Foreign Direct Investment and Foreign Portfolio Investment under Asymmetric Information

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Abstract

This paper develops a model of international capital flows when there is asymmetric information between foreign investors and domestic managers. Direct investors have a direct influence on the management, thus overcoming agency and information problems. This information advantage, however, comes at the cost of having to acquire management expertise. The tradeoff between management costs and the costs of asymmetric information consequently determines the level and composition of a country's international capital flows. Analyzing how this tradeoff changes with economic conditions in a country, the model can qualitatively capture the experiences of many crisis countries during the 1990s. Specifically, the model can capture the rise in FDI inflows despite the reversals of foreign portfolio investment inflows during deteriorating economic conditions which has been documented in this paper for the crises that involved no sovereign default or no imposition of capital controls. Moreover, the model can also explain growing evidence on the impacts of good governance and institutional quality on the composition of a country's capital flows, predicting a lower level of capital inflows and a larger share of FDI in countries with weaker corporate governance.

JEL Classifications: F21, F23, F34, F41, G14, G20, G32. Keywords: Foreign direct investment, international capital flows, asymmetric information, corporate governance.

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1 Introduction

The 1990s was a period characterized by a dramatic increase in the volume of international capital flows,[1] especially to developing countries. As has been documented by many studies, different forms of financial flows differ remarkably in their behaviors. First, foreign direct investment (FDI) appears to be dramatically less volatile than other forms of capital flows.[2] This pattern has been more apparent in developing countries, especially during many crisis episodes in the 1990s such as the Mexican crisis of 1994-95 and the Asian crises of 1997-98. Furthermore, FDI flows substantially increased while other flows were subjected to large reversals during crises involving no default by the country's government on its debts or no imposition of capital controls.[3] Moreover, there has been growing evidence on the impacts of good governance and institutions on the composition and volatility of a country's capital flows. Specifically, the share of FDI in total flows tends to be higher for countries that have higher risk, a lower level of financial development, and weaker institutions.[4]

Despite these distinctive behaviors of FDI, only a small body of literature has jointly incorporated FDI together with other types of flows in a general equilibrium model. This chapter, therefore, develops a theory of international capital flows aiming at filling this gap. However, since this chapter abstracts from the government sector, it can only explain the pattern of FDI during crisis periods in the absence of capital controls or sovereign defaults. In particular, it attempts at accounting for an increase in the fraction of FDI in total inflows during a deteriorating economic condition of the recipient country, while the level of FDI may increase during the same time that other flows decline.

The framework proposed is one of informational asymmetry between foreign investors and agents in the recipient countries of capital flows. In this model there are two types of asymmetric information frictions. The first is idiosyncratic and specific to each local manager. In the model heterogenous local managers differ in terms of the difficulty at which they can be monitored early on in the production process (information friction). The other friction is a country-wide phenomenon where managers can steal a fraction of the output left in the firm for their own benefits later in the production process (agency friction). This description of the asymmetric information frictions is similar to Atkeson and Cole (2005) and will be explained in more detail in Section 2.

FDI differs from other types of international capital flows, which are simply referred to in this model as portfolio investments, because it can help foreign investors overcome these informational problems. Direct investors acquire management expertise specific to the local market so that they gain a direct influence on the management and are better informed about the firm. Portfolio investors, on the other hand, can gain insight about the firm and prevent managers' stealing only if

[1] International capital flows as classified by the IMF and the OECD, consist of three categories: direct investment, portfolio investment, and other investments. According to Lipsey (1999), the concept of lasting interest and a significant influence on management has become an emphasis of the IMF's and the OECD's current definition of direct investment. In their classification, foreign direct investment (FDI) includes an investment by a foreign investor with an ownership of more than 10 percent of a local firm while the remaining investment into local firms' equity is classified as portfolio investment. In addition to equity securities, portfolio investment includes corporate securities such as bonds and money market instruments. The third category, other investments, covers transactions in currency and deposits, trade credit, and loans.

[2] For a summary, see Albuquerque (2003). See also Lipsey (1999, 2001).

[3] For the crisis in Mexico and the crises in Korea, Malaysia, and Thailand, FDI continued without interruption or even accelerated. During the crises in Indonesia and Malaysia, on the other hand, FDI was also subject to reversals. This empirical evidence is detailed in Appendix B.

[4] See Hausmann and Fernandez-Arias (2000), Albuquerque (2003), Alfaro et al. (2007) and Leuz et al. (2008).

they pay monitoring costs. As the monitoring costs vary across managers, while the management costs do not, the optimal choice of contract will depend on whom the foreign investors are hiring. Given the distribution of the monitoring costs across manager, this tradeoff determines the composition of a country's international capital flows. Specifically, foreign investors hiring managers who are very difficult to monitor will optimally choose direct investment as they are better off paying management costs. Foreign investors who hire easy to monitor managers, on the contrary, find portfolio investment to be the optimal choice as the costs of management will dominate the costs of asymmetric information. As a consequence, there will be a cutoff level of the managers' monitoring costs below which portfolio investment is the optimal investment choice and above which direct investment is the optimal decision. The main analysis of the model will be to analyze how this cutoff and the amount of investment of each type changes with economic conditions in the country. Hence, the model will not only give implications on the composition of international capital flows when a country experiences a crisis, but also offer predictions regarding the cross-country characteristics of FDI share. The model predicts that FDI share will be larger in countries which have a lower level of corporate governance.

Other papers that incorporate the composition of FDI and other types of capital flows address different kinds of tradeoff among different types of flows. The tradeoff between management efficiency and liquidity is emphasized in Goldstein and Razin (2006). They assume that foreign investors differ in terms of how likely they are to experience a liquidity shock forcing them to sell their firm prematurely. In their model, the productivity level is realized before an investment decision is made. Direct investors have the advantage of being more informed about the firm, thus allowing them to manage the project more efficiently. This, however, leads to a lower resell price in case they need to sell their projects for liquidity reasons due to the lemon type asymmetric information problem between the investors and the potential buyers. As a result of this tradeoff, in equilibrium foreign investors with higher probability of liquidity needs will more likely choose portfolio investment instead of FDI. Given this result, they are able to explain the higher rates of withdrawals of portfolio investment. In addition, under the hypothesis that the cost of production and the level of transparency are lower in developing countries, a larger share of FDI in these countries is predicted. Nonetheless, their model does not address the change in the pattern and composition of capital flows as economic conditions of the recipient country change, which is a major emphasis in this chapter.

Another paper that addresses the composition of international capital flows to developing countries is Albuquerque (2003). The key feature in this paper is the assumption that financial contracts cannot be perfectly enforced as foreign investment are subject to the risk of expropriation by agents in the recipient countries. The advantage of direct investment is that FDI is harder to expropriate as it requires intangible assets of the multinational company while other types of flows are fully appropriable. Given this difference in the degree of inalienability, the model implies that financially constrained countries receive a larger share of international capital in the form of FDI as the risks associated with FDI is lower than those of other flows. However, since both types of flows always move in the same direction in this model, it cannot explain the rise in FDI flows as opposed to the fall in other flows during crises as observed in many developing countries.

The rest of the chapter is organized as follows. The details of the model and the contracting problem are presented in Sections 2 and 3. Section 4 analyzes the implications of the model on the optimal composition of international capital flows when economic conditions in the host country change. The model is solved numerically for various parameter values. The summary of the numerical exercises are presented in Section 5. Section 6 concludes and discusses the implications of the model. All proofs of the propositions in the chapter and the empirical evidence on international capital flows for each individual crisis countries during the 1990s are provided in the appendix.

2 The Model

2.1 The Environment

The model economy is a small open economy. Time is discrete and denoted by $t = 0,\ 1,\ 2, ..$ and there are three subperiods in each period. There is a continuum of infinite-lived heterogenous domestic agents/managers, indexed by $j \in [0, 1]$, with measure one and a large number of foreign investors.

There are two types of non-storable goods, the internationally tradable and the internationally nontradable goods. The tradable good is the numeraire and can be bought or sold in any amount in the international market at the world price, normalized to one. The nontradable good can only be produced in the domestic economy using the tradable good and labor of local agents.

Each local manager is endowed with the same amount of the tradable good y_t each period and none of the nontradable good. The endowment y_t is strictly positive and iid over time. The local managers are risk-neutral, supply labor inelastically, and derive utility only from the consumption of the nontradable good, while risk-neutral foreign investors only derive utility from the consumption of the tradable good.

For simplicity, only foreign investors are assumed to own the technology to produce the nontradable good even though the model can also be interpreted as foreign investors having more productive technology than local agents. To take advantage of this investment opportunity, foreign investors buy the tradable good from the international market, hire a local manager to run the firm, and then sell the output in the local market. The relative price of the nontradable in terms of the tradable in this local market is denoted by q_t. This production process, however, is subjected to asymmetric information between the foreign investors and the local managers. All foreign investors are alike, but local managers are heterogeneous in terms of the severity of the asymmetric information problem which will be described in more detail below. This specific characteristic of the manager j is publicly observable at the time of the hiring.

2.2 The Investment Contract

At the beginning of each period, a foreign investor and a local manager which are randomly matched sign an investment contract which is one period in length and renegotiable every period. Due to the heterogeneity of the managers, the resulting efficient contract signed will potentially differ from one another. For now the index j and t are dropped when describing the general setup of the investment contract.

The description of asymmetric information frictions between the investors and managers is similar to that of Atkeson and Cole (2005). An investment of the tradable good, $i \geq 0$, is made in the first subperiod, yielding an output of the nontradable good of $\theta G(i)$ in the second subperiod. θ is the productivity level, $G(i) = i^{\kappa} l^{1-\kappa}$, $\kappa < 1$, and $l = 1$ is inelastically supplied by the manager. The productivity shock is i.i.d. across time and project with cumulative distribution function P, density p, and a nonnegative support Θ. In this subperiod, θ is realized and observed only by the manager. After the manager makes a report $\widehat{\theta}$ and the investor makes a monitoring decision $m(\widehat{\theta})$ (information friction), the manager makes a payment v to the investor contingent on the report and the monitoring decision. Let $m(\widehat{\theta})$ denote the indicator function that specify the investor's decision to monitor, then $m(\widehat{\theta}) = 1$ if monitoring occurs and 0 otherwise. Let $M \subseteq \Theta$ denote the set of reports in which monitoring takes place i.e. $m(\widehat{\theta}) = 1$ for $\widehat{\theta} \in M$. Let $v_0(\widehat{\theta})$ denote the payment as a function of the report $\widehat{\theta}$ in case monitoring does not take place and $v_1(\widehat{\theta}, \theta)$ denote the payment as a function of the report $\widehat{\theta}$ and the actual θ in case monitoring does take place.

At the end of the second subperiod, the manager can steal a fraction τ of whatever output he has not paid to the investor (agency friction). Otherwise, that output is reinvested in the firm with the gross return between the second and third subperiods of one. In the third subperiod, θ and the manager's stealing decision become publicly available. The manager receives a compensation of $x(\widehat{\theta}, \theta)$ from the investor if no stealing occurs and receives nothing otherwise. The timeline of the contract is shown in Figure 1.

The one-period investment contract between an investor and a manager is, therefore, a level of investment i to be installed in the first subperiod, a decision to monitor m and a payment made to the investor v in the second subperiod, and a compensation x from the investor to the manager in the third subperiod.

Each contract will be designed in such a way that the manager will never misreport or steal. For reasons of limited liability (LL), we require that the amount of payment v is feasible given the report $\widehat{\theta}$ and the monitoring decision, and that the worst thing that foreign investors can do at the end of the third subperiod is not giving any compensation to the manager.

$$\forall \widehat{\theta} \notin M,\ v_0(\widehat{\theta}) \leq \widehat{\theta} G(i);\quad \forall \widehat{\theta} \in M,\quad v_1(\widehat{\theta}, \theta) \leq \theta G(i),\quad \textit{and}\ \forall \widehat{\theta}, \theta,\ x(\widehat{\theta}, \theta) \geq 0 \tag{LL}$$

Given the risk neutrality of the manager, to guarantee that the manager will not steal in the second subperiod, $x(\widehat{\theta}, \theta)$ must be made high enough such that the manager prefers to receive $x(\widehat{\theta}, \theta)$ instead of stealing. Thus, the no-stealing constraints (NS) require that

$$\begin{aligned} &\forall \widehat{\theta} \notin M,\ \ x(\widehat{\theta}, \theta) \geq \tau[\theta G(i) - v_0(\widehat{\theta})] \text{ and } \widehat{\theta} \text{ feasible given } \theta \text{ and } v_0 \\ &\forall \widehat{\theta} \in M,\ \ x(\widehat{\theta}, \theta) \geq \tau[\theta G(i) - v_1(\widehat{\theta}, \theta)] \end{aligned} \tag{NS}$$

where $\widehat{\theta}$ is feasible given θ and v_0 if either $\widehat{\theta} \in M$, or $\widehat{\theta} \notin M$ and $v_0(\widehat{\theta}) \leq \theta G(i)$. In other words, a report $\widehat{\theta}$ is feasible if it leads to monitoring, or the manager has enough resources to make payment $v_0(\widehat{\theta})$ if $\widehat{\theta} \notin M$.

Given the risk neutrality of the manager, he will not misreport θ if $x(\theta, \theta)$ satisfies the incentive constraints (IC) below.

$$\forall \theta \in \Theta, \qquad x(\theta, \theta) \geq x(\widehat{\theta}, \theta) \quad \forall \text{ feasible } \widehat{\theta} \text{ given } \theta \text{ and } v_0 \tag{IC}$$

Furthermore, if the manager has an outside opportunity, delivering him utility U_0, besides working for the foreign investor, the manager will agree on the terms of the contract as long as the expected payment specified in the contract satisfies the individual rationality constraint (IR).

$$\int x(\theta, \theta) dP(\theta) \geq U_0 \tag{IR}$$

However, due to the assumption that only the foreign investors own the production technology of the nontradable good, the manager's reservation utility is equal to zero. This assumption greatly simplifies the rest of the analysis.

