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An Information-Based Model of Foreign Direct Investment: The Gains from Trade Revisited
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ABSTRACT

Foreign direct investment (FDI) is observed to be a predominant form of capital flows to emerging economies, especially when they are liquidity-constrained internationally during a global financial crisis. The financial aspects of FDI are the focus of the paper. We analyze the problem of channeling domestic saving into productive investment in the presence of asymmetric information between the managing owners of firms and the other portfolio stakeholders. We explore the role played by FDI in reviving equity-financed capital investment for economies plagued by such information problems. In the presence of asymmetry, the paper identifies how, however, FDI gives rise to foreign overinvestment as well as domestic undersaving. We re-examine the gains from trade argument (applied to intertemporal trade) in this case of informational-asymmetry driven FDI. We show that the gains could be sizable when the domestic credit market is either underdeveloped or failing as a result of a financial crisis. But with well-functioning domestic credit market, the gains turn into losses. Surprisingly, capital may flow into the country even though the autarkic marginal productivity of capital in the domestic economy falls short of the world rate of interest. In such a situation, capital should have efficiently flown out rather than in, and FDI is a loss-generating phenomenon.

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1 Introduction

The financial turmoil in East Asia was both a consequence of, and a trigger for, severe international illiquidity.[1] Despite their being liquidity-constrained internationally when foreign bank lending and foreign portfolio equity flows dried up, the Asian crisis economies continued to be the recipients of large foreign direct investment (FDI) flows which remarkably did not decline at all (see figure 1). This striking episode underscores an important feature of FDI: it serves as a major link between the domestic capital market and the world capital market when other types of international financial investment dry up. This paper develops a model aimed at highlighting this important role of FDI, and addresses the issue of whether this type of international capital market link through FDI is in general also beneficial from the social welfare viewpoint.

[1] See, for example, Roberto Chang and Andrès Velasco (1998) who trace the emergence of international illiquidity to the shortening of the foreign debt structure, the different currency denomination of assets and liabilities, and a vulnerability triggered by financial liberalization.

In a formal sense, foreign acquisition of shares in domestic firms is classified as FDI when the shares acquired exceed a certain fraction of ownership (usually, 10-20%). From an economic perspective, however, FDI is not just a purchase of a sizable share in a company but, more importantly, is an actual exercise of control and management. The exercise of control enables the foreign direct investors better access to **information** about the acquired firm's current and potential performance than what is generally available to a minority shareholder.

Frequently, there is a significant asymmetry in information between the managing stockholders (owners-managers) and other portfolio stakeholders (such as the debt and small equity holders) . In the absence of FDI, this informational asymmetry causes a market failure which can be quite severe in the case of equity-financed capital investment. In such case, the equity market shrinks to a lemon market á la Akerlof (1970), implying a severe shortage of financing for capital investment. We show here that FDI has an essential role to play in restoring the functioning of the domestic equity market for capital investment. As indicated, though, such a market will not be fully efficient because it leads to foreign over-investment and domestic under-saving.[2]

The international trade literature looked carefully at the interactions between FDI and international trade, focussing on the role of multinationals and the role of FDI in explaining intra-industry trade (see Helpman (1984) and an empirical assessment by Wickham and Thompson (1989)). Brainard (1993 a,b) provides a useful empirical assessment of the trade off between the proximity to the market and the advantages of concentration in production. FDI is the main instrument that affects this tradeoff. Goldberg and Klein (1997) investigate the relationship between trade, FDI and the real exchange rate. To complement this liter-

[2]See Frenkel, Razin and Sadka (1991) for a discussion of these two wedges of inefficiency associated with capital flows and their corrective tax implications.

ature, we identify in this paper a distinct mechanism associated with FDI. Our analysis of the financial sides of FDI therefore add a new mechanism to the variety of explanations for the widespread flows of FDI in the world economy.

The inefficiencies associated with FDI finance may sometimes dominate the traditional gains from trade emanating from directing capital from the world market where the rate of interest is relatively low to the domestic capital market where the return to capital is relatively high. Furthermore, the inefficient domestic capital market may attract FDI even when the domestic social rate of return to capital is below the world rate of interest. In such a case financial liberalization may even misdirect the world capital flows. Accordingly, we demonstrate how the existence of informational asymmetry driven FDI can actually turn the gains from international (intertemporal) trade into strict losses.

The organization of the paper is as follows. Section II develops an FDI-equity model without a domestic credit market and examines the welfare gains (losses) from FDI. Section III introduces a well-functioning domestic credit market and reexamines the gains (losses) from FDI. Concluding remarks are provided in Section IV.

2 Foreign Direct Investment and Equity Finance

In this section and the next, we assume a two-period model of a small, capital-importing country, referred to as the home country. It is assumed that capital imports are channelled solely through foreign direct investment (FDI). The economy is small enough so that, in the absence of any government intervention, it faces a perfectly elastic supply of external funds at a given risk-free world rate of interest, r^*.

We follow Gordon and Bovenberg (1996) and Razin, Sadka, and Yuen (1998a, 1999) in modelling the risk in this economy. 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 δ . 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. (ε is bounded from below by 1, so that output is always nonnegative.) We assume that ε is purely idiosyncratic, so that there is no aggregate uncertainty. Through optimal portfolio decisions, consumers-investors will thus behave in a risk-neutral way.

Investment decisions are made by the firms before the state of the world (i.e., ε) is known.[3] Since all firms face the same probability distribution of ε, they all choose the same level of investment. They then seek funds to finance the investment. At this stage, the owners-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. In order to facilitate the analysis, however, we simply assume that the owners-managers, being "close to the action", observe ε before they make their financing decisions; but the fund-providers, being "far away from the action", do not.

In this section where investment is equity-financed, the original owners-managers observe ε while the new potential shareholders of the firm do not. The market will be trapped in the lemon situation described by Akerlof (1970). At the price offered by the new (uninformed) potential equity buyers, which reflects the average productivity of all firms (i.e., the average level of ε) in the market, the owner-manager of a firm experiencing a higher-than-average value of ε will not be willing to sell its shares and will pull out of the market completely. The equity market will fail to serve its investment financing functions

[3] For a principal-agent foundations for such an economic structure in which investment is precommitted before the realization of the productivity parameter see Sosner (1998).

efficiently. We therefore turn to consider another source of equity finance - viz. international capital flows in the form of foreign direct investment (FDI).

