose ε parameter is above this ε_1. The cost is $C(\varepsilon_1)$ *per each* elicited firm. We assume that the cost rises as one tries to skim a more narrow group of higher productivity firms that is: $C(\varepsilon_1)$ is an increasing function of ε_1.

We assume that foreign direct investors are better equipped and experienced in skimming the good firms than their domestic counterparts. They have a better access to this information technology. This means that the aforementioned cost function of the foreign direct investors is lower than that of the domestic investors. Therefore, the foreign direct investors can outbid the domestic investors in the purchase of the top productivity firms; we refer to these firms as FDI firms. The rest of the firms, those with a productivity factor ε below ε_1 will be allocated among domestic investors and foreign portfolio investors; we refer to these firms as non-FDI firms. Our economy is a small open economy, with a free access to the world capital market. The domestic interest rate is thus equal to the world rate of interest which is denoted by r (in the absence of any taxes on interest income). Before completing the discussion concerning the determination of FDI, we must describe how investment decisions are made.

In the first period, when all firms are still owned by the original (domestic) owners, we distinguish between two stages. In the first stage, the planning stage, firms determine their investment and financing rules. The actual investment and its funding are delayed until the second stage, the implementation stage. These investment rules are approved by the owners of the firms before realization of their productivity shocks. The management then implements these rules by seeking funds to finance the investment after ε is known. For simplicity, we assume

[3] This assumption may differ from what is assumed in some strands of the corporate finance literature whereby return volatilities may vary across firms. If firms differ by their *ex ante* risk characteristics, then higher-volatility firms would face higher *ex ante* default risk if they issue debt. As a result, their gearing (i.e., debt-equity) ratio will be lower than the low-volatility firms. Because a high-risk firm must offer its shareholders higher expected return, there must be a negative cross-sectional correlation between mean return and the gearing ratio. We abstract, however, from this variable volatility assumption, and assume instead homogeneous *ex ante* risk characteristics, in order to focus on an alternative mechanism that links firm productivities with their debt-equity ratios and their attractiveness to foreign direct investors.

that the original owners of the investment sites do not have any retained earnings to finance their capital outlays, and will have to appeal to the equity or debt market instead. At the implementation and financing stage, the managers of the firms are better informed than the outside fund-suppliers. There are many ways to specify the degree of this asymmetry in information. However, in order to facilitate the analysis, we simply assume that the managers being "close to the action", observe ε before they implement the investment rules and make their financing decisions; but the fund-providers, being "far away from the action", do not.

A possible rationale behind this sequence of firm decisions whereby the investment choice is made *ex ante,* whereas the financing of the pre-committed investment is decided *ex post* has to do with a potential agency problem between the owners and the managers (who are responsible for making these decisions). Loosely speaking, the latter are not exclusively interested in the net worth of the firm as are the former. In the absence of full information about the firm's productivity, the owners will have to set investment guidelines for the managers (who know more about ε than they do) so as to protect their own interests. This agency problem is not modelled explicitly here because we want to focus instead on the control and management characteristics of FDI (which we discussed below) and on the asymmetric information between the firm's "insiders" and "outsiders". What we do, however, capture in our model is the spirit of these investment guidelines in terms of the sequencing of information and the firm's investment and financing decisions.

The investment rules are, however, quite rigid in the degrees of freedom they allow the management. Depending on the realized value of the productivity factor (ε), it may be strikingly more advantageous to debt-finance or equity-finance new investment or not to inveset at all. For instance, a higher-than-average value of ε which is observed by the manager but not by the fund-suppliers will be insufficiently priced by the equity market. In such a case, it will not be optimal for the manager to resort to the equity market. Similarly, a low realization of ε observed by the manager but not by potential creditors will make it unprofitable for the manager to issue debt even though she is able to do so (as the creditors do not obvserve ε) because of the detrimental effects of default. In the case of default, the original owners lose part or all of the existing capital as the residual value of the firm is seized by the debt-holders; whereas if the firm takes no loans and makes no new investment, she can retain all of the existing capital.

Specifically, the investment rule dictates the manager to take either one of three possible courses of actions,

once ε is made known to her[4]:

(i) portfolio-equity-finance new capital investment, so as to augment the stock of capital of the firm to a pre-determined level of K_E;

(ii) not to invest at all; and

(iii) debt-finance new capital investment, so as to augment the stock of capital of the firm to a pre-determined level of K_D.