Assumption 2.1: $U_0 = 0$

There are two types of investment available for foreign investors in each period, direct investment and portfolio investment. If the investors choose direct investment, they can gain insight in the firm and observe the firm's productivity θ in the second subperiod, but they have to pay the costs of acquiring management expertise specific to the local market, assumed to be a fraction of the realized production. Denote this fraction by λ where $0 < \lambda < 1$ which yields the total management costs of $\lambda\theta G(i)$. This can be interpreted as direct investors always being able to monitor θ in the second subperiod without further monitoring costs. As will be shown later, this type of investment helps eliminate problems of information and agency frictions. Portfolio investors, on the other hand, can choose to monitor θ in the second subperiod if they pay a fixed cost of γ^j. This fixed cost γ^j is specific to the manager j and publicly observable. The distribution of γ^j among the local managers is assumed to be uniform with a nonnegative support Γ and a cumulative distribution function $\mu(\gamma^j)$. As these monitoring costs vary across managers, while the management costs do not, the optimal choice of contract will depend on whom the foreign investors are hiring. The characteristics of each type of investment contracts will be shown in the next section.

Since each financial contract is one period in length and renegotiable every period, the analysis of the contract can be separated from the rest of the model and the general equilibrium conditions only affect the contract through the relative price of the nontradable, denoted by q_t. In each period, depending on the relative price q_t the foreign investor who hires the manager with the potential monitoring costs γ^j chooses the type of investment to maximize his expected returns

$$\max\{V^D(q_t, \gamma^j), V^P(q_t, \gamma^j)\}$$

where $V^D(q_t, \gamma^j)$ denotes the expected value of an efficient direct investment contract when the relative price is q_t and the potential costs of monitoring is γ^j, while $V^P(q_t, \gamma^j)$ is similarly defined as the expected value of an efficient portfolio investment contract given q_t and γ^j. The derivations of both value functions are shown in the next section. Foreign investors will choose direct investment if $V^D(q_t, \gamma^j) > V^P(q_t, \gamma^j)$, choose portfolio investment when $V^D(q_t, \gamma^j) < V^P(q_t, \gamma^j)$, and are indifferent between the two types of investment when $V^D(q_t, \gamma^j) = V^P(q_t, \gamma^j)$. Let Z_{jt}^D denote the indicator function that specifies the decision to become a direct investor, then $Z_{jt}^D = 1$ if $V^D(q_t, \gamma^j) > V^P(q_t, \gamma^j)$ and 0 otherwise. After choosing the type of investment, all the conditions of the efficient investment contract are implemented including the investment level i_{jt}, the monitoring decisions $m_{jt}(\widehat{\theta})\ \forall\widehat{\theta} \in \Theta$, the payments in the second subperiod $\left\{v_{0,jt}(\widehat{\theta}) \text{ and } v_{1,jt}(\widehat{\theta}, \theta)\ \forall\widehat{\theta}, \theta \in \Theta\right\}$, and the compensation to the manager $x_{jt}(\widehat{\theta}, \theta)\ \forall\widehat{\theta}, \theta \in \Theta$. The analysis made in this chapter will be to analyze how this decision of each investor changes with varying economic conditions through the changes in q_t.

2.3 Equilibrium

Since both types of goods are non-storable, agents have no intertemporal saving technology, and all financial contracts are only one-period in length, the economy's environment is indeed static; all agents in this model solve a static maximization problem. Given that the financial contracts are designed in such a way that the manager will never misreport or steal, an equilibrium in this model economy is defined only in terms of the actual realization of the firms' productivity θ not on the report $\widehat{\theta}$.

An equilibrium is a sequence of prices of the nontradable good $\{q_t\}_{t=0}^{\infty}$, a sequence of foreign investors' decision on types of investment $\left\{Z_{jt}^D\right\}_{t=0}^{\infty}$, investment level $\{i_{jt}\}_{t=0}^{\infty}$, monitoring $\{m_{jt}(\theta)\ \forall\theta\in\Theta\}_{t=0}^{\infty}$, payments in the second subperiod $\{v_{0,jt}(\theta)\ \ \forall\theta\in\Theta\}_{t=0}^{\infty}$ and $\{v_{1,jt}(\theta,\theta)\ \forall\theta\in\Theta\}_{t=0}^{\infty}$, and compensation to the manager $\{x_{jt}(\theta,\theta)\ \forall\theta\in\Theta\}_{t=0}^{\infty}$, and a sequence of local agents' allocation $\{l_{jt},\ c_{jt}(\theta)\ \forall\theta\in\Theta\}_{t=0}^{\infty}$ for all $\gamma^j\in\Gamma$, $j\in[0,1]$ such that

1. foreign investors choose the type of investment contract to maximize their expected returns:

- for all t and j, given prices q_t and the properties of each type of investment contract, foreign investors who hires a manager with potential monitoring costs of γ^j chooses the type of investment to solve

$$\max\{V^D(q_t,\gamma^j),V^P(q_t,\gamma^j)\}$$

where $Z_{jt}^D=1$ if $V^D(q_t,\gamma^j)>V^P(q_t,\gamma^j)$ and 0 otherwise. The investment level i_{jt}, the monitoring decisions $m_{jt}(\theta)\ \forall\theta\in\Theta$, the payments in the second subperiod $v_{0,jt}(\theta)$ and $v_{1,jt}(\theta,\theta)\ \forall\theta\in\Theta$, and the compensation to the manager $x_{jt}(\theta,\theta)\ \forall\theta\in\Theta$ are implemented as specified by the efficient investment contract.

2. all local managers maximize utility subject to their budget constraint:

- for all t, given prices q_t, the endowment processes y_t, and the compensation $x_{jt}(\theta,\theta)\ \forall\theta\in\Theta$ specified by the contract with the foreign investor, the local manager j who supplies labor inelastically chooses the level of consumption $c_{jt}(\theta)$ depending on the current period realization of θ to solve

$$\begin{aligned}&\max\ E_t\sum_{t=0}^{\infty}\beta^t c_{jt}(\theta)\\ &\text{s.t.}\ \ q_t c_{jt}(\theta)=y_t+q_t x_{jt}(\theta,\theta)\\ &\qquad l_{jt}\le 1,\ \ c_{jt}(\theta)\ge 0\end{aligned}$$

3. the labor market clears: $\forall j,\ t$ $\qquad l_{jt}=1$; and

4. the nontradable good market clears i.e. the aggregate domestic consumption must be equal to the aggregate production after the management costs and monitoring costs by foreign investors, assuming the law of large numbers: $\forall j,\ t$

$$\int\limits_{\gamma^j}\int\limits_{\theta}c_{jt}(\theta)dP(\theta)d\mu(\gamma^j)=\int\limits_{\gamma^j}\ \int\limits_{\theta}\left[\theta G(i_{jt})-Z_{jt}^D\lambda\theta G(i_{jt})-\left[1-Z_{jt}^D\right]\gamma^j m_{jt}(\theta)\right]dP(\theta)d\mu(\gamma^j)$$

3 Efficient Investment Contract Decision

In this section, an investment contract of each investment type is characterized. Given the relative price of the nontradable q_t, an efficient contract between a foreign investor and a manager is a contract that maximizes the expected return to the foreign investor subject to the limited liability constraints (LL), the no-stealing constraints (NS), the incentive constraints (IC), and the manager's individual rationality constraint (IR).

3.1 An Efficient Direct Investment Contract

Since under a direct investment contract, foreign investors pay only the costs of management but no monitoring costs, their optimal monitoring decision is to always monitor. Therefore, for all q_t and γ^j, $m(\widehat{\theta}; q_t, \gamma^j) = 1$ for all $\widehat{\theta} \in \Theta$ or, in other words, $M(q_t, \gamma^j) = \Theta$. As a result, the only relevant payment to investors in the second subperiod is $v_1(\widehat{\theta}, \theta; q_t, \gamma^j)$.

Given the above characteristic, the expected value of an efficient direct investment contract, denoted by $V^D(q_t, \gamma^j)$, must be independent of γ^j. In particular, an efficient direct investment contract must maximize the expected return to a direct investor, after the management costs $\lambda\theta G(i_{jt})$ and the compensation to the manager are paid, subject to the limited liability constraints (LL), the no-stealing constraints (NS), the incentive constraints (IC), and the manager's individual rationality constraint (IR). Thus, $V^D(q_t, \gamma^j)$ must be equal to the expected value of the contract that is a solution of the problem (P1) below.

Given q_t and γ^j, a direct investor chooses $x(\widehat{\theta}, \theta; q_t, \gamma^j)$ and $v_1(\widehat{\theta}, \theta; q_t, \gamma^j)$ for all $\forall\widehat{\theta}, \theta \in \Theta$, and $i(q_t, \gamma^j) \geq 0$ to solve

$$\begin{array}{llll}
\text{(P1)} & \max\ q_t \int\{[1-\lambda]\theta G(i_{jt}) & -x_{jt}(\theta,\theta)\}dP(\theta) - i_{jt} & \\
& \text{s.t. [LL]}\ \forall\widehat{\theta}, \quad v_{1,jt}(\widehat{\theta},\theta) & \leq \theta G(i_{jt}) & \\
& \qquad\qquad\qquad x_{jt}(\widehat{\theta},\theta) & \geq 0 & \\
& \text{[IC]}\ \forall\theta, \quad x_{jt}(\theta,\theta) & \geq x_{jt}(\widehat{\theta},\theta) & \forall \text{ feasible } \widehat{\theta} \text{ given } \theta \text{ and } v_{0,jt} \\
& \text{[NS]}\ \forall\widehat{\theta}, \quad x_{jt}(\widehat{\theta},\theta) & \geq \tau[\theta G(i_{jt}) - v_{1,jt}(\widehat{\theta},\theta)] & \\
& \text{[IR]}\ \int x_{jt}(\theta,\theta)dP(\theta) & \geq U_0 &
\end{array}$$

Proposition 1 presents properties of an efficient direct investment contract. Since direct investors always observe the productivity level θ, an efficient contract must demand the highest possible payment in the second subperiod to prevent the manager from stealing and specify the lowest possible compensation to manager in the third subperiod when he misreports as these will relax the incentive constraints and the no-stealing constraints as much as possible without affecting the investor's expected return. In addition, the manager's individual rationality constraint must be binding and, thus, there is an optimal contract which specifies a constant compensation to the manager $x_{jt}(\theta, \theta) = U_0$, which by Assumption 2.1 is equal to zero as the manager has no outside option.

Proposition 1. *There is an efficient direct investment contract with the following properties:*

(i) $\forall\widehat{\theta}, \theta$ $v_{1,jt}(\widehat{\theta}, \theta) = \theta G(i_{jt})$ *and* $x_{jt}(\widehat{\theta}, \theta) = 0$ *for* $\widehat{\theta} \neq \theta$*; and (ii)* $\forall\theta,\ x_{jt}(\theta, \theta) = U_0$

The proof of the proposition is shown in the Appendix A. The approach taken in the proof is to show that there is a contract with the above properties that satisfies the same set of constraints as those in (P1) and delivers the same expected payoff to both the foreign investor and the local manager. Given the above properties of an efficient contract, the problem of a direct investor is now simply to choose the level of investment $i(q_t, \gamma^j)$ to solve the following problem:

$$\max_{i_{jt}\geq 0}\ q_t \int \{[1-\lambda]\theta G(i_{jt})\}dP(\theta) - i_{jt}$$

Let $\widetilde{\theta}$ denote the average level of the firm's productivity, $\widetilde{\theta} \equiv \int \theta dP(\theta)$, then the optimal level of direct investment $i^D_{jt} \equiv i^D(q_t, \gamma^j)$ must satisfy the first-order condition $q_t[1-\lambda]\widetilde{\theta}G'(i^D_{jt}) = 1$. With the functional form of the production function $G(i) = i^{\kappa}$, then under an efficient direct investment contract, the optimal level of investment and the expected value of the contract are:

$$\begin{aligned} i^D(q_t, \gamma^j) &= \left[\kappa q_t[1-\lambda]\widetilde{\theta}\right]^{1/[1-\kappa]} \text{ and} \\ V^D(q_t, \gamma^j) &= q_t[1-\lambda]\widetilde{\theta}G(i^D_{jt}) - i^D_{jt} = [\frac{1}{\kappa} - 1]i^D_{jt} \end{aligned} \tag{1}$$

Clearly, $i^D(q_t, \gamma^j)$ and $V^D(q_t, \gamma^j)$ are strictly positive, independent of γ^j, and strictly increasing in q_t. In particular, $\frac{\partial i^D(q_t,\gamma^j)}{\partial q_t} = \frac{1}{[1-\kappa]q_t} i^D(q_t, \gamma^j)$ and $\frac{\partial V^D(q_t,\gamma^j)}{\partial q_t} = \frac{1}{\kappa q_t} i^D(q_t, \gamma^j)$.

3.2 An Efficient Portfolio Investment Contract

First, I characterize the first-best contract, which is an efficient contract when there is neither the information friction nor agency friction. Then, I characterize an efficient portfolio investment contract with the presence of the two frictions specified and identifies the circumstances under which a first-best outcome is achievable. As in the case of a direct investment contract, general equilibrium conditions only affect the contracting problem through q_t, the relative price of the nontradable good.

3.2.1 The First-Best Environment

In this environment the productivity parameter θ is publicly observable and managers cannot steal; thus, the contracting problem become independent of the monitoring costs γ^j. For similar reasons as those in the direct investment contracting problem, a first-best contract must specify the lowest possible compensation to the manager when he misreports and the manager's individual rationality constraint must be binding. Given these properties, there must be a first-best contract with a constant compensation to the manager $x_t(\theta, \theta) = x^{FB} = U_0$, and as a result the investment level specified by a first-best contract must be the solution to

$$\max_{i_{jt} \geq 0} \; q_t \int \theta G(i_t) dP(\theta) - i_t$$

In other words, the optimal level of investment $i^{FB}_t \equiv i^{FB}(q_t, \gamma^j)$ must satisfy the first-order condition $q_t\widetilde{\theta}G'(i^{FB}_t) = 1$. With the functional form of the production function that I have,

$$\begin{aligned} i^{FB}(q_t, \gamma^j) &= \left[\kappa q_t \widetilde{\theta}\right]^{1/[1-\kappa]} \text{ and} \\ V^{FB}(q_t, \gamma^j) &= q_t \left[\int \{\theta G(i^{FB}_t) - x^{FB}\} dP(\theta)\right] - i^{FB}_t = [\frac{1}{\kappa} - 1]i^{FB}_t \end{aligned} \tag{2}$$

Clearly, $V^{FB}(q_t, \gamma^j) > V^D(q_t, \gamma^j)$ for all γ^j and q_t, and they only differ in terms of the costs of management λ. It is straightforward to show that for the case that both investors and managers are risk neutral, the first-best outcome is always attainable when only one type of the two frictions is present. As will be shown in the next subsection, with the two types of frictions and $U_0 = 0$, the first-best outcome is not attainable for strictly positive monitoring costs $\gamma^j > 0$.