2.1 The FDI-Equity Equilibrium

In a formal sense, foreign acquisition of shares in domestic firms is classified as FDI when the shares acquired exceed a certain fraction of ownership (say, 10-20%). From an economic point of view, we look at FDI not just as ownership of a sizable share in a company but, more importantly, as an actual exercise of control and management and acquisition of inside information (the value of ε in our model).

Suppose that foreign direct investors purchase domestic companies from scratch, at the "greenfield" stage, i.e., before any capital investment is made.[4] For the sake of simplicity and in order to focus on FDI, we ignore, with no loss of generality, all other sectors of the economy in which information is symmetric, and assume that foreign direct investors acquire all the greenfield investment sites. Any single home investor who lacks access to foreign capital markets cannot challenge the foreign direct investors for these sites. Note that if a home investor uses only her own fund, she can purchase only a tiny fraction of a greenfield investment site. In such a case, she cannot gain control of the site and the informational advantage entailed by such control.

Upon acquisition and before ε is known, these foreign investors make their capital investment decisions. The realized value of ε is then revealed to them, but not to the potential new equity holders who are solicited to finance the capital investment. Being unable to observe ε , domestic investors will offer the same price for all firms, reflecting the

[4]For instance, Barry and Bradley (1997) report that "... most of the FDI into Irish manufacturing entails the construction of entirely new state-of-the-art factories on green-field sites..." (p. 1809). This is not the case in Central and Eastern Europe where most of the FDI flows to "brown-field" sites.

average productivity for the group of low productivity firms they purchase. On the other hand, the foreign direct investors who do observe ε will not be willing to sell at this price the firms which experience high values of ε. Therefore, there will be a cutoff level of ε, say ε^o, such that all firms which experience a lower value of ε than the cutoff level will be purchased by domestic investors. All other firms will be retained by the foreign direct investors.

Define e^- as the mean value of ε realized by the low productivity firms:

$$e^-(\varepsilon^o) \equiv E(\varepsilon/\varepsilon \leq \varepsilon^o), \tag{1}$$

i.e., e^- is the conditional expectation of ε, given that $\varepsilon \leq \varepsilon^o$. For later use, we also denote by $\varepsilon^+(\varepsilon^o)$ the conditional expectation of ε, given that $\varepsilon \geq \varepsilon^o$:

$$e^+(\varepsilon^o) \equiv E(\varepsilon/\varepsilon \geq \varepsilon^o) \tag{2}$$

Note that the weighted average of $e^-(\varepsilon^o)$ and $e^+(\varepsilon^o)$ must yield the average value of ε, that is:

$$\Phi(\varepsilon^o)e^-(\varepsilon^o) + [1 - \Phi(\varepsilon^o)]\, e^+(\varepsilon^o) = E(\varepsilon) = 0, \tag{3}$$

where $\Phi(\cdot)$ is the cumulative probability distribution of ε, i.e., $\Phi(\varepsilon^o) = prob(\varepsilon \leq \varepsilon^o)$. Equation (3) also implies that $e^-(\varepsilon^o) < 0$ while $e^+(\varepsilon^o) > 0$ i.e., the expected value of ε for the "bad" ("good") firm is negative (positive).

The cutoff level of ε is then defined by:

$$\left\{F(K)\left[1+e^{-}(\varepsilon^{o})\right]+(1-\delta)K\right\}/(1+\bar{r}) \qquad (4)$$
$$= \left[F(K)(1+\varepsilon^{o})+(1-\delta)K\right]/(1+r^{*}) \quad ,$$

where $\bar{r}$ is the domestic consumer rate of interest (return). The value of a typical domestic firm in the second period is equal to its output, plus the undepretiated capital, i.e., $F(K)(1+\varepsilon)+(1-\delta)K$. Since domestic equity investors will buy only those firms with $\varepsilon \leq \varepsilon^{o}$, the expected second-period value of a firm they buy is $F(K)\left[1+e^{-}(\varepsilon^{o})\right]+(1-\delta)K$, which they then discount by the factor $1+\bar{r}$ to determine the price they are willing to pay in the first period. At equilibrium, this price is equal to the price that a foreign direct investor is willing to accept for the firm which experiences a productivity value of ε^{o}. The cutoff price is equal to the expected value of the marginal ε^{o}-firm, $F(K)(1+\varepsilon^{o})+(1-\delta)K$, discounted by a factor $1+r^{*}$. Firms that experience a value of ε higher than ε^{o} are retained by the foreign direct investors. This explains the equilibrium condition (4).

As $e^{-}(\varepsilon^{o}) < \varepsilon^{o}$, an interior equilibrium (i.e., $-1 < \varepsilon^{o} < 1$) requires that the foreigners' rate of return (r^{*}) be higher than the residents' rate of return (r). In some sense, this means that domestic investors are "overcharged" by foreign direct investors for their purchases of domestic firms. These foreign investors will not accept a price below $\{F(K)(1+\varepsilon^{o})+(1-\delta)K\}/(1+r^{*})$ for the low productivity firms. Note the crucial role of FDI in allowing for an international rate-of-return differential (viz., $r^{*} > \bar{r}$). This differential is essential for the existence of an equity market. In an autarkic situation without FDI, there is no rate-of-return differential between the original owner-managers and potential equity buyers. Without this differential, the market will collapse to one of "lemons" and it will be difficult to equity-finance capital investment.