Since all firms face the same probability distribution of ε when designing their investment rules, they all choose the same rule (that is, the same K_E and K_D). Now, before elaborating on these three possibilities, we return to completing the discussion regarding the determination of FDI..

2.1 Foreign Direct Investment

At the end of the planning stage, when ε is still not yet known, the foreign direct investors step in. Employing their skimming technology they can outbid all other investors for the top productivity firms (namely, the firms with productivity parameter above ε_1). At what price are the firms' original owners willing to sell their firms? Note that an owner of such a firm does not know the exact value of her firm's ε, but she can infer from the signal that her firm is targeted by FDI "raiders" that her firm belongs to the group of firms whose productivity parameter is above ε_1. If she does not sell her firm, she would choose a rigid investment rule (that is, a given, not ε-dependent K_F), so as to maximize the net present value of her firm, conditional on the firm having $\varepsilon \geq \varepsilon_1$. The net present value of the firm is given by

$$(1+r)^{-1}F(K_F)[1+e_1(\varepsilon_1)] + (1-\delta)K_F\} - [K_F - (1-\delta)K_0], \tag{1}$$

[4]The rigid investment rule is imposed because of a conflict of interest between owners and managers. But the managers do pursue the interests of the owners in the financing decision in some key circumstances (e.g., the managers are concerned about default because the owners will lose their capital and may lay them off in such cases). In specifying these rigid rules, we are implicity assuming that the conflict between owners and managers are potentially more severe in investment than financing decisions.

where K_0 is the (given) initial stock of capital (the same for all firms), δ is the rate of depreciation, and $e_1(\varepsilon_1)$ is the expected (average) value of ε, conditional on ε being larger than ε_1. That is,

$$e_1(\varepsilon_1) = E(\varepsilon/\varepsilon \geqq \varepsilon_1) = \int_{\varepsilon_1}^{1} \varepsilon \frac{g(\varepsilon)}{1 - G(\varepsilon_1)} d\varepsilon. \tag{2}$$

Thus, K_F is given by the marginal productivity condition

$$F'(K_F)[1 + e_1(\varepsilon_1)] = r + \delta. \tag{3}$$

The asking price, which is the same for all the firms approached by the FDI investors, is

$$P(\varepsilon_1) = (1 + r)^{-1}\{F(K_F)[1 + e_1(\varepsilon_1)] + (1 - \delta)K_F\} - [K_F - (1 - \delta)K_0]. \tag{4}$$

The foreign direct investors do not accurately observe ε either (except that it is higher than ε_1) at this stage, when the purchases of the domestic firms are made. However, we emphasize here a second key feature of FDI, namely, the actual control and hands-on management of the firm. The FDI investors are not constrained by a rigid investment rule. They will choose the level of investment *after* ε is revealed. Their chosen K will thus be a function, $K(\varepsilon)$, of ε given by the marginal productivity condition:

$$F'[K(\varepsilon)](1 + \varepsilon) = r + \delta \; for \; \varepsilon \geqq \varepsilon_1. \tag{5}$$

However, they do not observe ε when they decide to purchase the firms. They will therefore offer the same price for all the top productivity firms, taking into account that they will later, when ε will be revealed to them, choose $K(\varepsilon)$ (but not K_F). The value to the FDI investor of a firm that she purchases is therefore:

$$V(\varepsilon_1) = [1 - G(\varepsilon_1)]^{-1} \int_{\varepsilon_1}^{1} \{\frac{F[K(\varepsilon)](1 + \varepsilon) + (1 - \delta)K(\varepsilon)}{1 + r} - [K(\varepsilon) - (1 - \delta)K_0]\} g(\varepsilon) d\varepsilon. \tag{6}$$

Note that $V(\varepsilon_1)$ must be larger than $P(\varepsilon_1)$, because V is the maximized expected value of a firm that belongs to the top productivity group when K is allowed to be ε-dependent; whereas $P(\varepsilon_1)$ is calculated under the constraint

that K_F is not ε-dependent. However, the FDI investors incurs a cost of $C(\varepsilon_1)$ per firm in order to elicit the top productivity firms. Therefore, an FDI investor is willing to pay a maximal price of $V(\varepsilon_1) - C(\varepsilon_1)$. Competition among FDI investors over the purchase of the domest firms yields the competitive equilibrium level of skimming:

$$V(\varepsilon_1) - C(\varepsilon_1) = P(\varepsilon_1). \tag{7}$$

We now turn to the discussion of the remaining firms (those with $\varepsilon < \varepsilon_1$) who will be at the hand of non-FDI investors.