3.2.2 Contracting with Information and Agency Frictions

This subsection presents properties of an efficient portfolio investment contract when there are both information and agency frictions. In this environment, an efficient portfolio investment contract must maximize the expected return to an investor, after the monitoring costs and the compensation to the manager, are paid subject to the limited liability constraints (LL), the no-stealing constraints (NS), the incentive constraints (IC), and the manager's individual rationality constraint (IR). The expected value of an efficient portfolio investment, denoted by $V^P(q_t, \gamma^j)$, is given by the expected value of an efficient contract that is a solution of the problem (P2) described below.

Given q_t and γ^j, a portfolio investor chooses for all $\widehat{\theta}, \theta \in \Theta$, $m_{jt}(\widehat{\theta}; q_t, \gamma^j)$, $x(\widehat{\theta}, \theta; q_t, \gamma^j)$, $v_0(\widehat{\theta}; q_t, \gamma^j)$, and $v_1(\widehat{\theta}, \theta; q_t, \gamma^j)$, and $i(q_t, \gamma^j) \geq 0$ to solve

$$\text{(P2) max } q_t \left[\int \{\theta G(i_{jt}) - x_{jt}(\theta, \theta)\} dP(\theta) - \int \gamma^j m_{jt}(\widehat{\theta}) dP(\theta)\right] - i_{jt}$$

$$\begin{aligned}
\text{s.t. [LL]} \quad & \forall \widehat{\theta} \notin M_{jt}, \; v_{0,jt}(\widehat{\theta}) \leq \widehat{\theta} G(i_{jt}) \\
& \forall \widehat{\theta} \in M_{jt}, \; v_{1,jt}(\widehat{\theta}, \theta) \leq \theta G(i_{jt}) \\
& x_{jt}(\widehat{\theta}, \theta) \geq 0 \\
\text{[IC]} \quad & \forall \theta \in \Theta, \quad x_{jt}(\theta, \theta) \geq x_{jt}(\widehat{\theta}, \theta) \quad \forall \text{ feasible } \widehat{\theta} \text{ given } \theta \text{ and } v_{0,jt} \\
\text{[NS]} \quad & \forall \widehat{\theta} \notin M_{jt}, \quad x_{jt}(\widehat{\theta}, \theta) \geq \tau[\theta G(i_{jt}) - v_{0,jt}(\widehat{\theta})] \quad \forall \text{ feasible } \widehat{\theta} \text{ given } \theta \text{ and } v_{0,jt} \\
& \forall \widehat{\theta} \in M_{jt}, \quad x_{jt}(\widehat{\theta}, \theta) \geq \tau[\theta G(i_{jt}) - v_{1,jt}(\widehat{\theta}, \theta)] \\
\text{[IR]} \quad & \int x_{jt}(\theta, \theta) dP(\theta) \geq U_0
\end{aligned}$$

where $m(\widehat{\theta}) = 1$ for $\widehat{\theta} \in M$.

The properties of an efficient portfolio investment contract that solves (P2) are characterized in series of propositions, proofs of which can be found in Appendix A. The approach taken throughout is to show that there is a contract with the proposed properties that satisfies the same set of constraints as those in (P2) and delivers the same expected payoff to both the foreign investor and the local manager.

Proposition 2. *There is an efficient portfolio investment contract with the following properties:*

(i) $\forall \widehat{\theta} \in M_{jt}, \; v_{1,jt}(\widehat{\theta}, \theta) = \theta G(i_{jt})$ *and* $x_{jt}(\widehat{\theta}, \theta) = 0$ *for* $\widehat{\theta} \neq \theta$;

(ii) $\forall \widehat{\theta} \notin M_{jt}, \; v_{0,jt}(\widehat{\theta}) = \theta^M_{jt} G(i_{jt})$ *and* $x_{jt}(\widehat{\theta}, \theta) = \tau[\theta - \theta^M_{jt}] G(i_{jt})$ *for* $\widehat{\theta} \neq \theta$ *where* $\theta^M_{jt} = \inf_{\theta \notin M_{jt}} \theta$; *and*

(iii) $M_{jt} = [0, \theta^M_{jt}]$

By Proposition 2, the monitoring set of an efficient contract must be the lower region of Θ which means that only if the manager reports a low enough productivity level, will the monitoring by the investor occur. In this case, the contract specifies that the investor confiscates all the production in the second subperiod and the manager receives the lowest possible compensation in the third subperiod if he misreports. For a high enough productivity report, on the other hand, monitoring will not occur and an incentive compatible contract will require a uniform payment from the manager to the investor in the second subperiod. An efficient contract requires the uniform payment as otherwise the manager will have an incentive to misreport in order to retain as much output in the firm as possible without being monitored. In this case, an incentive compatible contract specifies compensation to the manager equal to the amount of output that he would be able to steal if he misreports.

Using the above results, the problem for a portfolio investor given q_t and γ^j is now to choose the upper bound of the monitoring set θ_{jt}^M, the manager's compensation $x_{jt}(\theta,\theta)$, and the level of investment $i_{jt} \geq 0$ to solve the following problem.

$$
\begin{aligned}
\text{(P3)}\ \max\ & q_t\left[\int\{\theta G(i_{jt}) - x_{jt}(\theta,\theta)\}dP(\theta) - \gamma^j P(\theta_{jt}^M)\right] - i_{jt} \\
\text{s.t.}\ & \text{[LL]}\ \forall\theta\in\Theta, \quad x_{jt}(\theta,\theta) \geq 0 \\
& \text{[IC]}\ \forall\theta\in\Theta, \quad x_{jt}(\theta,\theta) \geq x_{jt}(\widehat{\theta},\theta) \quad \forall \text{ feasible } \widehat{\theta} \text{ given } \theta \text{ and } v_{0,jt} \\
& \text{[NS]}\ \forall\theta\notin M_{jt}, \quad x_{jt}(\theta,\theta) \geq \tau[\theta-\theta_{jt}^M]G(i_{jt}) \\
& \text{[IR]} \quad \int x_{jt}(\theta,\theta)dP(\theta) \geq U_0
\end{aligned}
$$

Given the risk-neutrality of the manager, we can further focus on the set of contracts that have a relatively simple compensation structure. Proposition 3 shows that there is an efficient contract that specifies no compensation to the manager if the firm's productivity is low while giving the manager a fraction τ of the output not paid out in the second subperiod if the firm is productive enough. This compensation scheme is the lowest possible that satisfies the no-stealing constraints and is incentive compatible. When no monitoring occurs, the manager's compensation increases with the firm's productivity and is equal to the fraction τ of the output after the uniform payment $v_{0,jt}(\theta) = \theta_{jt}^M G(i_{jt})$ is paid.

Proposition 3. *There is an efficient portfolio investment contract with the following properties:*

(i) $\forall\theta \in M_{jt},\ x_{jt}(\theta,\theta) = 0$; *and*

(ii) $\forall\theta \notin M_{jt},\ x_{jt}(\theta,\theta) = \tau[\theta-\theta_{jt}^M]G(i_{jt})$

By Proposition 3, the portfolio investor's problem is completely characterized by θ_{jt}^M and i_{jt} and becomes

$$
\begin{aligned}
\text{(P4)}\ \max_{\theta_{jt}^M, i_{jt}\geq 0}\ & q_t\left[\int \theta G(i_{jt})dP(\theta) - \int_{\theta_{jt}^M} \tau[\theta-\theta_{jt}^M]G(i_{jt})dP(\theta) - \gamma^j P(\theta_{jt}^M)\right] - i_{jt} \\
\text{s.t.}\ & \text{[IR]} \int_{\theta_{jt}^M} \tau[\theta-\theta_{jt}^M]G(i_{jt})dP(\theta) \geq U_0
\end{aligned}
$$

Notice that there is a tradeoff between the information rent $\int_{\theta_{jt}^M} \tau[\theta-\theta_{jt}^M]G(i_{jt})dP(\theta)$ and the monitoring costs $\gamma^j P(\theta_{jt}^M)$. As the monitoring set is reduced, the costs of monitoring decline. However, in order for the contract to be incentive compatible, the uniform payment, for the cases not involving monitoring, must also be lower. This, due to the agency friction, increases the costs to the investors in terms of the compensation to the manager as it increases the amount of output left in the firm at the end of the second subperiod. Therefore, only in the case that $\gamma^j = 0$ will the monitoring set M_{jt} become the set Θ for all q_t. For $\gamma^j > 0$, due to the above tradeoff, the no-monitoring set will never be empty, implying that the expected compensation for the manager, $\int\limits_{\theta_{jt}^M} \tau[\theta - \theta_{jt}^M]G(i_{jt})dP(\theta)$, will strictly be positive. Thus, with $U_0 = 0$, the individual rationality constraint of the above problem will not be binding unless $\gamma^j = 0$ as in this case the portfolio investors always monitor, leaving no information rent to the manager. Therefore, only in this case, will the first-best outcome be attainable. Let $i_M^P(q_t, \gamma^j)$ and $V_M^P(q_t, \gamma^j)$ denote the portfolio investor's optimal investment level and expected value from an efficient contract that involves monitoring. Then $i_M^P(q_t, \gamma^j = 0) = i^{FB}(q_t)$ and $V_M^P(q_t, \gamma^j = 0) = V^{FB}(q_t)$. Since the individual rationality constraint does not bind for the case of strictly positive monitoring costs, $\gamma^j > 0$, the optimal level of investment and monitoring decisions are completely characterized by the two first-order conditions of the unconstrained problem of (P4):

$$
\begin{aligned}
i_{jt}: &\quad q_t \left[\widetilde{\theta} - \int\limits_{\theta_{jt}^M} \tau[\theta - \theta_{jt}^M]dP(\theta) \right] G'(i_{jt}) = 1, \quad i_{jt} > 0 \\
\theta_{jt}^M: &\quad \tau G(i_{jt})[1 - P(\theta_{jt}^M)] \leq \gamma^j p(\theta_{jt}^M) \ \text{ and } \quad \theta_{jt}^M \geq 0
\end{aligned}
$$

There are two possibilities; an efficient contract may or may not involve monitoring depending on the price of the output q_t and the potential monitoring costs γ^j. For any given q_t, it may be optimal for a portfolio investor not to monitor at all, i.e. $\theta_{jt}^M = 0$ and $M_{jt} = \varnothing$, if γ^j is high enough. This may also be the case if q_t is low enough because as q_t declines, more portfolio investors will find monitoring to be too costly relative to the value of the output. On the contrary, for low enough γ^j or high enough q_t, portfolio investors will find monitoring optimal; an efficient contract will involve monitoring with positive probability.

Let $i_N^P(q_t, \gamma^j)$ and $V_N^P(q_t, \gamma^j)$ denote the portfolio investor's investment level and expected value from the contract when monitoring is not optimal. In this case the level of investment and the expected return to the investor will be independent of γ^j. In particular, for the case of nonnegative support of Θ, $i_{N,jt}^P \equiv i_N^P(q_t, \gamma^j)$ must satisfy $q_t \left[[1 - \tau]\widetilde{\theta} \right] G'(i_{N,jt}^P) = 1$.[5] Given the functional form of the production function,

$$
\begin{aligned}
i_N^P(q_t, \gamma^j) &= \left[\kappa q_t [1 - \tau]\widetilde{\theta} \right]^{1/[1-\kappa]} \\
V_N^P(q_t, \gamma^j) &= q_t \int [1 - \tau]\theta G(i_{N,jt}^P)dP(\theta) - i_{N,jt}^P = [\frac{1}{\kappa} - 1]i_{N,jt}^P
\end{aligned}
\tag{3}
$$

Clearly, $i_N^P(q_t, \gamma^j)$ and $V_N^P(q_t, \gamma^j)$ are strictly positive, strictly increasing in q_t, and independent of γ^j. Also, $V_N^P(q_t, \gamma^j) < V^{FB}(q_t)$ for any q_t and γ^j, and they only differ in terms of the stealing fraction τ. In order to guarantee that the solution to this model economy is not trivial and that foreign investors will not always find a portfolio investment more profitable than a direct investment, we assume that the expected value of a portfolio investment in this case is below that of a direct investment. For the case of nonnegative support of Θ, assuming that $\tau > \lambda$ will ensure this analysis.[6] With this assumption, the comparison of (1) and (3) clearly indicates that $V_N^P(q_t, \gamma^j)$

[5] If $\Theta = [\theta_{\min}, \infty)$ and $\theta_{\min} > 0$, this condition becomes $q_t \left[\widetilde{\theta} - \int\limits_{\theta_{\min}} \tau[\theta - \theta_{\min}]dP(\theta) \right] G'(i_{N,jt}^P) = 1$ or $q_t \left[(1 - \tau)\widetilde{\theta} + \tau\theta_{\min} \right] G'(i_{N,jt}^P) = 1$

[6] If $\theta \in [\theta_{\min}, \infty)$ and $\theta_{\min} > 0$, this assumption becomes $(1 - \tau)\widetilde{\theta} + \tau\theta_{\min} < (1 - \lambda)\widetilde{\theta}$.

$< V^D(q_t, \gamma^j)$ for all q_t and γ^j. This assumption, therefore, guarantees that for the case of high enough γ^j or a low enough q_t, foreign investors will find a direct investment to give higher expected return that a portfolio investment.

Assumption 2.2: $\tau > \lambda$

For the other case where monitoring is optimal i.e. $\theta_{jt}^M > 0$, the two first-order conditions must hold with equality. Let $i_{M,jt}^P \equiv i_M^P(q_t, \gamma^j)$ and $\theta_{M,jt}^P \equiv \theta_M^P(q_t, \gamma^j)$ denote the optimal level of investment and the optimal upper bound of the monitoring set in this case, respectively. The expected value of an efficient portfolio investment contract involving monitoring is, therefore, equal to

$$\begin{aligned} V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j) &= q_t \int \theta G(i_{M,jt}^P) dP(\theta) - q_t \int_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P] G(i_{M,jt}^P) dP(\theta) \\ &\quad - q_t \gamma^j P(\theta_{M,jt}^P) - i_{M,jt}^P \end{aligned}$$

where $i_{M,jt}^P$ and $\theta_{M,jt}^P$ are solutions to the nonlinear systems of the two first-order conditions below.

$$\begin{aligned} F^1(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j) &= q_t \left[\widetilde{\theta} - \int_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P] dP(\theta) \right] G'(i_{M,jt}^P) - 1 = 0 \\ F^2(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j) &= q_t \tau G(i_{M,jt}^P)[1 - P(\theta_{M,jt}^P)] - q_t \gamma^j p(\theta_{M,jt}^P) = 0 \end{aligned}$$

As can be seen, the solutions to these systems will depend on the distribution of θ on Θ. For the case of a uniform distribution function, the solutions to these systems can be derived and some of interesting properties of the model economy in terms of the levels and the composition of international capital flows can be solved analytically.