Consider the capital investment decision of the firm that is made before ε becomes known, while it is still owned by foreign direct investors. The firm seeks to maximize its market value, net of the original investment. With a probability $\Phi(\varepsilon^o)$, it will be sold to domestic investors, who pay $\{F(K)[1+e^-(\varepsilon^o)] + K(1-\delta)\}/(1+\bar{r})$. With a probability $[1-\Phi(\varepsilon^o)]$, it will be retained by the foreign investors, for whom it is worth on average $\{F(K)\,[1+e^+(\varepsilon^o)] + (1-\delta)K\}\,/(1+r^*)$. Hence, the firm's expected market value, net of the original capital investment, is:

$$
\begin{aligned}
V \;=\; & \Phi(\varepsilon^o)\left(\left\{F(K)\left[1+e^-(\varepsilon^o)\right] + (1-\delta)K\right\}/(1+\bar{r}) - \left[K-(1-\delta)\,K_o\right]\right) \\
& + [1-\Phi(\varepsilon^o)]\left(\left\{F(K)\left[1+e^+(\varepsilon^o)\right] + (1-\delta)K\right\}/(1+r^*) - \left[K-(1-\delta)K_o\right]\right),
\end{aligned} \tag{5}
$$

where $K-(1-\delta)K_o$ is gross investment and K_o is the initial stock of capital. Maximizing this expression with respect to K yields the following first-order condition:

$$
\begin{aligned}
& \Phi(\varepsilon^o)\left\{F'(K)\left[1+e^-(\varepsilon^o)\right] + (1-\delta)\right\}/(1+\bar{r}) \\
+ & [1-\Phi(\varepsilon^o)]\,F'(K)\left[1+e^+(\varepsilon^o)\right] + (1-\delta)\}/(1+r^*) = 1.
\end{aligned} \tag{6}
$$

Equation (6) implies that:

$$
\bar{r} < F'(K) - \delta < r^*. \tag{7}
$$

A formal proof of these inequalities is provided in Appendix A.

Notice that the "textbook presumption" is that in the absence of capital flows (i.e., in a financial autarky) the domestic net-of-depreciation marginal productivity of capital (i.e., $F'(K_o) - \delta$) exceeds the world rate of interest r^*. We have shown that the flows of FDI bring down the net-of-depreciation marginal productivity of capital (i.e. $F'(K) - \delta$) below the world rate of interest. Thus, FDI transforms the initial shortage of domestic capital into an overly abundant stock of domestic capital, that is, we have foreign over-investment. Furthermore, the more surprising effect of FDI occurs when the "textbook presumption" of an initial shortage of capital does not hold (i.e., when $F'(K_o) - \delta < r^*$). In this case, capital inflows are not fundamentally needed. Nevertheless, the odd nature of incentives which emanate from the domestic equity market, plagued by asymmetric information, elicits capital inflows. These misdirected flows of capital widen the gap between the relatively high world rate of interest and the relatively low net-of-depreciation marginal productivity of capital.

The (maximized) value of V in (5) is the price paid by the foreign direct investors at the greenfield stage of investment. Since the value of ε is not known at this point, the same price is paid for all firms. Note, however, that some of the firms are then resold to domestic savers, so that net foreign direct investment (FDI) is equal to:

$$FDI = N[1 - \Phi(\varepsilon^o)]\{[K - (1-\delta)K_o] + \hat{V}\}, \tag{8'}$$

where

$$\hat{V} \;=\; \{F(K)[1 + e^+(\varepsilon^o)] + (1-\delta)K\} \;/\; (1 + r^*) - [K - (1-\delta)K_o]. \tag{9}$$

(Recall that {V-[1-$\Phi(\varepsilon^o)]\hat{V}$} / $\Phi(\varepsilon^o)$ is the price at which the low-productivity firms are resold to domestic savers. It is assumed that the foreign direct investors import capital to finance investment in the high-productivity firms which they retain.

Employing (9), equation (8′) reduces to:

$$FDI = N[1 - \Phi(\varepsilon^o)]F(K)[1 + e^+(\varepsilon^o)] \;/\; (1 + r^*). \tag{8}$$

The remaining equilibrium conditions are standard. In the first period, the economy faces a resource constraint stating that FDI must suffice to cover the difference between domestic investment (viz. $N[K - (1-\delta)K_o]$) and national savings (viz., the difference between the first period output and consumption, $NF(K_o) - c_1$:

$$FDI = N[K - (1-\delta)K_o] - [NF(K_o) - c_1]. \tag{10}$$

Since foreigners will be able to extract from the home country an amount of $1 + r^*$ units of output in the second period for each unit that they invest in the first period, the home country faces the following second-period budget constraint:[5]

$$NF(K) + (1-\delta)NK - FDI(1 + r^*) = c_2. \tag{11}$$

That is, the second period gross *national* output (namely, $NF(K) - FDI(1 + r^*)$), plus the undepreciated capital, (namely, $(1-\delta)K$), must suffice to support private consumption (c_2).

[5]Note that aggregate output is $NF(K)$, since $E(\varepsilon) = 0$.

Employing (10), one can rewrite (11) in present value terms as:

$$\begin{aligned} NF(K_o) + N[F(K) + (1-\delta)K]/(1+r^*) &= c_1 + c_2/(1+r^*) \\ &\quad + N[K - (1-\delta)K_o]. \end{aligned} \tag{12}$$

Naturally, c_1 and c_2 are determined by the single utility-maximizing consumer and must satisfy the following first-order condition:

$$\frac{\partial u}{\partial c_1}(c_1, c_2) \ / \ \frac{\partial u}{\partial c_2}(c_1, c_2) = 1 + \bar{r}, \tag{13}$$

where u is the consumer's utility function.

In this model the six equations - (4), (6), (8), (10), (11) and (13) - determine the six endogenous variables - ε^o, r, K, FDI, c_1 and c_2.

2.2 Gains from Trade

We have demonstrated the crucial role of FDI in sustaining a non-"lemon"-type domestic equity market, albeit not a fully efficient market. There is also a second role, the traditional "gains from trade" role of directing foreign savings into domestic investment. To flash out in a simplified manner the kind of gains or losses brought about by FDI, we compare the laissez-faire allocation in the presence of FDI with the closed economy laissez-faire allocation.

The laissez-faire allocation in the presence of FDI is characterized by:

$$\bar{r} < F'(K) - \delta < r^*.$$

(see equation (7)). The first inequality states that the return accruing to domestic savers (i.e., $\bar{r}$) is below the return to the economy (i.e., $F'(K) - \delta$). This indicates that domestic households under-save. The second inequality states that the return accruing to the economy from the inflow of foreign capital (i.e., $F'(K) - \delta$) is below its cost to the economy (i.e., r^*), indicating excessive capital inflows. Therefore, the laissez-faire allocation with FDI is characterized by domestic undersaving and foreign overinvestment.[6]

In a closed economy, the original owner of a greenfield investment site cannot finance capital outlays on her own. She has to appeal instead to the domestic equity market. In this case the economy will be trapped in a "lemon"-type equilibrium. Any owner-manager of a firm realizing a higher-than-average productivity factor (ε) will pull out of the market which prices all firms according to their average productivity. The market thus shrinks to "lemons", the shares of the firms with the lowest productivity. Strictly speaking, no new investment can be financed through the equity market and all firms will simply produce with their initial stock of capital which is K_o.[7] In this autarkic economy there is no capital market and there is neither saving nor investment.