2.2 Portfolio Equity Flows

As mentioned above, the managers observe ε, whereas the new potential share-holders of the firm do not. The market will be trapped in the "lemons" situation *a la* Akerlof (1970). The price offered by the new uninformed potential equity buyers (who are either domestic or foreign portfolio investors), reflects the average productivity of all firms (that is, the average level of ε) in the market. The manager of a firm experiencing a higher-than-average value of ε would prefer to employ just the existing capital (that is, K_0), or issue debt, rather than to raise equity from a market that will not pay a premium for a high value of ε. Thus, there exists a cutoff level of ε, denoted by ε_3, such that all firms which experience a value of ε above ε_3 will either make no new investment or finance investment by debt, while all other firms (that is, the low-ε firms) will equity-finance their new investment at a price reflecting the average value of the "lemons". Define $e_3(\varepsilon_3)$ as the mean value of ε realized by the low-productivity firms, that is:

$$e_3 \equiv E(\varepsilon/\varepsilon \leq \varepsilon_3) = \int_{-1}^{\varepsilon_3} \varepsilon \frac{g(\varepsilon)}{G(\varepsilon_3)} d\varepsilon. \tag{8}$$

The cutoff level of ε is then defined by

$$\begin{aligned} &- [K_E - (1-\delta)K_0] + \{F(K_0)[1 + e_3(\varepsilon_3)] + (1-\delta)K_E\}(1+r)^{-1} \\ &= \{F[(1-\delta)K_0](1+\varepsilon_3) + (1-\delta)^2 K_0\}(1+r)^{-1}, \end{aligned} \tag{9}$$

where K_E is the stock of capital of the low-ε firms that do make equity-financed new investment, and $(1-\delta)K_0$

the undepreciated initial stock of capital for the firms that do not make any new investment. The left-hand side of equation (9) represents the market value of the firm net of the new capital investment. Note that, to the potential new shareholders, all firms on the market are indistinguishable so that their productivity is evaluated at $e_3(\varepsilon_3)$, which is the average productivity of the group of firms that choose to equity-finance their new investment. The right-hand side of equation (9) represents the value of the marginal firm to the manager who observes ε, and acts on behalf of the original firm owner. By the marginal firm, we mean the firm with the lowest productivity factor (ε_3) among the group of firms that do not make equity-financed new investment.

Recall that firms need external funds, which amount to $K_E - (1-\delta)K_0$. We assume that equity-financing takes the following form. The entire firm is sold in the equity market, and the new owners inject the additional funds needed to finance the new investment [that is, $K_E - (1-\delta)K_0$]. These are the guidelines issued by the original shareholders to the managers.[5]

2.3 Debt Flows

Besides equity finance, an alternative source of finance is to have domestic firms finance their investment by borrowing either at home or abroad. As in Stiglitz and Weiss (1981), we allow for the possibility of default.[6] However, since the manager observes the realized value of ε before proceeding with the actual implementation of the pre-determined level of investment [denoted by $K_D - (1-\delta)K_0$] and the borrowing needed for its finance, it will never pay her to borrow, if she knows that the firm will not be able to repay its loans at the end. That is, it does not pay to default. This is because in the latter case, all its post-investment assets [that is, $F(K_D)(1+\varepsilon) + (1-\delta)K_D$] will be seized; whereas, if it decides not to borrow to finance new investment, then it will still be left with $F[(1-\delta)K_0](1+\varepsilon) + (1-\delta)^2 K_0$.[7]

[5] Another possibility is that the original owner sells only a fraction of the firm's equity, a fraction that will suffice to finance the new investment. Evidently, this fraction will be state-dependent. That is, once ε is realized, the manager decides what fraction of the equity to issue. This productivity-dependent fraction will, however, provide a perfect signal about ε that will unravel the asymmetric information problem. We are then back to a full-information environment with its well-known efficiency properties. Nevertheless, a completely state-dependent investment guideline may empower the manager with excessive discretion in the eyes of the shareholders. The full-information outcome cannot arise, however, if equity-buyers can use the revelation principle to extract information about the quality of the firm by offering to buy its equity at prices that are quoted as a function of the fraction of the firm's equity offered in the market. It is beyond the scope of the present paper to develop a more complicated model so as to pursue this issue of incentive-compatible, separating contracts. Instead, we stick to the simpler assumption that, under equity-financing, the entire firm is sold.