4 The Case of Uniformly Distributed Firm's Productivity

4.1 Contracting with Information and Agency Frictions

Assume that firm's productivity level is uniformly distributed with a nonnegative support $\Theta = [\theta_{\min},\ \theta_{\max}]$. [7] For simplicity, it is assumed that $\theta_{\min} = 0$; the analysis is very similar for the case that $\theta_{\min} > 0$. To guarantee the uniqueness of solutions to the portfolio investor's problem, I make another assumption regarding the value of the production function and stealing fraction parameters.

Assumption 2.3: $\frac{1-\kappa}{1+\kappa} > \tau$

Assumption 2.3 gives a sufficient condition that the solutions $i_M^P(q_t, \gamma^j)$ and $\theta_M^P(q_t, \gamma^j)$ to the nonlinear systems above will be the unique solution to the portfolio investor's maximization

[7] In this case for all θ, $p(\theta) = \frac{1}{\theta_{\max} - \theta_{\min}}$, $P(\theta) = \frac{\theta - \theta_{\min}}{\theta_{\max} - \theta_{\min}}$, and $\widetilde{\theta} \equiv \int \theta dP(\theta) = \frac{\theta_{\max} - \theta_{\min}}{2}$.

problem.[8] Since $V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j)$ is continuously differentiable in every arguments and the solutions are unique, $i_M^P(q_t, \gamma^j)$ and $\theta_M^P(q_t, \gamma^j)$ are continuously differentiable in q_t and γ^j.

The proof that the Hessian matrix of the objective function of the unconstrained maximization problem of (P4), $D^2V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j)$, is negative definite is shown in Appendix A. Proposition 4 analyzes how the optimal investment level, the monitoring decisions, and the optimal value of an efficient portfolio investment contract involving monitoring vary with the price of the nontradable good q_t and the monitoring characteristic of the manager, γ^j. In particular, Proposition4 shows that $i_M^P(q_t, \gamma^j)$, $\theta_M^P(q_t, \gamma^j)$, and $V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j)$ are all strictly increasing in q_t and strictly decreasing in γ^j.

Proposition 4. *If θ is uniformly distributed and Assumption 3 holds, the optimal portfolio investment level and the upper bound of the monitoring set have the following properties:*

(i) $\frac{\partial i_M^P(q_t,\gamma^j)}{\partial q_t} > 0$ *and* $\frac{\partial i_M^P(q_t,\gamma^j)}{\partial \gamma^j} < 0$;

(ii) $\frac{\partial \theta_M^P(q_t,\gamma^j)}{\partial q_t} > 0$ *and* $\frac{\partial \theta_M^P(q_t,\gamma^j)}{\partial \gamma^j} < 0$; *and*

(iii) $\frac{\partial V_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{\partial q_t} > 0$ *and* $\frac{\partial V_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{\partial \gamma^j} < 0$.

As q_t increases, portfolio investors will increase both the investment level and the size of the monitoring set simultaneously in order to take advantage of a higher return from producing each unit of output and to reduce the incentive of the managers to steal and misreport. Together, as the level of investment and the size of the monitoring set vary optimally, the expected value of the contract to the foreign investors also increases.

On the other hand, for any given price of the output q_t, portfolio investors who hire managers with higher γ^j will find monitoring less beneficial and are more willing to give higher information rent $\int_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P]G(i_{M,jt}^P)$ to the manager instead of paying the monitoring costs. Since the costs of asymmetric information frictions are all in units of the output, this change reduces the rate of the return from investment. Therefore, these investors will optimally choose lower investment level leading to lower expected value of the contract.

Given the functional form of the production function and the two first-order conditions of the investor's problem, which hold with equality, the optimal monitoring set $\theta_{M,jt}^P$ must satisfy the following condition:

$$q_t\tau\left[\kappa q_t\left[\widetilde{\theta} - \int_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P]dP(\theta)\right]\right]^{\frac{\kappa}{1-\kappa}}[1 - P(\theta_{M,jt}^P)] - q_t\gamma^j p(\theta_{M,jt}^P) = 0$$

As a result, the optimal investment level and the expected value of an efficient portfolio investment contract in this case can be defined in terms of $\theta_{M,jt}^P$ as follows:

[8]For the case that $\theta_{\min} > 0$, this assumption becomes $\left[\frac{\theta_{\max}-\theta_{\min}}{\theta_{\max}}\right]^2 \frac{1-\kappa}{[1+\kappa]} > \tau$, which requires lower levels of the stealing fraction.

$$i_M^P(q_t,\ \gamma^j) = \left[\kappa q_t\left[\widetilde{\theta} - \int_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P]dP(\theta)\right]\right]^{\frac{1}{1-\kappa}} \tag{4}$$

$$\begin{aligned} V_M^P(q_t,\ \gamma^j) &= q_t\left[\left[\widetilde{\theta} - \int_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P]dP(\theta)\right]G(i_{M,jt}^P) - \gamma^j P(\theta_{M,jt}^P)\right] - i_{M,jt}^P \\ &= \left[\frac{1}{\kappa} - 1\right] i_{M,jt}^P - q_t\gamma^j P(\theta_{M,jt}^P) \end{aligned}$$

In particular, as shown in the proof of Proposition 4, $\frac{\partial V_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{\partial q_t} = \frac{1}{\kappa q_t} i_{M,jt}^P - \gamma^j P(\theta_{M,jt}^P)$. By Proposition 4, the strictly negative relationship between $\theta_{M,jt}^P$ and γ^j implies that as γ^j varies from a value close to zero, the size of the monitoring set strictly declines from that close to the whole set Θ, and as γ^j becomes high enough $\theta_{M,jt}^P$ declines to that close to the lower bound and this holds true for any level of q_t. In other words, by the results of Proposition 4, as the monitoring costs varies, the optimal monitoring set as well as the optimal level of investment $i_{M,jt}^P$ and the expected value of an efficient contract $V_M^P(\ q_t,\ \gamma^j)$ will strictly decline from those close to the first-best levels to those close to the case of a portfolio investment with no monitoring. This can be seen by comparing (4) with (2) and (3) as $\theta_{M,jt}^P$ approaches the upper bound of Θ or zero, respectively.

4.2 Optimal Choice of Investment Contracts

From the previous subsection, $V_M^P(\ q_t,\ \gamma^j)$ is strictly decreasing in γ^j and it varies from the first-best level $V^{FB}(q_t)$ for very low γ^j to that of the no-monitoring case $V_N^P(q_t,\gamma^j)$ for high enough γ^j. Since for all q_t and γ^j, $V^{FB}(q_t) > V^D(q_t,\gamma^j)$ while $V_N^P(q_t,\gamma^j) < V^D(q_t,\gamma^j)$, there must be a unique and strictly positive cutoff level of monitoring costs, γ^* for each q_t, such that a foreign investor who hires manager with this monitoring characteristics will be indifferent between the a direct investment contract and a portfolio investment contract. In other words, this cutoff $\gamma^*(q_t)$ is defined implicitly by evaluating the expected value of an efficient direct investment contract and the expected value of an efficient portfolio investment contract which involves monitoring. In other words, $\gamma^*(q_t)$ must satisfy the equation below.

$$V^D(q_t,\gamma^*(q_t)) = V_M^P(q_t,\gamma^*(q_t)) \tag{5}$$

Thus, foreign investors will strictly prefer direct investment contract if they meet with managers with $\gamma^j > \gamma^*(q_t)$ and, on the contrary, they will prefer portfolio investment contract if γ^j is lower than the cutoff level. This optimal choice of the type of investment for each level of γ^j is proved in Proposition 5 and presented in Figure 2.

Proposition 5. *For all q_t, there is a unique cutoff $\gamma^* > 0$ such that*

(i) $V^D(q_t,\gamma^*) = V_M^P(q_t,\gamma^*)$;

(ii) $V^D(q_t,\gamma^j) < V_M^P(q_t,\gamma^j)$ for $\gamma^j < \gamma^*$; and

(iii) $V^D(q_t, \gamma^j) > V_M^P(q_t, \gamma^j)$ *for* $\gamma^j > \gamma^*$.

Thus, this implies that the indicator function that specifies the decision to become a direct investor, Z_{jt}^D, takes the following form. $Z_{jt}^D = 1$ if $\gamma^j > \gamma^*$ and 0 otherwise. Proposition 5 also implies that, for a given distribution of γ^j over local managers in the economy, the composition of the types of investment contracts at any period is completely summarized by this cutoff level. The dependence of the cutoff level on the relative price of the nontradable good implies that the composition of foreign investors' capital inflows will vary with the recipient country's economic conditions. This analysis is presented next.

4.3 Changes in Investment Choice as Economic Conditions Vary

This section analyzes how the cutoff level $\gamma^*(q_t)$, which determines the composition of direct investment contracts and portfolio investment contracts, varies with the model economy's endowment of the tradable good y_t. In particular, it will be shown that a decline in the economy's endowment will lead to a decline in the relative price of the nontradable good q_t and a higher fraction of foreign investors choosing direct investment contracts simultaneously. In other words, q_t varies in same direction as y_t and $\gamma^*(q_t)$ is an increaing function of q_t. These relationships are presented in Propositions 6 and 7.

Proposition 6. *If* $\gamma^*(q_t)$ *is* C^1, $\frac{\partial \gamma^*(q_t)}{\partial q_t} > 0$.

The intuition of Proposition 6 is that the effect of the change in the relative price on the portfolio investment is higher than that on the direct investment for the marginal investor who was previously indifferent between the two types of investment contracts due to the presence of the two frictions, information and agency frictions which are more severe for a portfolio investment contract. In other words, due to the two frictions $\frac{\partial V_M^P(q_t, \gamma^*(q_t))}{\partial q_t} > \frac{\partial V^D(q_t, \gamma^*(q_t))}{\partial q_t}$. Therefore, for the marginal foreign investor, any increase in q_t will induce him to strictly prefer a portfolio investment as the price increase will raise the expected value of a portfolio investment contract by more than that of a direct investment. Conversely, a decrease in the relative price will lower the expected value of a portfolio investment by much more than that of a direct investment. As all the value functions are continuous, these changes must also be the case for foreign investors with γ^j close enough to the previous cutoff. In addition, as $V_M^P(q_t, \gamma^j)$ varies negatively with γ^j, it must be the case that the cutoff level of monitoring costs will increase as q_t rises and decline when q_t falls. Figure 3 demonstrates the changes in the expected values of each type of investment contracts and the resulting change in the cutoff level $\gamma^*(q_t)$ as q_t declines. As can be seen, a decline in q_t leads to a higher fraction of direct investors in the recipient economy. The next proposition completes the analysis in the general equilibrium model.

To prove that the equilibrium relative price q_t declines with a decline in y_t, it is sufficient to show that the amount of the nontradable good supplied in the domestic market by any foreign investors is strictly increasing in q_t. From the market-clearing condition of the nontradable good after using the local managers' budget constraints and the results from Propositions 1 to 5, we have

$$\begin{aligned}
\int_{\gamma^j}\int_{\theta} \frac{y_t}{q_t} dP(\theta)d\mu(\gamma^j) &= \int_{\gamma^j}\int_{\theta} \left[\theta G(i_{jt}) - Z_{jt}^D \lambda\theta G(i_{jt}) - \left[1 - Z_{jt}^D\right]\gamma^j m_{jt}(\theta)\right] dP(\theta)d\mu(\gamma^j) \\
&\quad - \int_{\gamma^j}\int_{\theta} x_{jt}(\theta,\theta)dP(\theta)d\mu(\gamma^j) \\
&= \int_0^{\gamma^*(q_t)} \left[\widetilde{\theta} - \int_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P]dP(\theta)\right] G(i_{M,jt}^P)d\mu(\gamma^j) \\
&\quad - \int_0^{\gamma^*(q_t)} \gamma^j P(\theta_{M,jt}^P)d\mu(\gamma^j) + \left[1 - \mu(\gamma^*(q_t))\right]\left[1 - \lambda\right]\widetilde{\theta}G(i_{jt}^D)
\end{aligned}$$

The left-hand side of the above equation represents the net quantity demanded of the nontradable good, which is equal to the local managers' demand in excess of the compensation received from the investment contracts signed with foreign investors. The right-hand side represents the net quantity supplied of the nontradable good by foreign investors. This is equal to the amount of the output after the monitoring costs or the management costs are incurred and the compensation to the managers are paid.

The next proposition shows that the equilibrium relative price q_t will decline with y_t. The intuition of this proposition is simple. In this model economy, local managers are the only buyers of the foreign investors' output. As their major source of income decreases, there will be a lower demand for the nontradable good, their consumption good, in the local market. This will lead to a lower equilibrium price that clears the local market as long as the aggregate net quantity supplied of the nontradable good is strictly increasing in q_t. From (1) the quantity supplied by the direct investors are obviously increasing in q_t as $G(i_{jt}^D)$ is strictly increasing and i_{jt}^D is strictly increasing in q_t. Proposition 7 shows how the net quantity supplied by the portfolio investors changes as q_t varies; the proof of which is presented in Appendix A.

Proposition 7. *The net quantity supplied of the nontradable good by portfolio investors is increasing in q_t for each γ^j. Thus, the equilibrium relative price q_t varies positively with y_t.*

Thus far, it has only been proved that worsen economic conditions of the recipient country of capital flows will lead to a lower level of total capital inflows, while at the same time more foreign investors find direct investments more profitable than portfolio investments. This is due to the fact that the optimal level of all types of investment contracts as well as the cutoff level $\gamma^*(q_t)$ vary positively with q_t. However, it has not yet been proved that the aggregate level of capital inflows in the form of direct investments, $[1 - \mu(\gamma^*(q_t))]\, i_{jt}^D$, may indeed increase as q_t declines. The next section shows results of the model for some parameter values and demonstrates that the aggregate foreign direct investment inflows may increase for these specific cases.