In this case with no domestic credit, FDI has conflicting effects on welfare. Its first crucial (and unique to this model) role discussed above is to facilitate the chanelling of domestic saving into domestic investment. This, by itself, is welfare enhancing. But, as we

[6] One can show that it is possible to restore a first-best efficiency (i.e., $\bar{r} = F'(K) - \delta = r^*$) by employing a Pigouvian corrective policy which consists of a corporate income subsidy and a tax on capital income of non-residents.

[7] One can restore some investment into this closed economy by modifying the decision-making process of the firm; see Appendix B.

have already indicated, FDI is driven also by distorted incentives and its traditional role of directing foreign savings into domestic investment generates an excessive stock of domestic capital. (Either when capital inflows were not all needed or when they were needed to start with, too much of them took place). This foreign overinvestment (coupled with domestic undersaving) tends to reduce welfare.

We use numerical examples to illustrate the total effect of FDI on welfare. In these examples we employ a log linear utility function ($u(c_1, c_2) = \log c_1 + \gamma \log c_2$), with a subjective discount factor γ, a uniform distribution of ε, and a Cobb-Douglas production function. The welfare gain (loss) is measured by the uniform percentage change (in c_1 and c_2) which is needed in order to lift the autarkic utility level to the FDI utility level. These welfare gains (losses) were calculated for various levels of r^*, ranging from 1.0 to 3.5. (These rates correspond to real annual rates of interest, ranging from 2.8% to 6.2% on a 25-year period interval.) When initially there is a positive gap between the net-of-depreciation marginal productivity of capital (i.e., $F'(K_o) - \delta - r^* > 0$) which is relatively high, so that the traditional gains from trade are potentially large, the total effect of FDI on welfare is positive. At $r^* = 1$, the welfare gain is quite large, about 8.4% of life-time consumption. As r^* rises, and consequently the gap between the net-of-depreciation marginal product of capital and the world rate of interest narrows down, the welfare gain shrinks to zero. The asymmetric information inefficiency effect dominates and the welfare gain turns into a loss when this gap is still positive. Naturally, when the gap is negative and to start with there is no economic need for capital inflows, there is a welfare loss which reaches 2% of life-time consumption at $r^* = 3.5$.[8]

[8] For another example of misdirected capital flows in the context of international trade with differentiated products, see Helpman and Razin (1983).

3 FDI with Domestic Equity and Credit

In the preceding section we have demonstrated that the gains from trade that were brought by FDI can be quite sizable. In fact, FDI fulfilled several roles: It created an active (albeit distorted) domestic stock market that facilitated new investment; it also facilitated the chanelling of foreign saving to the emerging domestic stock market which helps finance part of the new investment. This is why the gains from trade through FDI were rather substantial.

However, when a domestic credit market is doing most of the job of chanelling domestic savings into domestic investments, the role of FDI diminishes. Furthermore, it is often observed that FDI is highly leveraged domestically; that is, after gaining control of the domestic firm, a foreigh direct investor resorts to the domestic credit market to finance new investments. We thus extend in this section the model of the preceding section to include a domestic credit market. We then demonstrate, somewhat surprisingly, that not only the gains from trade through FDI diminish, but that they can well be significantly negative.

3.1 The FDI-Equity-Credit Equilibrium

The sequencing of firm decisions is as follows. Before ε is revealed to anyone (i.e., under symmetric information), foreign investors bid up domestic firms from their original domestic owners, investment decisions are made, and full financing through domestic credit is secured. Then, ε is revealed to owners-managers (who are all foreigners), but not to domestic equity investors. At this stage, shares are offered in the domestic equity market and the ownership in some of the firms is transferred to the domestic investors. The foreign direct investors are able in the initial stage (i.e., before ε is revealed to anyone) to outbid the domestic savers because the latter lack access to large amounts of funds necessary in order to seize control of firms while the former, by assumption, are not liquidity constrained.

Since credit is extended ex ante, before ε is revealed, firms cannot sign default-free loan contracts with the lenders. We therefore consider loan contracts which allow for the possibility of default. We adopt the "costly state verification" framework á la Townsend (1979) in assuming that lenders make firm-specific loans, charging an interest rate of r^j to firm j $(0 \leqq j \leqq N)$.[9] The interest and principal payment commitment will be honored when the firms encounter relatively good shocks, and defaulted when they encounter relatively bad shocks. The loan contract is characterized by a loan rate (r^j), with possible default, and a threshold value $(\bar{\varepsilon}^j)$ of the productivity parameter as follows:

$$F(K^j)(1+\bar{\varepsilon}^j) + K^j(1-\delta) = [K^j - K_o^j(1-\delta)](1+r^j). \tag{14}$$

When the realized value of $\varepsilon^j >$ is larger than $\bar{\varepsilon}^j$, the firm is solvent and will thus pay the lenders the promised amount $[K' - K_o^j(1-\delta)](1+r^j)$, consisting of the principal $K^j - K_0^j(1-\delta)]$ plus the interest as given by the right-hand-side of (14). If, however, $\varepsilon^j < \bar{\varepsilon}^j$, the firm will default. In the case of default, the lenders can incur a cost in order to verify the true value of ε^j and to seize the residual value of the firm. This cost, interpretable as the cost of bankruptcy, is assumed to be proportional to the firm's realized gross return, $\mu[F(K^j)(1+\varepsilon^j) + (1-\delta)K^j]$, where $\mu \leq 1$ is the factor of proportionality. Net of this cost, the lenders will receive $(1-\mu)[F(K^j)(1+\varepsilon^j) + (1-\delta)K^j]$.