[6] For simplicity, we abstract from agency costs associated with debt-financing. Among other things, we assume that managers cannot affect the riskiness of investment and, hence, the probability of default.

[7] With moral hazard, the possibility of default becomes more real. See, e.g., Gertler and Rogoff (1990), Lane (1999), and Fuest, Huber, and Nielsen (2000).

Therefore, there will be a cutoff level of ε, denoted by ε_2, such that all firms that realize a value of ε below ε_2 will not make any new debt-financed investment and all firms realizing a value of ε above ε_2 (and below ε_1) will borrow $K_D - (1-\delta)K_0$ in order to increase their capital stock to K_D. This cutoff level of ε is given by

$$\begin{aligned} &- [K_D - (1-\delta)K_0] + \{[F(K_D)(1+\varepsilon_2) + (1-\delta)K_D\}(1+r)^{-1} \\ &= \{F[(1-\delta)K_0](1+\varepsilon_2) + (1-\delta)^2 K_0\}(1+r)^{-1}. \end{aligned} \tag{10}$$

The left-hand side of equation (10) represents the market value, net of the new investment, of the marginal firm that debt-finances new investment; whereas the right-hand side represents the alternative market value for that firm, if it chooses not to invest. By the marginal firm, we mean here the firm with the lowest realized productivity value among the group of firms that make debt-financed investment.

For later use, we denote the mean value of the productivity factor for the firms that debt-finance their investment by $e_{12}(\varepsilon_2, \varepsilon_1)$, that is

$$e_{12}(\varepsilon_2, \varepsilon_1) = E(\varepsilon / \varepsilon_2 < \varepsilon \leqq \varepsilon_1) = \int_{\varepsilon_2}^{\varepsilon_1} \varepsilon \frac{g(\varepsilon)}{G(\varepsilon_1 - G(\varepsilon_2)} d\varepsilon. \tag{11}$$

2.4 Which Firms Do Not Make New Investment?

All the firms that realize a value of ε above ε_3 and below ε_2 will neither equity-finance nor debt-finance new investment, that is, they will not make new investment at all. This set of firms will not be empty if $\varepsilon_3 < \varepsilon_2$. By comparing conditions (9) and (10), one can see that $\varepsilon_3 < \varepsilon_2$ is indeed a possibility. Because, then the right-hand side of equation (9) will fall short of the right-hand side of equation (10). It follows that the left-hand side of equation (9) will also fall short of the left-hand side of equation (10), which is certainly true when $\varepsilon_3 < \varepsilon_2$ as the left-hand side of equation (9) represents the mean market value of the low-productivity firms (firms with $\varepsilon < \varepsilon_3$), whereas the left-hand side of equation (10) represents the market value of the marginal high-productivity firm (the firm with $\varepsilon = \varepsilon_2$). Using similar arguments, one can easily see that $\varepsilon_3 = \varepsilon_2$ can be ruled out, but $\varepsilon_3 > \varepsilon_2$ remains as another possibility. In other words, it is possible to have some medium-productivity firms (firms with $\varepsilon_3 > \varepsilon > \varepsilon_2$) with a mixture of debt and equity finance, if $\varepsilon_3 > \varepsilon_2$. In this case the no investment zone shrinks

to zero. In what follows, we shall continue to suppose $\varepsilon_3 < \varepsilon_2$, for the sake of brevity.

For later use, we define by $e_{23}(\varepsilon_3, \varepsilon_2)$ the mean value of ε for the firms that make no new investment, that is,

$$e_{23}(\varepsilon_3, \varepsilon_2) \equiv E(\varepsilon/\varepsilon_3 \leq \varepsilon \leq \varepsilon_2) = \int_{\varepsilon_3}^{\varepsilon_2} \varepsilon \frac{g(\varepsilon)}{G(\varepsilon_2) - G(\varepsilon_3)} d\varepsilon. \tag{12}$$

2.5 The Capital Flows Structure of the Economy

In this economy, the set of firms is divided into four groups:

1. There are $NG(\varepsilon_3)$ low-ε firms (that is, firms with realized values of ε below ε_3), which finance their new investment by equity, either from domestic portfolio investors or foreign portfolio investors. The new investment augments the capital stock of each one of them to K_E.

2. There are $N[G(\varepsilon_2) - G(\varepsilon_3)]$ medium-low-ε-firms (that is, firms with realized values of ε between ε_3 and ε_2) that make no new investment and operate with the undepreciated initial stock of capital $(1-\delta)K_0$. (This set may be empty.)