5 Numerical Exercises

In this section, the model is parameterized, and the results for different parameter values are reported. In order to illustrate the effects of changes in the recipient country's economic conditions on the levels and composition of international investment inflows, the model is solved for various values of the recipient country's endowment of the tradable good y_t. A decline in the level of the endowment represents the economy's deteriorating economic conditions. In addition, for a cross-country comparison, the model is solved for two levels of country-wide corporate governance or institution quality parameter. Countries with a lower overall level of corporate governance or weaker institutions are represented in this model as countries with a higher τ, the level of stealing by the manager of the firm. The baseline parameters used are shown in Table 1.

The endowment considered varies between 40, 35, 25, 20, 10, 5, and 2.5 units of the tradable good. The stealing fraction is assumed to be 30% in countries with weaker corporate governance and 20% in countries with stronger corporate governance, respectively. In the production of the nontradable good, the share of the tradable good input κ is assumed to be the same as the share of the labor input of the local manager, equal to 0.5, and the firms' productivity levels θ are assumed to be uniformly distributed between zero and 10. The potential monitoring costs of local managers γ^j are between zero and 5 units of the output, the nontradable good, whereas management costs λ are chosen to be 10% of the output level.

Tables 2 shows results for the case of countries with weaker corporate governance, τ of 30%, while Table 3 reports similar results for the case of better-corporate-governance countries, τ of 20%. As can be seen in both tables, the model can explain the decline in the total inflows and the rise in FDI share in the total inflows as economic conditions in the recipient country deteriorate. When the domestic consumers' income endowment y_t declines, the demand for the nontradable good in the domestic market declines as well. This leads to a lower equilibrium relative price of the nontradable good q_t and, thus, a lower return from investment to foreign investors. Foreign investors, therefore, choose to invest less in the country resulting in a lower level of the total inflows. However, as the return declines, more foreign investors find direct investment more beneficial than portfolio investment; therefore, the percentage of direct investors and also the share of FDI inflows in the total inflows increase.

Figure 4 plots the expected value of direct investment and portfolio investment for each level of γ^j for two levels of y_t, a decrease from 5 and 2.5. As predicted by the model, the expected value of FDI is strictly increasing in the relative price q_t and independent of the monitoring costs γ^j. The expected value of portfolio investment is also strictly increasing in q_t. However, the value may vary with γ^j; for low enough γ^j, the case with positive monitoring probability, the expected value of portfolio investment is higher for lower γ^j. The highest value it can reach is the value of the first-best contract which is the case when γ^j is equal to zero. For high enough γ^j, it is optimal for portfolio investors not to monitor at all. In this case, the expected value of the contract is independent of the monitoring cost. As demonstrated in the figure, there is a unique cutoff level of the monitoring costs for each cases considered and this cutoff declines as the country's economic conditions become worsen.

However, Tables 2 and **??** suggest that the change in the levels of FDI inflows depends on the initial economic condition of the recipient country of capital flows. FDI inflows may increase if the economy was initially at a relatively high endowment level. For example, from Table 2, a decline of y_t from 40 to 30 or from 30 to 25 leads to an increase of FDI inflows from 7.49 to 9.64 or from

9.64 to 10.98, respectively. On the contrary, FDI inflows may also decline together with other flows if the initial endowment was relatively low; this pattern is observed for the decline of y_t from 25 and below. These characteristics of FDI are also observed in Table 3 for the case of a country with stronger corporate governance. Figure 5 which plots the composition of capital inflows for various levels of the relative price q_t demonstrates this point. Total inflows as well as the share of FDI decline with q_t; the levels of FDI inflows, however, may increase or decrease.

The model can also explain the stylized facts regarding differences in the levels and composition of international capital across countries. By comparing the results from Tables 2 and 3, the model suggests that total inflows tend to be higher in countries that have a stronger corporate governance, while the majority of those inflows take the form of portfolio investment. Countries with a weaker corporate governance, in contrast, receive a lower level of capital inflows, while the majority of them are direct investments.

6 Concluding Remarks

Recent empirical evidence has suggested that different forms of financial flows differ remarkably in their behaviors and this evidence becomes more apparent in developing countries especially during the time of a crisis. The model developed in the chapter suggests that these characteristics simply reflect the optimal investment decision of foreign investors in the presence of asymmetric information. Since foreign direct investment (FDI) enables foreign investors to overcome the problems of asymmetric information, this type of investment will become more profitable for many investors during the time of a crisis as on average its value is less sensitive to the changes in the recipient country's economic conditions. Therefore, the model can explain a larger fraction of FDI inflows during the time of deteriorating economic conditions while other types of flows decline. In addition, the numerical experiments of the model suggest that the model can also explain the increase in the level of FDI, as observed in the data, for some parameter values. Furthermore, the model suggests that a country with weaker corporate governance will attract less capital inflows, while the majority of the inflows it attracts are in the form of direct investment. This result is also consistent with empirical evidence.

The model, however, exhibits several limitations. First, the model is solved for some arbitrarily chosen parameter values. The results would have been more convincing if the model has been calibrated to match certain quantitative properties observed in the data, especially in terms of the volatility of each type of capital flows or the changes in the level of each type of capital flows during a crisis in some countries. In addition, the results of the model strongly rely on the assumptions about the setup of each type of investment contracts. The results may have been reversed if the monitoring costs are assumed to be a fraction of the firm's output and the management costs are in terms of fixed costs. Lastly, the model economy's environment is static since all goods in the model are non-storable, agents have no intertemporal saving technology, and all financial contracts are only one-period in length. In this respect, adding the dynamic structures to the model may be one avenue that is worth pursuing.

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Appendix A

Proof of Proposition 1

To show that there exists a contract that solves (P1) that has the proposed properties is to show that contracts with the payment $v_{1,jt}(\widehat{\theta},\theta) = \theta G(i_{jt})\ \forall\widehat{\theta},\theta$ and $x_{jt}(\widehat{\theta},\theta) = 0$ for $\widehat{\theta} \neq \theta$ satisfy the same set of constraints as those in (P1) and delivers the same expected payoff to both foreign investors and local manager. Setting the payment in the second subperiod this way relaxes the relevant no-stealing constraints as much as possible while satisfying all other constraints without affecting the objective function in (P1) nor the expected payoff to the manager. Similarly, setting $x_{jt}(\widehat{\theta},\theta) = 0$ for $\widehat{\theta} \neq \theta$ relaxes the relevant incentive constraints as much as possible without affecting any other constraints or the objective function. Thus, there must be an efficient contract that has these properties. If (ii) does not hold, or the manager's individual rationality constraint is not binding, it will be possible to increase the investor's expected return while still satisfying all the constraints, contradicting that the contract is optimal. Q.E.D.

Proof of Proposition 2

Proof of (i): For reports that lead to monitoring, $\widehat{\theta} \in M_{jt}$, setting the payment $v_{1,jt}(\widehat{\theta}, \theta) = \theta G(i_{jt})$ relaxes the relevant no stealing constraints as much as possible while satisfying all other constraints without affecting the objective function in (P2) nor the expected payoff to the manager. Similarly, setting $x_{jt}(\widehat{\theta}, \theta) = 0$ for $\widehat{\theta} \neq \theta, \widehat{\theta} \in M_{jt}$ relaxes the relevant incentive constraint as much as possible without affecting any other constraint or the objective function.

Proof of (ii): For reports that do not lead to monitoring,$\forall \widehat{\theta} \notin M_{jt}$, setting $v_{0,jt}(\widehat{\theta}) = \theta^M_{jt} G(i_{jt})$, where $\theta^M_{jt} = \inf\limits_{\theta \notin M_{jt}} \theta$, satisfies the relevant limited liability constraint since for all $\widehat{\theta} \notin M_{jt}$ and $\widehat{\theta}$ feasible, $\widehat{\theta} \geq \theta^M_{jt}$. Then, by letting $x_{jt}(\widehat{\theta}, \theta) = \tau[\theta - \theta^M_{jt}]G(i_{_{jt}})$ for feasible $\widehat{\theta}, \widehat{\theta} \neq \theta$, the relevant no-stealing constraints are trivially satisfied. To show that the incentive constraints are also satisfied for $\forall \widehat{\theta} \notin M_{jt}$, first note that the ICs are satisfied before for $\widehat{\theta} = \theta^M_{jt}$ and $\widehat{\theta}$ feasible. Thus, they must also still be satisfied when $v_{0,jt}(\theta^M_{jt})$ is set to the maximum possible value, $\theta^M_{jt} G(i_{jt})$.

The ICs hold for $\widehat{\theta} = \theta^M_{jt}$, $\quad x_{jt}(\theta, \theta) \geq x_{jt}(\theta^M_{jt}, \theta)$,

$$\geq \tau[\theta G(i_{_{jt}}) - v_{0,jt}(\theta^M_{jt})] \text{ by [NP] at } \theta^M_{jt}$$

$$\geq \tau[\theta G(i_{_{jt}}) - \theta^M_{jt} G(i_{jt})] \text{ by [LL]}$$

Thus, $\;x_{jt}(\theta, \theta) \geq x_{jt}(\widehat{\theta}, \theta) \;\; \forall \widehat{\theta} \notin M_{jt}, \widehat{\theta}$ feasible

Proof of (iii): We can prove that the monitoring set, M_{jt}, is the lower interval of Θ, or that the non-monitoring set, M'_{jt}, is the upper interval of Θ, by contradiction. Suppose not, then without loss of generality, there exists a nonempty subset $\Theta_M \subseteq M_{jt}$ such that $\forall \theta_M \in \Theta_M,\; \theta_M > \theta^M_{jt}$. Now consider an alternative contract which is otherwise identical to the original contract except that $\widetilde{M}_{jt} = M_{jt}/\Theta_M$; $\widetilde{M'}_{jt} = M'_{jt} \cup \Theta_M$; and $\forall \theta_M \in \Theta_M,\; \widetilde{x}_{jt}(\theta_M, \theta_M) = x_{jt}(\theta_M, \theta_M),\; \widetilde{x}_{jt}(\theta_M, \theta) = \tau[\theta - \theta^M_{jt}]G(i_{_{jt}})$, and $v_{0,jt}(\theta_M) = \theta^M_{jt} G(i_{jt})$. This contract satisfies all the constraints and by construction, the expected payoff of the manager remains unchanged. This contract, however, reduces the monitoring costs and thus improving the investor's expected return by $\int\limits_{\Theta_M} \gamma^j dP(\theta)$. Thus, this contradicts the fact that the original contract is efficient. Q.E.D.

Proof of Proposition 3

The proof is organized into two steps. To prove (i) and (ii), we consider an alternative contract that is otherwise identical to the original contract except having the proposed properties that $\widetilde{x}_{jt}(\theta, \theta) = 0$ for all $\theta \in M_{jt}$, and $\widetilde{x}_{jt}(\theta, \theta) = \tau[\theta - \theta^M_{jt}]G(i_{_{jt}})$ for all $\theta \notin M_{jt}$, and that the investor pays an uncontingent payment to the manager $\widetilde{\widetilde{x}}_{jt} = \int\limits_{M_{jt}} x_{jt}(\theta, \theta) dP(\theta) + \int\limits_{M'_{jt}} \{x_{jt}(\theta, \theta) - \tau[\theta - \theta^M_{jt}]G(i_{_{jt}})\} dP(\theta)$, which is ≥ 0 as [LL] and [NP] hold for the original contract. Then, we can show that this contract not only satisfies the same set of contraints, but also delivers the same expected return to both the investor and the manager as the original contract.

[NP] is trivially satisfied. Since $\widetilde{x}_{jt}(\theta, \theta) \geq 0$ for all $\theta \notin M_{jt}$, [LL] is satisfied. Similarly, given the properties of $x_{jt}(\widehat{\theta}, \theta)$ for $\widehat{\theta} \neq \theta$ from Proposition 1, [IC] is satisfied. By construction, the manager and the investor are indifferent between this contract and the original contract as

$$
\begin{aligned}
\int \widetilde{x}_{jt}(\theta,\theta)dP(\theta) + \widetilde{\widetilde{x}}_{jt} &= \int\limits_{M_{jt}} \widetilde{x}_{jt}(\theta,\theta)dP(\theta) + \int\limits_{M'_{jt}} \widetilde{x}_{jt}(\theta,\theta)dP(\theta) + \widetilde{\widetilde{x}}_{jt} \\
&= 0 + \int\limits_{M'_{jt}} \tau[\theta - \theta^M_{jt}]G(i_{jt})dP(\theta) + \int\limits_{M_{jt}} x_{jt}(\theta,\theta)dP(\theta) \\
&\quad + \int\limits_{M'_{jt}} \{x_{jt}(\theta,\theta) - \tau[\theta - \theta^M_{jt}]G(i_{jt})\}dP(\theta) \\
&= \int\limits_{M_{jt}} x_{jt}(\theta,\theta)dP(\theta) + \int\limits_{M'_{jt}} x_{jt}(\theta,\theta)dP(\theta) \qquad = \int x_{jt}(\theta,\theta)dP(\theta)
\end{aligned}
$$

Secondly, we show that there is an efficient contract with $\widetilde{\widetilde{x}}_{jt} = 0$. Given the above results, the problem now becomes

$$
\text{(P3')} \max \; q_t \left[\int \theta G(i_{jt})dP(\theta) - \int\limits_{M'_{jt}} \tau[\theta - \theta^M_{jt}]G(i_{jt})dP(\theta) - \widetilde{\widetilde{x}}_{jt} - \gamma^j P(\theta^M_{jt}) \right] - i_{jt}
$$

$$
\text{s.t. [IR]} \qquad \int\limits_{M'_{jt}} \tau[\theta - \theta^M_{jt}]G(i_{jt})dP(\theta) + \widetilde{\widetilde{x}}_{jt} \geq U_0
$$

Since in our model the manager has no outside options, $U_0 = 0$, while $\int\limits_{M'_{jt}} \tau[\theta - \theta^M_{jt}]G(i_{jt})dP(\theta)$ is always positive, it must be the case that $\widetilde{\widetilde{x}}_{jt} = 0$. If this is not the case, then given that $\int\limits_{M'_{jt}} \tau[\theta - \theta^M_{jt}]G(i_{jt})dP(\theta)$ is decreasing in θ^M_{jt}, it will be possible to increase the investor's expected return while still satisfying the individual rationality constraint by reducing $\widetilde{\widetilde{x}}_{jt}$ and θ^M_{jt}, and thus the size of the monitoring set, simultaneously. Q.E.D.