Recall that $\bar{r}$ is the expected rate of return required by domestic savers (consumers). This rate can be secured by sufficient diversification, since there is no aggregate risk. Therefore, the "default" rate of interest, r^j, must offer a premium over and above the default-free

[9] See also Stiglitz and Weiss (1981).

rate, $\bar{r}$, according to:

$$
\begin{aligned}
& \left[1-\Phi(\bar{\varepsilon}^j)\right]\left[K^j-K_0^j(1-\delta)\right](1+r^j) \qquad (15') \\
& +\Phi(\bar{\varepsilon}^j)(1-\mu)\left\{F(K^j)\left[1+e^-\left(\bar{\varepsilon}^j\right)\right]+K^j(1-\delta)\right\} \\
= \; & \left[K^j-(1-\delta)\,K_0^j\right](1+\bar{r})\,.
\end{aligned}
$$

The first term on the left-hand-side of (15′) is the contracted principal and interest payment, weighted by the no-default probability. The second term measures the net residual value of the firm, weighted by the default probability. The right-hand-side is the no-default return required by the domestic lender. Observe that (14) and (15′) together imply that:

$$\left[1-\Phi(\bar{\varepsilon}^j)\right]+\frac{\Phi(\bar{\varepsilon}^j)(1-\mu)\left\{F(K^j)\left[1+e^-\left(\bar{\varepsilon}^j\right)\right]+K^j\left(1-\delta\right)\right\}}{F(K^j)(1+\bar{\varepsilon}^j)+K^j(1-\delta)} \;=\; \frac{1+\bar{r}}{1+r^j}.$$

Since $e^-(\bar{\varepsilon}^j)<\bar{\varepsilon}^j$ and $\mu \geqq 0$, it follows that $r^j>\bar{r}$, the difference being a risk-premium (which depends, among other things, on K^j, $\bar{\varepsilon}^j$ and μ).

The firm in this setup is competitive (price-taker) with respect to $\bar{r}$ only, the market default-free rate of return. This $\bar{r}$ cannot be influenced by the firm's actions. However, r^j, K^j and $\bar{\varepsilon}^j$ are firm-specific and must satisfy equations (14) and (15′). In making its investment, $K^j-K_o^j(1-\delta)$, and its financing (loan contract) decisions, the firm takes these constraints into account. Since these decisions are made before ε is known, i.e., when all firms are (ex-ante) identical, they all make the same decision. We henceforth drop the superscript j.

The remainder of this section proceeds along similar lines as the preceding section. In the equity market which opens after ε is revealed to the (foreign) owners-managers, there is a cutoff level of ε, denoted by ε^o (generally different than the corresponding ε^o of the preceding section) such that all firms experiencing a value of ε above ε^o will be retained by the foreign direct investors and all other firms (with ε below ε^o) will be sold to domestic savers. This cutoff level of ε is given by:

$$\begin{aligned} &\frac{F(K)(1+\varepsilon^o)+(1-\delta)K-(1+r)[K-K_o(1-\delta)]}{1+r^*} \qquad (16') \\ = \; &\frac{\Phi(\varepsilon^o)-\Phi(\bar{\varepsilon})}{\Phi(\varepsilon^o)} \cdot \frac{F(K)\left[1+\hat{e}\left(\bar{\varepsilon},\varepsilon^o\right)\right]+(1-\delta)K-(1+r)[K-K_o(1-\delta)]}{1+\bar{r}} \\ &+\frac{\Phi(\bar{\varepsilon})}{\Phi(\varepsilon^o)} \cdot 0, \end{aligned}$$

where

$$\hat{e}(\bar{\varepsilon},\varepsilon^o) \equiv E\{\varepsilon/\bar{\varepsilon} \leqq \varepsilon \leqq \varepsilon^o\} \qquad (17)$$

is the conditional expectation of the $\varepsilon' s$ between $\bar{\varepsilon}$ and ε^o.

Notice that firms that experience a value of ε below $\bar{\varepsilon}$ default and have zero value. These firms are not retained by the foreign direct investors; hence $\varepsilon^o \geq \bar{\varepsilon}$. All other firms generate in the second period a **net** cash flow of $F(K)(1+\varepsilon)+K(1-\delta)-(1+r)[K-K_o(1-\delta)]$. The left-hand-side of (16′) represents the marginal (from the bottom of the distribution) firm retained by foreign investors. The right-hand-side of (16′) is the expected value of the firms that are purchased by domestic savers. With a conditional probability of $[\Phi(\varepsilon^o) - \Phi(\bar{\varepsilon})] \;/\; \Phi(\varepsilon^o)$, they generate a net expected cash flow of $F(K)[1+\hat{e}(\bar{\varepsilon},\varepsilon^o)] + K(1-\delta) - (1+$

$r)[K-(1-\delta)K_o]$; with a probability of $\Phi(\bar{\varepsilon})\ /\ \Phi(\varepsilon^o)$ they generate a zero net cash flow. This explains equation (16′).

We can substitute equation (14) into (15′) and (16′) in order to eliminate r and then rearrange terms to obtain:

$$\begin{aligned}&[1-\Phi(\bar{\varepsilon})]\,F(K)(1+\bar{\varepsilon})+\Phi(\bar{\varepsilon})(1-\mu)F(K)\left[1+e^{-}(\bar{\varepsilon})\right] \\ &\quad+[1-\Phi(\bar{\varepsilon})\mu]\,K(1-\delta)=[K-(1-\delta)K_o]\,(1+\bar{r}) \quad ,\end{aligned} \tag{15}$$

and

$$\frac{\varepsilon^o-\bar{\varepsilon}}{1+r^*}=\frac{\hat{e}(\bar{\varepsilon},\varepsilon^o)-\bar{\varepsilon}}{1+\bar{r}}\,[\Phi(\varepsilon^o)-\Phi(\bar{\varepsilon})]\ /\ \Phi(\varepsilon^o). \tag{16}$$