3. There are $N[G(\varepsilon_1) - G(\varepsilon_2)]$ medium-high-ε firms (that is, firms with realized values of ε between ε_2 and ε_1) which finance their new investment by debt issue either at home or abroad. The new investment augments the capital stock of each one of them to K_D.

4. There are $N[1 - G(\varepsilon_1)]$ high-ε firms, pre-screened by foreign direct investors to have productivity factors above ε_1, and sold to them. An ε-firm in this group make an ε-dependent new investment that augments its capital stock to $K(\varepsilon)$. The new owners, foreign direct investors, finance the new investment either from their own sources or through borrowing (at home or abroad). We refer to the firms in this group as the FDI firms.

3 The Investment Rule

At the planning stage, the initial owners determine K_E, K_D, and K_F *before* anyone knows anything about ε, except its cumulative distribution function, G. (Note that at this stage the foreign direct investors have not yet

arrived on the scene.) They take into account the following considerations. At the end of the planning (and before the start of the implementation stage), the foreign direct investors will purchase the fourth group of firms; at the implementation stage, the managers of the other firms (that were not approached by the foreign direct investors) can choose either to make a new debt-financed investment that augments the capital stock to K_D, or to make no new investment, or to make a new investment that augments the capital stock to K_E.

Therefore, at the planning stage, the objective of the owner of any firm (and all firms are alike at this ex-ante stage) is to maximize the expected market value of the firm which is given by

$$\begin{aligned} V^* = \underset{\{K_F,K_D,K_E\}}{Max} & [1-G(\varepsilon_1)]\left\{\frac{F(K_F)[1+e_1(\varepsilon_1)]+(1-\delta)K_F}{1+r}-[K_F-(1-\delta)K_0]\right\} \\ & + [G(\varepsilon_1)-G(\varepsilon_2)]\left\{\frac{F(K_D)[1+e_{12}(\varepsilon_2,\varepsilon_1)]+(1-\delta)K_D}{1+r}-[K_D-(1-\delta)K_0\right\} \\ & + [G(\varepsilon_2)-G(\varepsilon_3)]\left\{\frac{F[(1-\delta)K_0][1+e_{23}(\varepsilon_3,\varepsilon_2)]+(1-\delta)^2K_0}{1+r}\right\} \\ & + G(\varepsilon_3)\left\{\frac{F(K_E)[1+e_3(\varepsilon_3)]+(1-\delta)K_E}{1+r}-[K_E-(1-\delta)K_0]\right\}. \end{aligned} \tag{13}$$

The first curly-bracketed term on the right-hand side of equation (13) represents the expected value to the original domestic owners of the FDI firms. The first-order condition (that is, the pre-determined investment rule) for K_F is given by equation (3), and it determines the asking price of the original domestic owners [see equation (4)]. Note, however, that this rule will later be overruled by the new FDI owners, who are able to choose a state-dependent stock of capital [see equation (5)]. The second curly-bracketed term on the right-hand side of equation (13) represents the expected value of the firm, conditional on its being debt financed, which will occur with probability $G(\varepsilon_1)-G(\varepsilon_2)$. Similarly, the third curly-bracketed term represents the expected value of the firm, conditional on its making no new investment, which will occur with probability $G(\varepsilon_2)-G(\varepsilon_3)$. The fourth curly-bracketed term represents the expected value of the firm, conditional on its being equity-financed which will occur with probability $G(\varepsilon_3)$.

Maximization of (13) with respect to K_D and K_E yields the marginal capital productivity conditions:

$$F'(K_D)[1+e_{12}(\varepsilon_2,\varepsilon_1)] = r+\delta, \tag{14}$$

and

$$F'(K_E)[1 + e_3(\varepsilon_3)] = r + \delta. \tag{15}$$

For the FDI firms, whose hands-on owners observe ε before they make the new investment, the marginal product of capital (namely, $F'[K(\varepsilon)](1 + \varepsilon)$) must equal the cost of capital (namely, $r + \delta$). For all the other stocks of capital (including the pre-sale stock of capital of the FDI firms, namely K_F), which are determined by hands-off owners, it is the *conditional expected* marginal product of capital which is equated to the cost of capital. Because the marginal product of capital is diminishing, it follows that

$$K_F > K_D > K_E > (1 - \delta)K_0 \tag{16}$$

and

$$K(\varepsilon) > K_D \ \ for\, all\, \varepsilon > \varepsilon_1. \tag{17}$$

This ranking of the stocks of capital is portrayed in Figure 1.