Proof of Negative Definiteness of $D^2V^P_M(i^P_{M,jt}, \theta^P_{M,jt};\ q_t, \gamma^j)$

$$
D^2V^P_M(i^P_{M,jt}, \theta^P_{M,jt};\ q_t,\ \gamma^j) = \begin{bmatrix} \frac{\partial F^1}{\partial i_{jt}}(i^P_{M,jt}, \theta^P_{M,jt};\ q_t,\ \gamma^j) & \frac{\partial F^1}{\partial \theta^M_{jt}}(i^P_{M,jt}, \theta^P_{M,jt};\ q_t,\ \gamma^j) \\ \frac{\partial F^2}{\partial i_{jt}}(i^P_{M,jt}, \theta^P_{M,jt};\ q_t,\ \gamma^j) & \frac{\partial F^2}{\partial \theta^M_{jt}}(i^P_{M,jt}, \theta^P_{M,jt};\ q_t,\ \gamma^j) \end{bmatrix}
$$

$$
= \begin{bmatrix} q_t \left[\widetilde{\theta} - \int\limits_{\theta^P_{M,jt}} \tau[\theta - \theta^P_{M,jt}]dP(\theta) \right] G''(i^P_{M,jt}) & q_t\tau[1 - P(\theta^P_{M,jt})]G'(i^P_{M,jt}) \\ q_t\tau[1 - P(\theta^P_{M,jt})]G'(i^P_{M,jt}) & -q_t\tau G(i_{jt})\frac{dP(\theta^P_{M,jt})}{d\theta^P_{M,jt}} - q_t\gamma^j \frac{dp(\theta^P_{M,jt})}{d\theta^P_{M,jt}} \end{bmatrix}
$$

The first leading principal minors is negative by the strict concavity of the production function $G(i_{jt})$. Also, with $G(i) = i^\kappa, G'(i) = \frac{\kappa}{i^{1-\kappa}}$ and $G''(i) = \frac{-\kappa(1-\kappa)}{i^{2-\kappa}}$. Thus, we have

$$
\left| D^2V^P_M(i^P_{M,jt}, \theta^P_{M,jt};\ q_t,\ \gamma^j) \right|
$$

$$= -q_t^2 \left[\widetilde{\theta} - \int\limits_{\theta_{jt}^M} \tau[\theta - \theta_{jt}^M] dP(\theta) \right] G''(i_{jt}) \times \left[\tau G(i_{jt}) \frac{dP(\theta_{jt}^M)}{d\theta_{jt}^M} + \gamma^j \frac{dp(\theta_{jt}^M)}{d\theta_{jt}^M} \right]$$

$$- \left[q_t \tau [1 - P(\theta_{jt}^M)] G'(i_{jt}) \right]^2$$

$$= -q_t^2 \left[\widetilde{\theta} - \int\limits_{\theta_{jt}^M} \tau[\theta - \theta_{jt}^M] dP(\theta) \right] \frac{-\kappa(1-\kappa)}{i^{2-\kappa}} * \left[\tau i^{\kappa} \frac{dP(\theta_{jt}^M)}{d\theta_{jt}^M} + \gamma^j \frac{dp(\theta_{jt}^M)}{d\theta_{jt}^M} \right] - \left[q_t \tau [1 - P(\theta_{jt}^M)] \frac{\kappa}{i^{1-\kappa}} \right]^2$$

For the case of a uniform distribution function $p(\theta)$, $\frac{dp(\theta_{jt}^M)}{d\theta_{jt}^M} = 0$, $p(\theta_{jt}^M) = \frac{1}{B-A}$, $\widetilde{\theta} = \frac{B-A}{2}$, $[1 - P(\theta_{jt}^M)] = \frac{B-\theta_{jt}^M}{B-A}$, and $\int\limits_{\theta_{jt}^M} [\theta - \theta_{jt}^M] dP(\theta) = \frac{\left(B-\theta_{jt}^M\right)^2}{2(B-A)}$. Thus, we have

$$\left| D^2 V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j) \right| = \frac{q_t^2}{i^{2(1-\kappa)}} \tau\kappa \left\{ \frac{(1-\kappa)}{2} - \left[\frac{B-\theta_{jt}^M}{B-A} \right]^2 \frac{\tau(1+\kappa)}{2} \right\}.$$

Since the term in the bracket is strictly increasing in θ_{jt}^M and takes value between $[\frac{(1-\kappa)}{2} - \left[\frac{B}{B-A}\right]^2 \frac{\tau(1+\kappa)}{2}]$ and $\frac{(1-\kappa)}{2}$, Assumption 2.3 guarantees that $\left| D^2 V_M^P(i_{jt}, \theta_{jt}^M;\ q_t,\ \gamma^j) \right| > 0$. Q.E.D.

Proof of Proposition 4

Since for the case of $\gamma^j > 0$, $P(\theta_{jt}^M) < 1$, we can rewrite the nonlinear systems that define the solution to a portfolio investor's maximization problem as

$$F^1(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j) = \quad q_t \left[\widetilde{\theta} - \int\limits_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P] dP(\theta) \right] G'(i_{M,jt}^P) - 1 = 0 \text{ and}$$

$$F^2(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j) = \quad [1 - P(\theta_{jt}^M)] \left[q_t \tau G(i_{jt}) - \frac{q_t \gamma^j p(\theta_{jt}^M)}{[1-P(\theta_{jt}^M)]} \right] = 0$$

In this case $\frac{\partial F^2(i_{jt}, \theta_{jt}^M;\ q_t,\ \gamma^j)}{\partial \theta_{jt}^M} = -p(\theta_{jt}^M)] \left[q_t \tau G(i_{jt}) - \frac{q_t \gamma^j p(\theta_{jt}^M)}{[1-P(\theta_{jt}^M)]} \right] - [1 - P(\theta_{jt}^M)] q_t \gamma^j \frac{dh(\theta_{jt}^M)}{d\theta_{jt}^M}$. Since the hazard function $h(\theta_{jt}^M) = \frac{p(\theta_{jt}^M)}{[1-P(\theta_{jt}^M)]}$ for the uniform distribution is strictly increase in θ_{jt}^M, this partial derivative become $\frac{\partial F^2}{\partial \theta_{jt}^M}(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j) = -[1 - P(\theta_{M,jt}^P)] q_t \gamma^j \frac{dh(\theta_{M,jt}^P)}{d\theta_{jt}^M} < 0$ as the first term is equal to zero by the F.O.C.

Since the Hessian matrix $D^2 V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j)$ is nonsingular at $(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j)$, we can linearize the systems of the two first-order conditions into

$$\frac{\partial F^1}{\partial i_{jt}} di_{jt} + \frac{\partial F^1}{\partial \theta_{jt}^M} d\theta_{jt}^M + \frac{\partial F^1}{\partial q_t} dq_t + \frac{\partial F^1}{\partial \gamma^j} d\gamma^j = 0$$

$$\frac{\partial F^2}{\partial i_{jt}} di_{jt} + \frac{\partial F^2}{\partial \theta_{jt}^M} d\theta_{jt}^M + \frac{\partial F^2}{\partial q_t} dq_t + \frac{\partial F^2}{\partial \gamma^j} d\gamma^j = 0$$

where all the partial derivatives are evaluated at $(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j)$ and use the Implicit Function Theorem and apply Cramer's rule to the linearized systems above to find $\frac{\partial i_M^P(q_t, \gamma^j)}{\partial q_t}$,

$\frac{\partial i_M^P(q_t,\gamma^j)}{\partial \gamma^j}$, $\frac{\partial \theta_M^P(q_t,\gamma^j)}{\partial q_t}$, and $\frac{\partial \theta_M^P(q_t,\gamma^j)}{\partial \gamma^j}$.

Since $\frac{\partial F^1}{\partial i_{jt}} < 0$, $\frac{\partial F^1}{\partial \theta_{jt}^M} = \frac{\partial F^2}{\partial i_{jt}} > 0$, $\frac{\partial F^2}{\partial \theta_{jt}^M} < 0$, $\frac{\partial F^1}{\partial q_t} = \left[\widetilde{\theta} - \int\limits_{\theta_{jt}^M} \tau[\theta - \theta_{jt}^M] dP(\theta)\right] G'(i_{jt}) > 0$, $\frac{\partial F^1}{\partial \gamma^j} = 0$, $\frac{\partial F^2}{\partial q_t} = 0$, and $\frac{\partial F^2}{\partial \gamma^j} = -q_t p(\theta_{jt}^M) < 0$,

$$\frac{\partial i_M^P(q_t,\gamma^j)}{\partial q_t} = -\frac{\det\begin{bmatrix} \frac{\partial F^1}{\partial q_t} & \frac{\partial F^1}{\partial \theta_{jt}^M} \\ \frac{\partial F^2}{\partial q_t} & \frac{\partial F^2}{\partial \theta_{jt}^M}\end{bmatrix}}{\left|D^2 V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j)\right|} = -\frac{\frac{\partial F^1}{\partial q_t}\frac{\partial F^2}{\partial \theta_{jt}^M}}{\left|D^2 V_M^P\right|} = -\frac{(+)(-)}{(+)} > 0$$

$$\frac{\partial i_M^P(q_t,\gamma^j)}{\partial \gamma^j} = -\frac{\det\begin{bmatrix} \frac{\partial F^1}{\partial \gamma^j} & \frac{\partial F^1}{\partial \theta_{jt}^M} \\ \frac{\partial F^2}{\partial \gamma^j} & \frac{\partial F^2}{\partial \theta_{jt}^M}\end{bmatrix}}{\left|D^2 V_M^P\right|} = -\frac{-\frac{\partial F^2}{\partial \gamma^j}\frac{\partial F^1}{\partial \theta_{jt}^M}}{\left|D^2 V_M^P\right|} = \frac{(-)(+)}{(+)} < 0$$

$$\frac{\partial \theta_M^P(q_t,\gamma^j)}{\partial q_t} = -\frac{\det\begin{bmatrix} \frac{\partial F^1}{\partial i_{jt}} & \frac{\partial F^1}{\partial q_t} \\ \frac{\partial F^2}{\partial i_{jt}} & \frac{\partial F^2}{\partial q_t}\end{bmatrix}}{\left|D^2 V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j)\right|} = -\frac{-\frac{\partial F^2}{\partial i_{jt}}\frac{\partial F^1}{\partial q_t}}{\left|D^2 V_M^P\right|} = \frac{(+)(+)}{(+)} > 0$$

$$\frac{\partial \theta_M^P(q_t,\gamma^j)}{\partial \gamma^j} = -\frac{\det\begin{bmatrix} \frac{\partial F^1}{\partial i_{jt}} & \frac{\partial F^1}{\partial \gamma^j} \\ \frac{\partial F^2}{\partial i_{jt}} & \frac{\partial F^2}{\partial \gamma^j}\end{bmatrix}}{\left|D^2 V_M^P\right|} = -\frac{\frac{\partial F^1}{\partial i_{jt}}\frac{\partial F^2}{\partial \gamma^j}}{\left|D^2 V_M^P\right|} = -\frac{(-)(-)}{(+)} < 0$$

Next, to show that $V_M^P(i_{jt}, \theta_{jt}^M;\ q_t,\ \gamma^j)$ is strictly decreasing in γ^j and strictly increasing in q_t when evaluated at $i_M^P(q_t,\gamma^j)$ and $\theta_M^P(q_t,\gamma^j)$, apply the Envelope Theorem. Since $V_M^P(i_{jt}, \theta_{jt}^M;\ q_t,\ \gamma^j)$ is a C^1 function of $(i_{jt}, \theta_{jt}^M;\ q_t,\ \gamma^j)$ and the solution of the maximization problem $i_M^P(q_t,\gamma^j)$ and $\theta_M^P(q_t,\gamma^j)$ are C^1 function of (q_t,γ^j), $\frac{dV_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{d\gamma^j} = \frac{\partial V_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{\partial \gamma^j}$ and, similarly, $\frac{dV_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{dq_t} = \frac{\partial V_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{\partial q_t}$. Therefore, $\frac{\partial V_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{\partial \gamma^j} = -q_t P(\theta_{M,jt}^P) < 0$.

Since $V_M^P(i_{M,jt}^P, \theta_{M,jt}^P;\ q_t,\ \gamma^j) > 0$, we have

$\frac{\partial V_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{\partial q_t} = \left[\left[\widetilde{\theta} - \int\limits_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P] dP(\theta)\right] G(i_{M,jt}^P) - \gamma^j P(\theta_{M,jt}^P)\right] > 0$. In particular, $\frac{\partial V_M^P(i_{M,jt}^P,\theta_{M,jt}^P;\ q_t,\ \gamma^j)}{\partial q_t} = \left[\widetilde{\theta} - \int\limits_{\theta_{M,jt}^P} \tau[\theta - \theta_{M,jt}^P] dP(\theta)\right] \left[i_{M,jt}^P\right]^\kappa - \gamma^j P(\theta_{M,jt}^P) = \frac{1}{\kappa q_t} i_{M,jt}^P - \gamma^j P(\theta_{M,jt}^P)$. Q.E.D.

Proof of Proposition 5

By Proposition 4, $V_M^P(q_t,\gamma^j)$ is strictly decreasing and continuous in γ^j for any q_t. Since $\lim\limits_{\gamma^j \to 0} V_M^P(q_t,\gamma^j)$ $= V^{FB}(q_t,\gamma^j)$ where $V^{FB}(q_t,\gamma^j) > V^D(q_t,\gamma^j)$, and for high enough γ^j, $V_M^P(q_t,\gamma^j) \to V_N^P(q_t,\gamma^j)$ where $V_N^P(q_t,\gamma^j) < V^D(q_t,\gamma^j)$ for all q_t, by the Intermediate Value Theorem, there must be a unique cutoff $\gamma^* > 0$ such that $V^D(q_t, \gamma^*) = V_M^P(q_t, \gamma^*)$. Define $\gamma^*(q_t)$ implicitly by $V^D(q_t, \gamma^*(q_t)) = V_M^P(q_t, \gamma^*(q_t))$. Since $V_M^P(q_t, \gamma^j)$ is strictly decreasing in γ^j for each q_t while $V^D(q_t, \gamma^j)$ is independent of γ^j, for $\gamma^j < \gamma^*(q_t)$ it must be the case that $V^D(q_t, \gamma^j) < V_M^P(q_t, \gamma^j)$, and $V^D(q_t, \gamma^j) > V_M^P(q_t, \gamma^j)$ otherwise. Q.E.D.