Consider now the capital investment decision of the firm that is made before ε becomes known, while it is still owned by foreign direct investors. With a probability of $\Phi(\varepsilon^o)-\Phi(\bar{\varepsilon})$ it will be sold to domestic savers who pay a positive price equallying

$$\{F(K)\,[1+\hat{e}(\bar{\varepsilon},\varepsilon^o)]+(1-\delta)K-(1+r)[K-K_o(1-\delta)]\}\,/(1+\bar{r}),$$

which reduces to $F(K)\,[\hat{e}(\bar{\varepsilon},\varepsilon^o)-\bar{\varepsilon}]\,/(1+\bar{r})$, where use is made of (14). With a probability of $1-\Phi(\varepsilon^o)$ it will be retained by the foreign investors for whom it is worth

$$
\begin{aligned}
& \left\{F(K)[1+e^{+}(\varepsilon^{o})]+(1-\delta)K-(1+r)[K-K_{o}(1-\delta)]\right\}/(1+r^{*}) \\
= \; & F(K)[e^{+}(\varepsilon^{o})-\bar{\varepsilon}]/(1+r^{*}),
\end{aligned}
$$

where use is made of (14). Hence, the firm seeks to maximize

$$
V=\frac{[1-\Phi(\varepsilon^{o})]F(K)[e^{+}(\varepsilon^{o})-\bar{\varepsilon}]}{1+r^{*}}+0\cdot\Phi(\bar{\varepsilon})+\frac{[\Phi(\varepsilon^{o})-\Phi(\bar{\varepsilon})]F(K)[\hat{e}(\bar{\varepsilon},\varepsilon^{o})-\bar{\varepsilon}]}{1+\bar{r}} \tag{18}
$$

subject to constraint (15), by a choice of K and $\bar{\varepsilon}$. This maximization yields the following first-order conditions:

$$
\begin{aligned}
&\left\{\frac{[1-\Phi(\varepsilon^{o})][e^{+}(\varepsilon^{o})-\bar{\varepsilon}]}{1+r^{*}}+\frac{[\Phi(\varepsilon^{o})-\Phi(\bar{\varepsilon})][\hat{e}(\bar{\varepsilon},\varepsilon^{o})-\bar{\varepsilon}]}{1+\bar{r}}\right\}F'(K) \\
&\quad +\lambda\left\{[1-\Phi(\bar{\varepsilon})](1+\bar{\varepsilon})+\Phi(\bar{\varepsilon})(1-\mu)[1+e^{-}(\bar{\varepsilon})]\right\}F'(K) \\
&\quad -\lambda(\delta+\bar{r})-\lambda\Phi(\bar{\varepsilon})\mu(1-\delta)=0 \quad ,
\end{aligned} \tag{19}
$$

and

$$
\begin{aligned}
&\left\{-\frac{1-\Phi(\varepsilon^{o})}{1+r^{*}}-\frac{\Phi'(\bar{\varepsilon})\,[\hat{e}(\bar{\varepsilon},\varepsilon^{o})-\bar{\varepsilon}]}{1+\bar{r}}\right. \\
&\quad +\frac{[\Phi(\varepsilon^{o})-\Phi(\bar{\varepsilon})][\frac{\partial\hat{e}}{\partial\bar{e}}(\bar{\varepsilon},\varepsilon^{o})-1]}{1+\bar{r}}-\lambda\Phi'(\bar{\varepsilon})(1+\bar{\varepsilon}) \\
&\quad +\lambda[1-\Phi(\bar{\varepsilon})]+\lambda\Phi'(\bar{\varepsilon})(1-\mu)[1+e^{-}(\bar{\varepsilon})] \\
&\quad \left.+\lambda\Phi(\bar{\varepsilon})(1-\mu)\frac{de^{-}(\bar{\varepsilon})}{d\bar{\varepsilon}}\right\}F(K)-\lambda\mu\Phi'(\bar{\varepsilon})K(1-\delta)=0 \quad ,
\end{aligned} \tag{20}
$$

where λ is a Lagrange multiplier. Our numerical simulations reported below suggest that in this case too there will be domestic undersaving and foreign overinvestment: $\bar{r} < F'(K) - \delta < r^*$.

The (maximized) value of V in (18) is the price paid by the foreign direct investors at the greenfield stage of investment. Since the value of ε is not known at this point, the same price is paid for all firms. As in the preceding section, the low-ε firms are then (after ε is revealed to the foreign direct investors) resold to domestic savers, all at the same price, because ε is not observed by these savers. Net capital inflows through FDI are given by:

$$FDI = N[1 - \Phi(\varepsilon^o)]F(K)[e^+(\varepsilon^o) - \bar{\varepsilon}]/(1 + r^*) \tag{21}$$

(see equation (18)). Unlike the preceding section (with no domestic credit), in this section all capital outlays are financed domestically and FDI consists only of the price paid for the ownership and control of the high-ε firms.

The remainder of equilibrium conditions is standard. The first-period resource constraint is given by:

$$FDI = N\left[K - (1 - \delta)K_o\right] - \left[NF(K_o) - c_1\right]. \tag{22}$$

The second-period resource constraint is

$$\begin{aligned} &NF(K) + (1 - \delta)NK - FDI(1 + r^*) \\ &-N\mu\Phi(\bar{\varepsilon})\left\{F(K)\left[1 + e^-(\bar{\varepsilon})\right] + (1 - \delta)K\right\} = c_2. \end{aligned} \tag{23}$$

Note that the last term on the left-hand-side of (23) reflects the existence of real default costs. Finally, utility maximization implies that

$$\frac{\partial u}{\partial c_1}(c_1, c_2) \;/\; \frac{\partial u}{\partial c_2}(c_1, c_2) = 1 + \bar{r}. \tag{24}$$

In this model the eight equations ((15), (16), (19)-(24)) determine the eight endogenous variables (K, $\bar{\varepsilon}$, ε^o, c_1, c_2, $\bar{r}$, FDI, λ).

3.2 Gains from Trade

Unlike the preceding case of no domestic credit, an autarkic economy in this case with domestic credit can still sustain savings and investments. Therefore, the crucial role of FDI as a vehicle for stimulating a domestic equity market through which domestic savings are chanelled into domestic investment is substantially less important. Consequently, the negative effect of FDI associated with the distorted incentives emanating from the domestic equity markets dominates, and there is altogether a net welfare loss from trade. Figure 3 illustrates the welfare losses occurring at various levels of the world rate of interest, r^*, for the same parameter values as in Figure 2. These losses are strikingly high, ranging from 12.5% to 14.8% of life-time consumption, as r^* varies from 1.0 to 2.8. Note that the autarkic net-of-depreciation marginal product of capital, i.e. $F'(K) - \delta$, is 2.26. In this case again we have a possibility (namely, when $r^* > 2.26$) that although the FDI flows are not fundamentally needed, since the world rate of interest exceeds the autarkic domestic rate, they do nevertheless flow in.