4 The Determinants of Capital Flows

The rest of the model is standard. We denote the utility function of the single (or representative) household by $U(C_1, C_2)$, where C_1 is her consumption in period $t = 1, 2$. Note that there is no aggregate risk in this economy, so that a well-diversified consumer chooses her first-period consumption (along with the residual saving) and second-period consumption by maximizing her utility subject to her lifetime budget constraint. This maximization delivers the standard intertemporal condition:

$$U_1/U_2 = 1 + r, \tag{18}$$

where U_i is the partial derivative of U with respect to $C_i,\ i = 1, 2$.

In this small open economy, domestic investment can be financed by both domestic savings and capital imports.

The intertemporal resource constraint is given by:

$$
\begin{aligned}
& C_1 + (1+r)^{-1}C_2 + N[G(\varepsilon_1) - G(\varepsilon_2)][K_D - (1-\delta)K_0] + NG(\varepsilon_3)[K_E - (1-\delta)K_0] \\
& = NF(K_0) + N[1 - G(\varepsilon_1)]P(\varepsilon_1) + (1+r)^{-1}N[G(\varepsilon_1) \\
& - G(\varepsilon_2)]\left\{F(K_D)[1 + e_{12}(\varepsilon_2, \varepsilon_1)] + (1-\delta)K_D\right\} \\
& + (1+r)^{-1}N[G(\varepsilon_2) - G(\varepsilon_3)]\left\{F[(1-\delta)K_0][1 + e_{23}(\varepsilon_3, \varepsilon_2)] + (1-\delta)^2 K_0\right\} \\
& + (1+r)^{-1}NG(\varepsilon_3)\left\{F(K_E)[1 + e_3(\varepsilon_3)] + (1-\delta)K_E\right\}.
\end{aligned} \tag{19}
$$

It states that the present value of consumption and domestic investment in the non-FDI firms (that is, the uses of funds) cannot exceed the present value of national output and the undepreciated stocks of capital at the end of the production process of the same firms and the revenues from the sale of the FDI firms (that is, the sources of funds). Note also that, in period one, there is an amount of output $NF(K_0)$ whose production began one period earlier.

The capital inflows, denoted FI (for foreign investment) simply equal the excess of domestic investment over domestic saving, that is

$$
\begin{aligned}
FI \;=\; & N\int_{\varepsilon_1}^{1}[K(\varepsilon) - (1-\delta)K_0]g(\varepsilon)d\varepsilon + N[1 - G(\varepsilon_1)]C(\varepsilon_1) \\
& + N[G(\varepsilon_1) - G(\varepsilon_2)][K_D - (1+\delta)K_0] \\
& + NG(\varepsilon_3)[K_E - (1-\delta)K_0] - [NF(K_0) - C_1].
\end{aligned} \tag{20}
$$

Out of this FI flows, FDI constitutes of the first two terms on the right-hand side of equation (20), which measure the domestic investment made by the FDI firms, plus the price (that is, $N[1-G(\varepsilon_1)]P(\varepsilon_1)$) that the foreign direct investors paid to the original domestic owners for the FDI firms. We emphasize that this is only a gross measure of the FDI flows, because these flows may often be accompanied by a portfolio outflow when the FDI firms are domestically leveraged, both with respect to its initial acquisition and its investment.

5 Gains from FDI

We have already mentioned that competition among the foreign direct investors drives down their rent from their better access to the skimming technology to zero. This is formally seen from equation (7) which states that their gross rent [namely, $V(\varepsilon_1) - P(\varepsilon_1)$] is fully exhausted by the cost [namely, $C_1(\varepsilon_1)$]. Also, because the domestic economy is a small one and thus the intertemporal terms of trade (namely, the interest rate) are constant, the foreign portfolio equity investors and lenders do not gain anything from their investments in our small economy. Thus, the rest of the world has naturally no gains from trade. However, our small open economy does have some gains from the FDI flows. In the absence of the skimming technology brought about by FDI, the original domestic owners would not be able to distinguish between the medium-high productivity firms (that is, the firms with productivity factors above ε_2 and below ε_1) and the top productivity firms (that is, the firms with productivity factors above ε_1). Thus, they will pre-determine the same investment level (say, K_D^-) for these two groups of firms (that is, all the firms with productivity factors above ε_2). Whereas, in the presence of FDI, they can pre-determine one investment level (K_D) for the first group of firms and another level (K_F) for the second group of firms. Naturally, this one additional degree of freedom provided by FDI (or, more accurately, by the access to the skimming technology brought about by FDI) is beneficial to our small open economy. (Note that the additional gain provided later by replacing the ε-independent K_F in the FDI firms by an ε-dependent capital schedule $K(\varepsilon)$ is full captured by the foreign direct investors and just suffices to cover their skimming cost.)