Proof of Proposition 6

If $\gamma^*(q_t)$ is a C^1 solution to (5), by the Implicit Function Theorem where all the derivatives are evaluated at $(q_t, \gamma^*(q_t))$, we have

$$\frac{\partial \gamma^*(q_t)}{\partial q_t} = -\left[\frac{\partial V^D(q_t, \gamma^*(q_t))}{\partial q_t} - \frac{\partial V_M^P(q_t, \gamma^*(q_t))}{\partial q_t}\right] / \left[\frac{\partial V^D(q_t, \gamma^*(q_t))}{\partial \gamma^j} - \frac{\partial V_M^P(q_t, \gamma^*(q_t))}{\partial \gamma^j}\right].$$

Since $\frac{\partial V^D(q_t,\gamma^*(q_t))}{\partial \gamma^j} = 0$ and $\frac{\partial V_M^P(q_t,\gamma^*(q_t))}{\partial \gamma^j} = -q_t P(\theta_M^P(q_t, \gamma^*(q_t))) < 0$, $\frac{\partial \gamma^*(q_t)}{\partial q_t}$ has the same sign as $\left[\frac{\partial V_M^P(q_t,\gamma^*(q_t))}{\partial q_t} - \frac{\partial V^D(q_t,\gamma^*(q_t))}{\partial q_t}\right]$. From (1) and (4), $\frac{\partial V^D(q_t,\gamma^*(q_t))}{\partial q_t} = \frac{1}{\kappa q_t} i^D(q_t, \gamma^*(q_t))$ and $\frac{\partial V_M^P(\ q_t,\ \gamma^*(q_t))}{\partial q_t} = \frac{1}{\kappa q_t} i_M^P(q_t, \gamma^*(q_t)) - \gamma^*(q_t) P(\theta_M^P(q_t, \gamma^*(q_t)))$. Thus, $\left[\frac{\partial V_M^P(q_t,\gamma^*(q_t))}{\partial q_t} - \frac{\partial V^D(q_t,\gamma^*(q_t))}{\partial q_t}\right]$ $= \frac{\left[i_M^P(q_t,\gamma^*(q_t)) - i^D(q_t,\gamma^*(q_t))\right]}{\kappa q_t} - \gamma^*(q_t) P(\theta_M^P(q_t, \gamma^*(q_t)))$.

Using the definition of $\gamma^*(q_t)$ which is defined in (5) and the functional form of $V^D(q_t, \gamma^j)$ and $V_M^P(q_t, \gamma^j)$ from (1) and (4), it must be the case that

$\left[\frac{1}{\kappa} - 1\right] i^D(q_t, \gamma^*(q_t)) = \left[\frac{1}{\kappa} - 1\right] i_M^P(q_t, \gamma^*(q_t)) - q_t \gamma^*(q_t) P(\theta_M^P(q_t, \gamma^*(q_t)))$

or $\gamma^*(q_t) P(\theta_M^P(q_t, \gamma^*(q_t))) = \frac{1}{q_t}\left[\frac{1}{\kappa} - 1\right]\left[i_M^P(q_t, \gamma^*(q_t)) - i^D(q_t, \gamma^*(q_t))\right]$.

Notice that since $\gamma^*(q_t) > 0$ and $P(\theta_M^P(q_t, \gamma^*(q_t) > 0,\ \ i_M^P(q_t, \gamma^*(q_t)) > i^D(q_t, \gamma^*(q_t))$ i.e. there is a jump in the level of investment even though the value functions are equal.

Therefore, $\left[\frac{\partial V_M^P(q_t,\gamma^*(q_t))}{\partial q_t} - \frac{\partial V^D(q_t,\gamma^*(q_t))}{\partial q_t}\right] = \frac{1}{\kappa q_t}\left[i_M^P(q_t, \gamma^*(q_t)) - i^D(q_t, \gamma^*(q_t))\right]$ $-\frac{1}{q_t}\left[\frac{1}{\kappa} - 1\right]\left[i_M^P(q_t, \gamma^*(q_t)) - i^D(q_t, \gamma^*(q_t))\right] = i_M^P(q_t, \gamma^*(q_t)) - i^D(q_t, \gamma^*(q_t)) > 0$. Q.E.D.

Appendix B Empirical Evidence

Figures 6-11 plot international capital flows by foreign investors in six developing countries that experienced a financial crisis during the 1990s. All figures were constructed using annual data from the International Monetary Fund (IMF)'s International Financial Statistics (IFS) database, March 2006. Total flow is classified into foreign direct investment (FDI) and non-FDI flows.[9] For foreign direct investment (FDI) flows, IFS's direct investment in reporting economy (line 78bed) was used. Non-direct investment flows are calculated as the sum of IFS's portfolio investment liabilities (line 78bmd), debt security liabilities (line 78bnd), and other investment liabilities (line78bid). In the model, non-FDI flows are referred to as portfolio investment.

As can be seen in all figures with the exception of Figure 11 for Malaysia, non-FDI flows responded very sharply to the crises. For example, in Figure 6 non-FDI flows in Mexico fell to less than a third of the 1993 level in 1994 and then turned negative. Similarly, in Figures 7 and 8, they declined by more than 80 percent in Korea and 50 percent in the Philippines over the course of one year of the crises and then turned negative. From Figures 9 and 10 for Thailand and Indonesia, non-FDI flow even turned negative during the first year. However, this pattern was not observed for Malaysia in Figure 11.

The behavior of FDI flows, on the contrary, differs dramatically across the two groups of countries, classified according to whether or not the crises involved a default by the country's government on its debts and an imposition of controls on international capital.[10] As illustrated in Figures 6-9, FDI flows had increased over the course of the crisis periods when there were no capital controls or sovereign default. FDI flows had almost doubled in the Philippines, a little more than doubled in Mexico and Korea, and tripled in Thailand. In contrast, from Figures 10 and 11, the FDI flows had fallen in Indonesia and Malaysia.

[9] Plotting net flows as the sums between foreign investors' and residents' investment gives similar results.

[10] For more details on the policies used, see http://www.duke.edu/~charvey/Country_risk/couindex.htm

Figure 1: The Timeline of an Investment Contract within Each Period

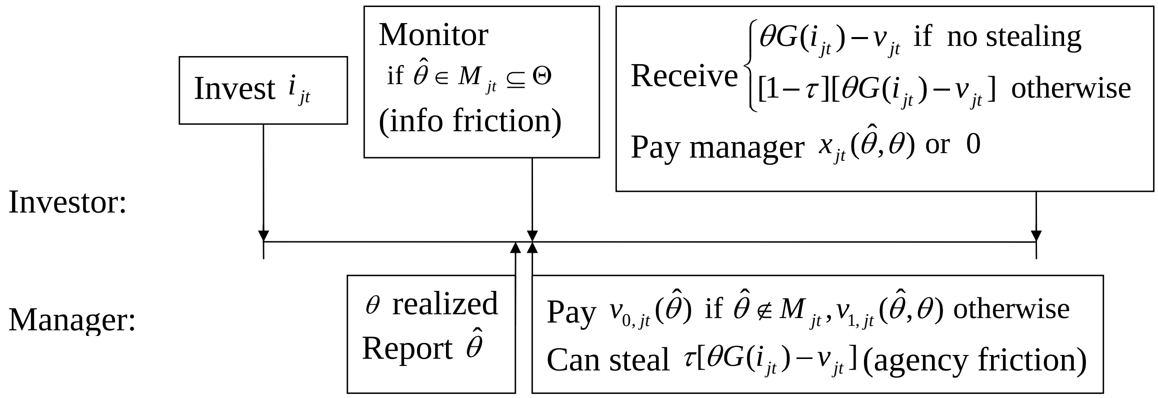


Figure 2: Expected Value of Each Type of an Efficient Investment Contract

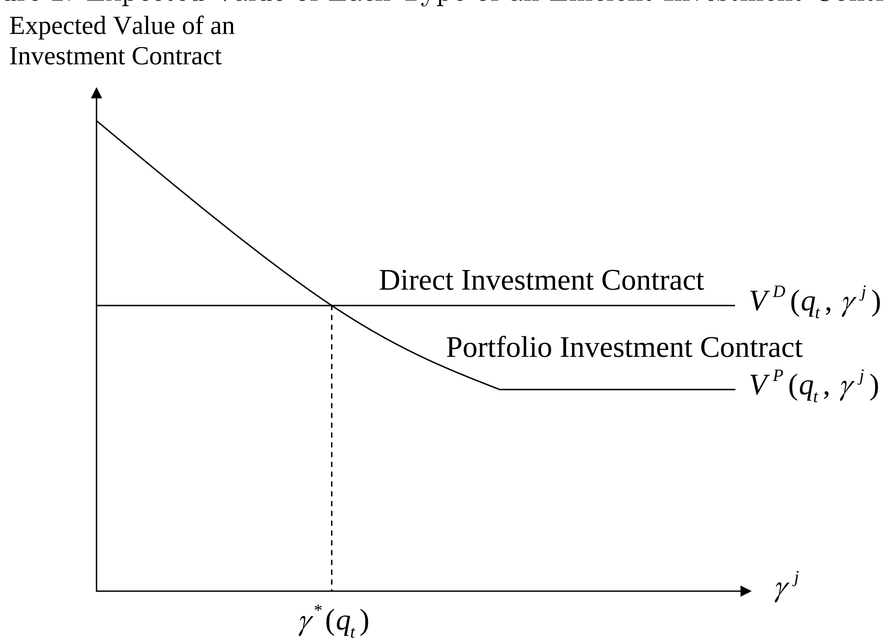


Figure 3: Comparative Statics of the Expected Value of Each Type of an Efficient Investment Contract with $q_1 < q_2$

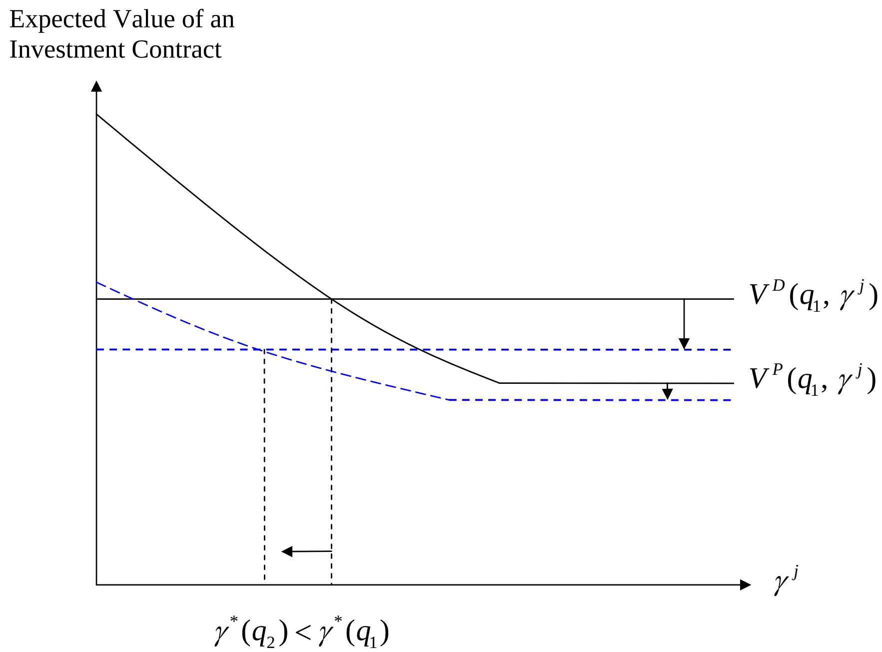


Figure 4: Equilibrium Expected Value of Each Type of Investment

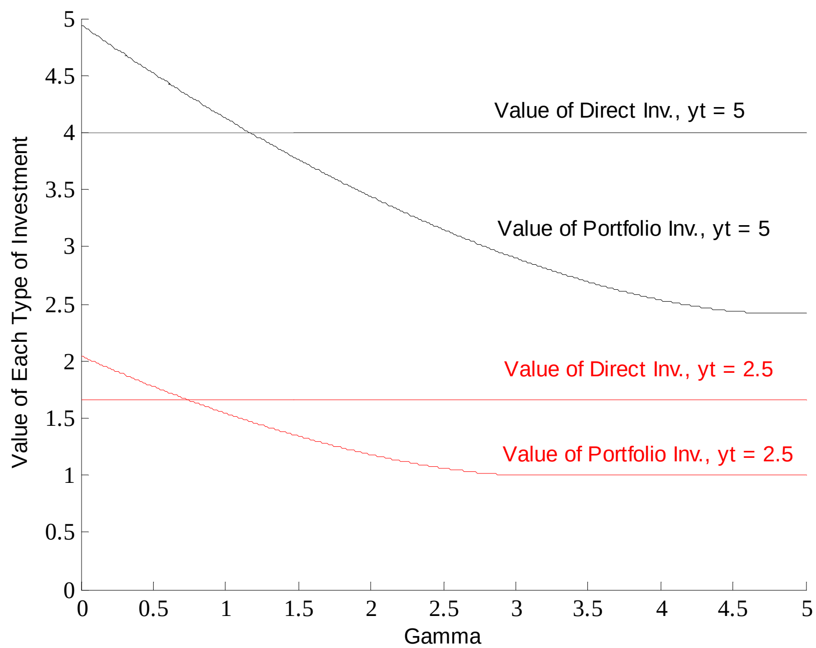


Figure 5: Composition of International Capital Inflows, a Partial Equilibrium Analysis