4 Concluding Remarks

International capital markets are notoriously imperfect. Indeed, under asymmetric information, the equity market may be plagued by the Akerlof-type lemons problem. In the absence of a well-developed domestic credit market, in which case domestic saving cannot be efficiently channelled into domestic investment, the FDI can play a double role. First, it provides a vehicle to revive the domestic equity market through which domestic savings can be directed to domestic investment; and, second, it supplies foreign savings on top of domestic savings to finance domestic investment for a capital-hungry economy.

The second role of FDI provides the traditional gains from trade to the domestic country. However, the first role, though crucial to the domestic country, is not costless: As the equity market is characterized by asymmetric information, then this market does not always generate the "correct" signals about the social rates of return to domestic capital. As a result, there are some welfare losses that offset some or all of the gains stemming from the mere channelling of domestic savings into domestic investment.

When a well-developed domestic credit market exists, through which domestic savings can be channelled into domestic investment even in the absence of an equity market, then the first role played by FDI does not generate any gain. On the contrary, the "incorrect" signalling effect entails a strict welfare loss. When FDI can be leveraged domestically (through the domestic credit market), then the traditional gains from trade associated with the second role of FDI is severely curtailed. As a result, the total net effect of FDI on the welfare of the domestic economy could well be negative.

The recent debate over international capital market liberalization generally focuses on the possible negative effects of short-term capital flows. Some economists even advocate a levy on short-term capital inflows in order to lessen the magnitude of these inflows on the grounds that such large inflows could abruptly turn around into uncontrollable capital outflows during financial crises. Although unrelated to financial crises we have seen here that at least one type of long-term capital inflow, namely FDI, may also entail some welfare loss.[10]

[10]See also Aizenman (1998) for an alternative modelling of financial intermediation that generates losses from capital inflows, based on moral hazard.

APPENDIX A: PROOF OF INEQUALITY (7)

Substituting for $1/(1+\bar{r})$ from (4) into (6) and rearranging terms we get:

$$\Phi(\varepsilon^o)[F'(K)(1+\varepsilon^o)+(1-\delta)]x+[1-\Phi(\varepsilon^o)]\{F'(K)[1+e^+(\varepsilon^o)] \\ +(1-\delta)\}=1+r^*, \tag{A1}$$

where $x=[F(K)(1+\varepsilon^o)+(1-\delta)K]\ /\ \{F(K)[1+e^-(\varepsilon^o)]+(1-\delta)K\}>1$, since $\varepsilon^o>e^-(\varepsilon^o)$. It follows from (A1) that:

$$1+r^*>[F'(K)+(1-\delta)]\{\Phi(\varepsilon^o)[1+e^-(\varepsilon^o)] \\ +[1-\Phi(\varepsilon^o)][1+e^+(\varepsilon^o)]\} \quad = F'(K)+1-\delta$$

because the term in the curly brackets is equal to one (see equation (3)). This proves the inequality at the right end of (7).

Substitute for $1+r^*$ from (4) into (6) and rearrange terms to get:

$$\Phi(\varepsilon^o)\{F'(K)[1+e^-(\varepsilon^o)]+(1-\delta)\} \\ +[1-\Phi(\varepsilon^o)]\{F'(K)[1+e^+(\varepsilon^o)]+(1-\delta)\}\ /\ x=1+\bar{r}. \tag{A2}$$

Since $x>1$, it follows from (A2) that

$$1 + \bar{r} < [F'(K) + (1 - \delta)]\{\Phi(\varepsilon^o)[1 + e^-(\varepsilon^o)]$$
$$+[1 - \Phi(\varepsilon^o)][1 + e^+(\varepsilon^o)]\} = F'(K) + (1 - \delta) \qquad ,$$

which completes the proof of (7).

APPENDIX B: AN ALTERNATIVE AUTARKIC MODEL OF DOMESTIC EQUITY MARKET WITH NO DOMESTIC CREDIT

One can restore some investment in our closed economy by modifying the decision-making process of the firm. We can envisage a two-stage decision rule imposed by firm owners on the managers. In the first period, firms determine their investment rules in the planning stage while the actual investment and its funding are delayed to the implementation stage. These investment rules are approved by the owners of the firms before ε is known. The management then implements these rules by seeking funds from the domestic equity market to finance the investment, after ε is known. They are also empowered by the owners not to invest at all when their ε is higher than some threshold level. For further discussion of the rationale behind this sequence of firm decisions, the reader is referred to Razin, Sadka and Yuen (1998b).

When the value of ε that is revealed to the manager is high enough, she would prefer to employ just the existing capital (i.e., K_o) rather than to raise equity in 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^o (generally different from the ε^o in the FDI case), such that all firms which experience a value of ε above ε^o will not make any new investment, while all other firms (i.e., the low-ε firms) will equity-finance their new investments at a price reflecting the average value of the "lemons". This cutoff level of ε is defined by:

$$\begin{aligned} & -[K^- - (1-\delta)K_o] + \{F(K^-)[1+e^-(\varepsilon^o)] + (1-\delta)K^-\} \;/\; (1+\bar{r}) \\ = \; & \{F[(1-\delta)K_o](1+\varepsilon^o) + (1-\delta)^2 K_o\}/(1+\bar{r}), \end{aligned}$$

where K^- is the stock of capital of the low-ε firms that do make new investments, and

$(1-\delta)K_o$ is the stock of capital for the high-ε firms that do not make any new investment. Thus, in contrast with the autarkic equilibrium of section 2.2, we have here a positive level of new investment.