We can also derive the marginal gain (denoted by MG) from FDI, defined by the net present value of the additional resources that become available to the domestic economy from enlarging the group of the FDI firms by one firm [namely, from lowering ε_1 by $1/g(\varepsilon_1)$]. It is equal to:

$$\begin{aligned} MG(\varepsilon_1) = &\left\{(1+r)^{-1}[F(K_F)(1+\varepsilon_1) + (1-\delta)K_F] - [K_F - (1-\delta)K_0]\right\} \\ &- \left\{(1+r)^{-1}[F(K_D)(1+\varepsilon_1) + (1-\delta)K_D] - [K_D - (1-\delta)K_0]\right\} \end{aligned} \tag{21}$$

(see the appendix). The interpretation of equation (21) is straightforward. Lowering ε_1 by $1/g(\varepsilon_1)$ amounts to shifting one firm from the non-FDI group to the FDI group. It means that the capital stock of the shifted firm (which has the cutoff productivity factor ε_1) is changed from K_D to K_F. The first curly-bracketed term on the

right-hand side of equation (21) is the net present value of the ε_1-firm when its stock of capital is K_E. Similarly, the second curly-bracketed term on the right-hand side of equation (21) is the net present value of the ε_1-firm when its stock of capital is K_D. Therefore, the difference between these two terms is the net gain from increasing the number of FDI firms by one.

We can show that some FDI is always beneficial to the host country. To see this, evaluate the marginal gain from FDI at autarky, that is at $\varepsilon_1 = 1$. At this point, the first curly-bracketed term must be larger than the second curly-bracketed term on the right-hand side of equation (21), because the group of FDI firms consists of just one type of firms, that is the ε_1-type, and K_F maximizes the value of this type of firms, whereas K_D does not.

6 Constrained Efficiency

An intrinsic feature of this economy is that the investment rule cannot be fine-tuned to be completely ε-dependent. Therefore, for a sensible evaluation of this market solution, we look for a benchmark efficiency concept that respects this quasi-institutional constraint.

This constraint boils down to dividing the firms into at most four categories: low-productivity investing firms, medium-low-productivity non-investing firms, medium-high productivity investing firms, and high-productivity investing firms to be sold to foreign direct investors. We first ask whether the market distribution of the firms into these four categories is efficient. We then ask whether the investment levels for the firms in the three investing categories are efficient.[8]

The objective is to maximize the utility of the single (representative) consumer, subject to the resource

[8] This idea of constrained efficiency follows a long tradition that started with Diamond (1967).

constraint (19). It is convenient to substitute for $P(\varepsilon_1)$ from equation (4) into equation (19) to get:

$$\begin{aligned}
&C_1 + (1+r)^{-1}C_2 + N[1-G(\varepsilon_1)][K_F - (1-\delta)K_0] \\
&+ N[G(\varepsilon_1) - G(\varepsilon_2)][K_D - (1-\delta)K_0] + NG(\varepsilon_3)[K_E - (1-\delta)K_0] \\
&= NF(K_0) + (1+r)^{-1}N[1-G(\varepsilon_1)]\left\{F(K_F)[1+e_1(\varepsilon_1)] + (1-\delta)K_F\right\} \\
&+ (1+r)^{-1}N[G(\varepsilon_1) - G(\varepsilon_2)]\left\{F(K_D)[1+e_{12}(\varepsilon_2,\varepsilon_1)] + (1-\delta)K_D\right\} \\
&+ (1+r)^{-1}N[G(\varepsilon_2) - G(\varepsilon_3)]\left\{F[(1-\delta)K_0][1+e_{23}(\varepsilon_3,\varepsilon_2)] + (1-\delta)^2K_0\right\} \\
&+ (1+r)^{-1}NG(\varepsilon_3)\left\{F(K_E)[1+e_3(\varepsilon_3)] + (1-\delta)K_E\right\}.
\end{aligned} \tag{22}$$

The control variables are ε_1, ε_2, ε_3 and K_F, K_D and K_E. (Note that eventually K_F will not be implemented because the new FDI owners will replace it by an ε-dependent capital schedule; however, K_F determinates the price at which the foreign direct investors purchase the FDI firms.)