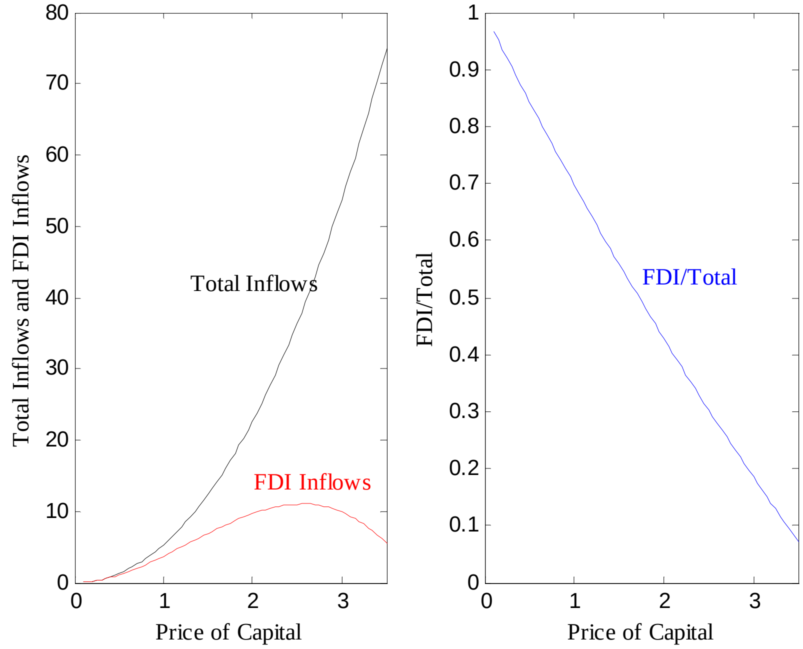
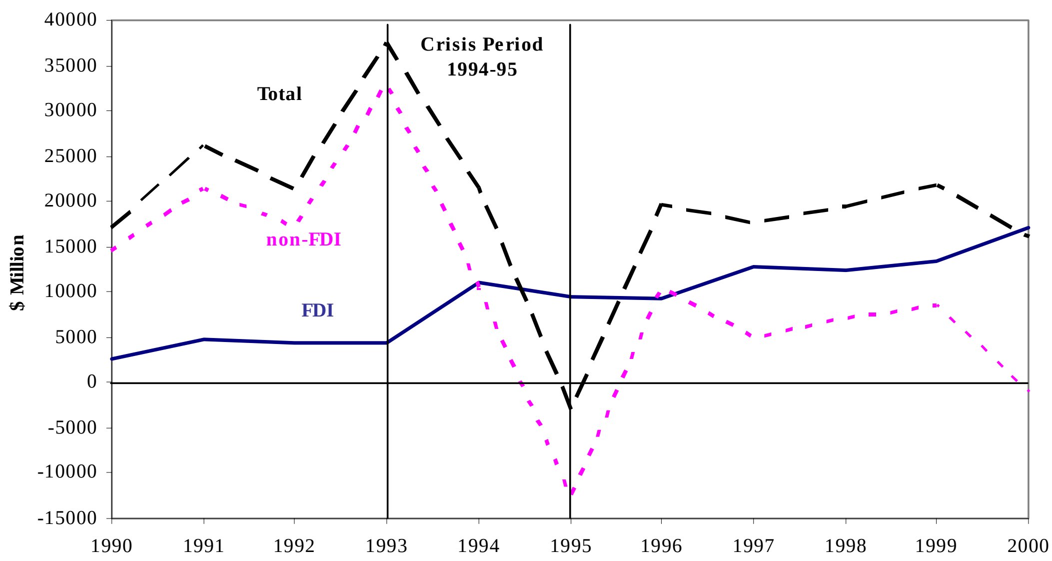
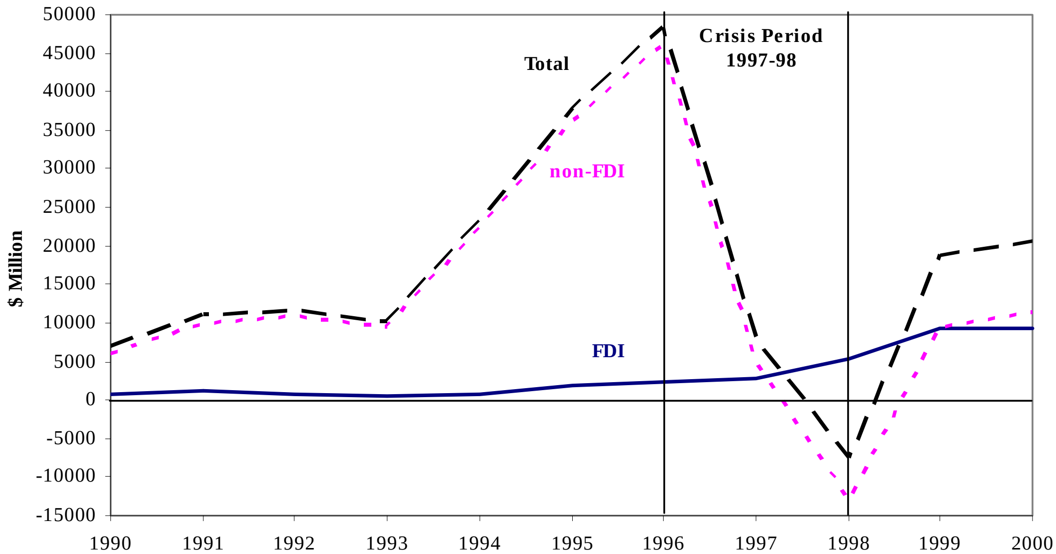


Figure 6: International Capital Flows by Foreign Investors in Mexico



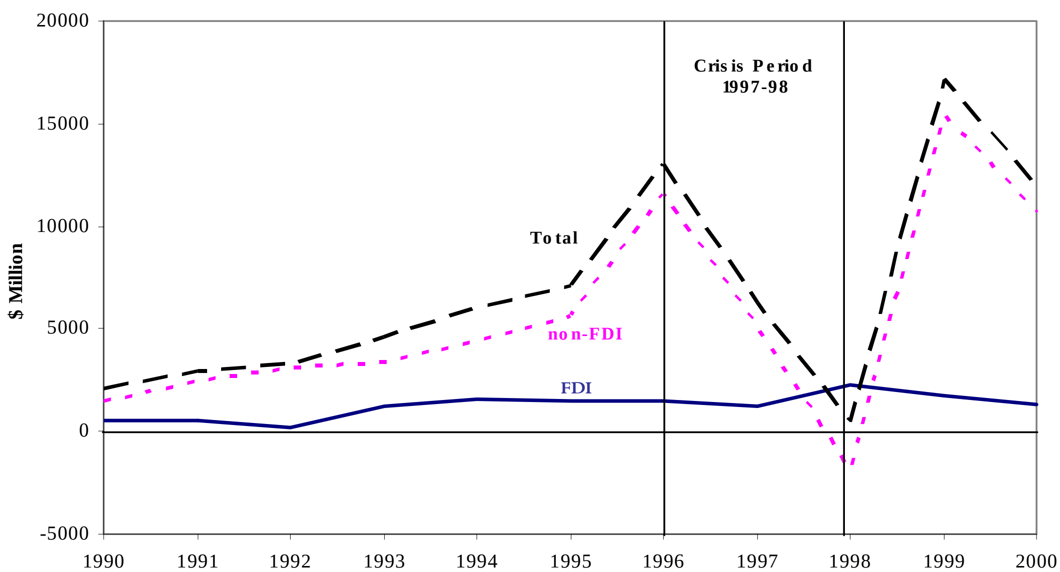
Source: IMF, International Financial Statistics (IFS) database, Mar 06.

Figure 7: International Capital Flows by Foreign Investors in Korea



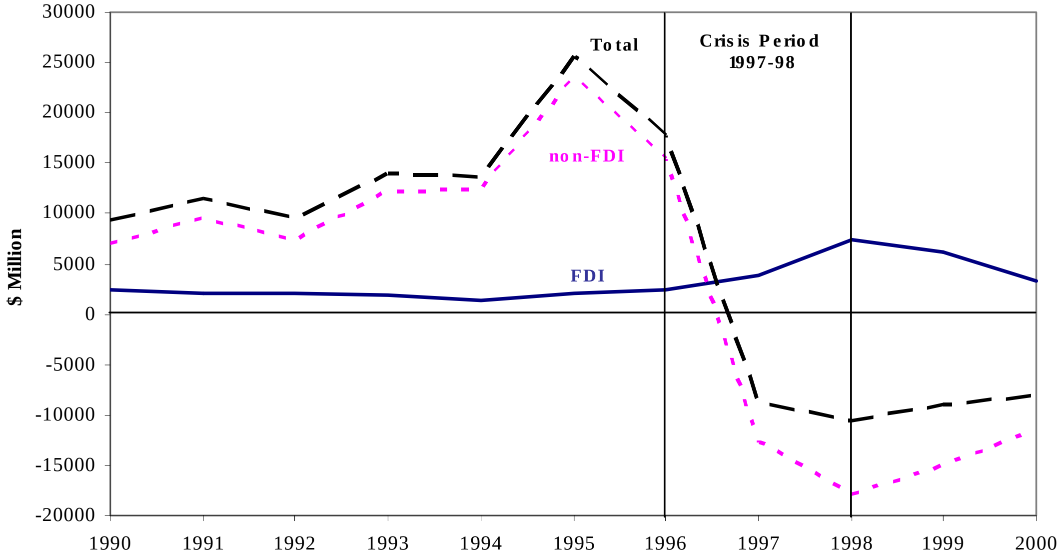
Source: IMF, International Financial Statistics (IFS) database, Mar 06.

Figure 8: International Capital Flows by Foreign Investors in the Philippines



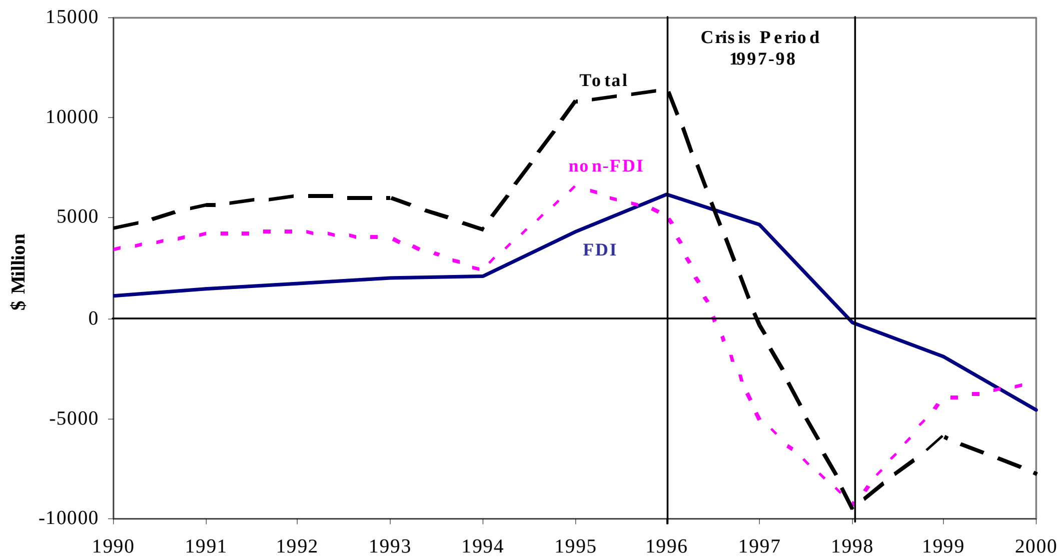
Source: IMF, International Financial Statistics (IFS) database, Mar 06.

Figure 9: International Capital Flows by Foreign Investors in Thailand



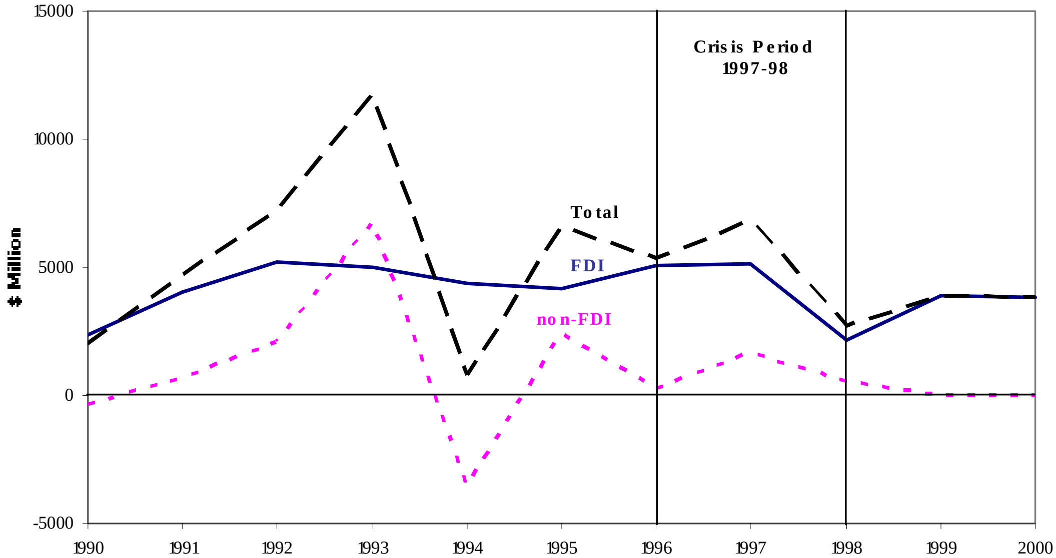
Source: IMF, International Financial Statistics (IFS) database, Mar 06.

Figure 10: International Capital Flows by Foreign Investors in Indonesia



Source: IMF, International Financial Statistics (IFS) database, Mar 06.

Figure 11: International Capital Flows by Foreign Investors in Malaysia



Source: IMF, International Financial Statistics (IFS) database, Mar 06.

Table 1: Baseline Parameters

Parameter	Values	Description
y_t	40, 35, 25, 20, 10, 5, and 2.5	Endowment of the tradable good in the recipient country
τ	0.3 and 0.2	Stealing fraction
θ	[0:0.1:10], uniformly distributed	Firms' productivity
κ	0.5	Tradable good share in the production
γ^j	[0:0.01:5]	Monitoring costs
λ	0.1	Management costs

Table 2: Levels and Composition of Capital Inflows by Foreign Investors for τ =30%

	$y_t = 40$	$y_t = 35$	$y_t = 25$	$y_t = 20$	$y_t = 10$	$y_t = 5$	$y_t = 2.5$
Relative price q_t	3.33	3.06	2.47	2.15	1.38	0.89	0.57
Total Inflows	67.06	55.89	35.44	26.26	10.46	4.22	1.7135
FDI Inflows	7.49	9.64	10.98	10.28	6.18	3.08	1.41
% of FDI/Total	11%	17%	31%	39%	59%	73%	82%
% of Direct Investors	13%	20%	36%	44%	64%	77%	85%

Table 3: Levels and Composition of Capital Inflows by Foreign Investors for τ =20%

	$y_t = 40$	$y_t = 35$	$y_t = 25$	$y_t = 20$	$y_t = 10$	$y_t = 5$	$y_t = 2.5$
Relative price q_t	3.33	3.06	2.47	2.15	1.38	0.89	0.57
Total Inflows	67.47	56.19	35.60	26.36	10.49	4.22	1.18
FDI Inflows	4.47	7.37	9.81	9.49	5.96	3.02	1.39
% of FDI/Total	7%	13%	28%	36%	57%	72%	81%
% of Direct Investors	8%	16%	32%	41%	62%	75%	84%