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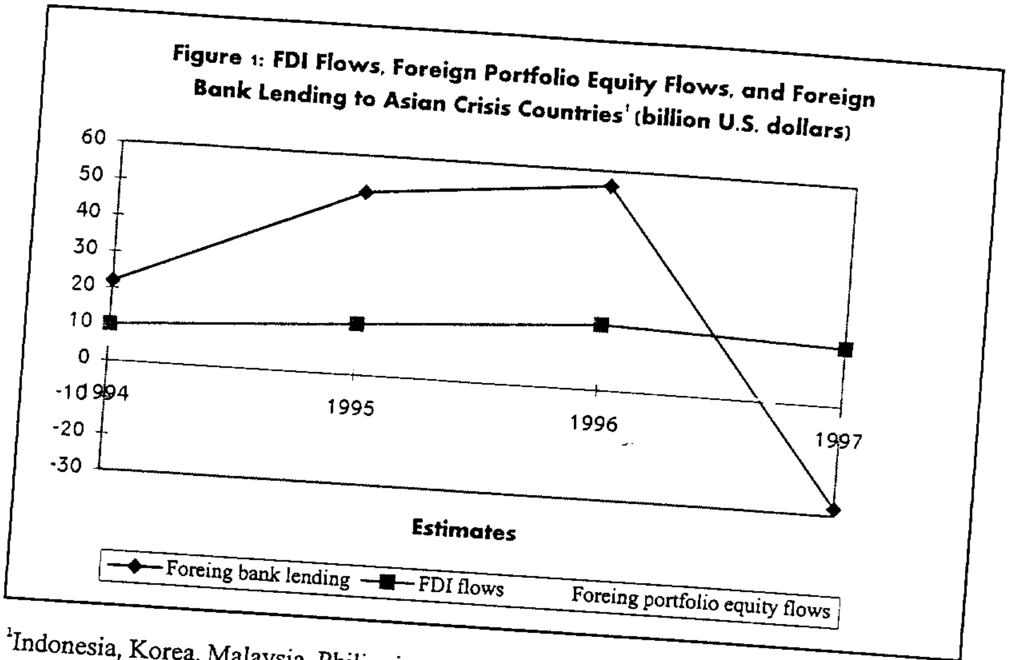
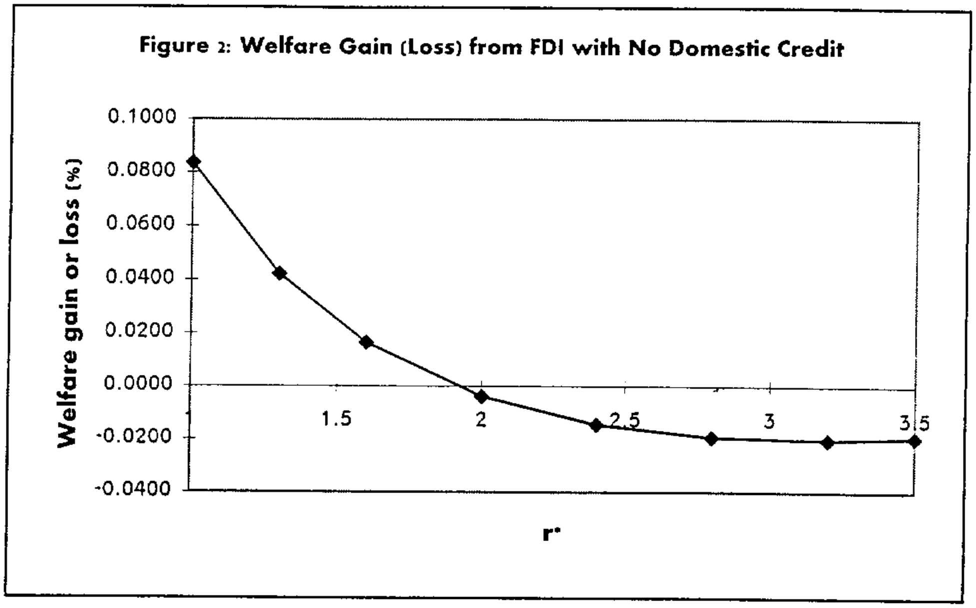
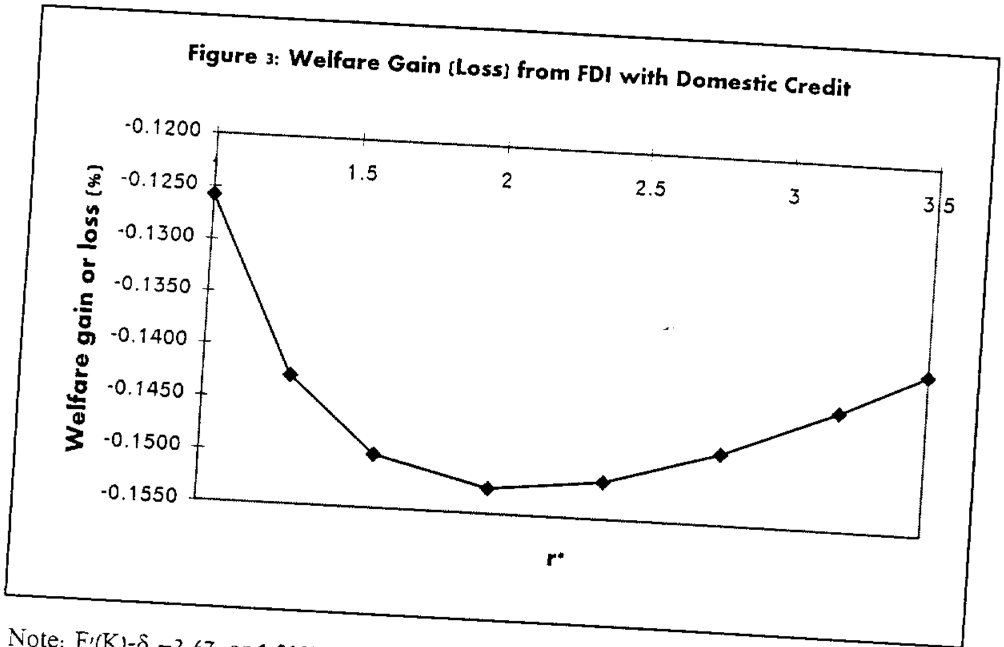


[1]Indonesia, Korea, Malaysia, Philippines and Thailand.

Data: UNCTAD, *World Investment Report, 1998: Trends and Determinants*



Note: $F'(K_0)-\delta = 2.8$, or 4.2% on an annual basis.



Note: $F'(\underline{K})-\delta = 2.67$, or 4.01% on an annual basis. $\underline{K}$=Autarkic Stock of Capital.