The efficiency aspects of the determination of the non-FDI variables (namely, ε_2, ε_3, K_D and K_E) were fully analyzed in Razin, Sadka and Yuen (2000), and we shall not repeat this here. We focus on the FDI variables K_F and ε_1. The efficient K_F and ε_1, denoted by K_F^* and ε_1^*, respectively, must satisfy the following first-order conditions:

$$F'(K_F^*)[1+e_1(\varepsilon_1^*)] = \delta + r \tag{23}$$

and

$$\begin{aligned}
&(1+r)^{-1}[F(K_F^*)(1+\varepsilon_1^*) + (1-\delta)K_F^*] - [K_F^* - (1-\delta)K_0] \\
&= (1+r)^{-1}[F(K_D^*)(1+\varepsilon_1^*) + (1-\delta)K_D^*] - [K_D^* - (1-\delta)K_0],
\end{aligned} \tag{24}$$

where K_D^* is the efficient K_D (the capital stock of the debt-financed, non-FDI firms). These efficiency conditions for K_F and ε_1 are different from the market equations (3) and (7).[9] Therefore we cannot a priori determine whether FDI flows are efficient, or whether they are inadequate or excessive.

[9] Furthermore, note that the efficiency conditions (23) and (24) depends also on K_D^*, whereas the market equations (3) and (7) do not depend on K_D and can be solved for K_F and ε_1, independently of the rest of the economy.

7 Conclusion

We developed a model in which foreign direct investors are better equipped and experienced in skimming the "good" firms than their domestic counterparts. Employing this technology, the foreign direct investors are able to outbid domestic and foreign portfolio investors for the good firms. We emphasize a second feature of FDI which is hands-on management standards that enable them to react in real time to a changing business environment. This feature allows foreign direct investor to recover the cost of the skimming technology.

We are able to establish a pecking order among capital flows: high-productivity firms are acquired by foreign direct investors; medium-high-productivity firms attract debt flows; and low-productivity firms attract portfolio equity flows. In this context, we are able to establish the clear existence of gains from FDI to the host economy. Nevertheless, it is impossible to determine whether the FDI flows are efficient, or whether they are inadequate of excessive.

A Appendix: The Marginal Gain from FDI

In this appendix we derive equation (21). Moving all the expressions on the left-hand side of equation (22) to its right-hand side and differentiating it with respect to ε_1 yields:

$$\begin{aligned} -Ng(\varepsilon_1)[MG(\varepsilon_1)] &= Ng(\varepsilon_1)[K_F-(1-\delta)K_0]-Ng(\varepsilon_1)[K_0-(1-\delta)K_0] \\ &\quad -(1+r)^{-1}Ng(\varepsilon_1)\left\{F(K_F)[1+e_1(\varepsilon_1)]+(1-\delta)K_F\right\} \\ &\quad +(1+r)^{-1}N[1-G(\varepsilon_1)](K_F)\frac{de_1}{d\varepsilon_1}(\varepsilon_1) \\ &\quad +(1+r)^{-1}Ng(\varepsilon_1)\left\{F(K_D)[1+e_{12}(\varepsilon_2,\varepsilon_1)]+(1-\delta)K_D\right\} \\ &\quad +(1+r)^{-1}N[G(\varepsilon_1)-G(\varepsilon_2)]F(K_D)\frac{\partial e_{12}}{\partial \varepsilon_1}(\varepsilon_2,\varepsilon_1). \end{aligned} \tag{A.1}$$

Note that increasing ε_1 by one unit amounts to lowering the number of FDI firms by $Ng(\varepsilon_1)$ firms; therefore the derivative of transformed resource constraint with respect to ε_1 is equal to $-Ng(\varepsilon_1)[MG(\varepsilon_1)]$. From equation (2) we get:

$$\frac{de_1}{d\varepsilon_1}=\frac{g(\varepsilon_1[e_1(\varepsilon_1)-\varepsilon_1]}{1-G(\varepsilon_1)} \tag{A.2}$$

and from equation (11) we get

$$\frac{\partial e_{12}}{\partial \varepsilon_1} = \frac{g(\varepsilon_1)[\varepsilon_1 - e_{12}(\varepsilon_2, \varepsilon_1)]}{G(\varepsilon_1) - G(\varepsilon_2)}. \tag{A.3}$$

Substituting equations (A2) and (A3) into equation (A1) and re-arranging terms yield equation (21).

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