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The Composition of Capital Flows When Emerging Market Firms Face Financing Constraints *

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Abstract

Using a small open economy framework, we model the composition of capital inflows as the equilibrium outcome of emerging market firms' financing decisions. We show that debt limits, equity issuing costs, and foreign direct investment search costs generate a financing premium and that the "cheapest" source of financing depends on the phase of the business cycle and past financing decisions. The model delivers several results that are consistent with stylized facts observed in emerging markets. First, as the cost of each financing instrument changes, the demand for foreign debt, portfolio equity, and foreign direct investment adjusts thereby explaining fluctuations in the composition of the capital account over the business cycle. Second, the financial frictions generate a countercyclical financing premium which is consistent with countercyclical interest rates and a countercyclical current account.

JEL Codes: F32, F34, F41, G15

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1 Introduction

This work explains patterns in capital inflows to emerging markets by modeling capital inflows as a source of financing for firms in a small open economy (SOE). Assuming financial frictions are non-trivial, a firm must not only decide how much to invest but how to best finance a particular project. Using a dynamic SOE model, we show that capital flow composition can be explained as the optimal choice of firms' financing decisions.

Capital inflows over the long term vary tremendously by country and seem to exhibit slow moving trends within regions. The composition of inflows varies significantly by country and region. If you break down private inflows into three major categories, foreign direct investment (FDI), debt, and portfolio equity by country, there does not appear to be a consistently strong revealed preference toward one channel across the emerging markets. As seen in Figures 1 and 2 and Tables 1, Latin American and East Asian countries tend to primarily use FDI, while Eastern European countries use more debt. While the cross section of flows exhibits much heterogeneity, over time the volume and composition of flows to individual countries and over regions has strong, somewhat smooth trends. For example, as shown in Figure 2, for Latin America debt inflows were practically zero during the 1980's, grew during until the East Asian and Russian crises, and then retrenched afterwards. Eastern Europe exhibits the opposite behavior. For East Asia, debt inflows severely dropped in the aftermath of the Asian Crisis. FDI financing has been relatively stable, particularly since 1990 for the three regions. Inflows of portfolio equity were practically zero for the three regions during the 1980's, grew during the 1990's, and became somewhat less important since 1999.

At the business cycle frequency capital inflows are characterized by three stylized facts. First, each type of flow tends to be more volatile than the sum of flows, suggesting there is some degree of substitutability. To further support this notion of substitutability Table 2 lists the correlation between flows for various countries. For example, in Mexico, FDI is negatively correlated with debt and portfolio equity inflows. However, for different countries and regions, the degree of substitutability (negative correlation) or complementarity (positive correlation) varies. For example, for South Korea, while FDI and debt appear to be substitutes, as in Mexico, FDI and portfolio equity seem to be complements. Second, as Table 3 shows, flows tend to move with investment, and thus with the business cycle. Third, each type of flow has a different correlation with investment. In Mexico (see Figure 3 and Table 3), there seems to be a clear correlation of the type of financing depending on the state of the business cycle. In particular, debt seems to be positively correlated with output, while FDI seems to be negatively correlated with output. In South Korea (see Figure 4) a similar pattern emerges.

Theoretically, going back to at least Modigliani and Miller (1958), if sources of financing are perfect substitutes, then a firm can simply focus on how much to invest and randomly choose financing without affecting the value of the firm. Since capital flows are a source of financing, in a world with no financial frictions the external capital structure would be indeterminate and there would be no visible pattern in the flows. Yet, the fact that a particular country does seem to be favor one type of flow over another and that these flows tend to vary with the business cycle suggest that these forms of financing are not perfect substitutes.

In our model, financing constraints are present, and firms are forced to optimize over the array of financing choices. A firm chooses not only the type of financing instrument but the owner of that instrument by choosing to raise capital among domestic agents and foreigners. There are four potential sources of financial frictions. First, firms cannot allow their dividends to go below a certain lower bound. Second, foreign lenders place an upper bound on the amount they are willing to lend based on the desired fixed capital of the firm. Third, to launch an international equity or debt offering the domestic agents pay transaction costs based on the firm size and the size of the offering. Last, a multinational firm faces search costs when trying to find a domestic firm to buy. Given these constraints exist, financing options are no longer be perfect substitutes. A domestic firm decides not only how much to invest but also chooses the cheapest way to finance the project. In doing so, a country's external capital structure is determined.

The occasionally binding financing constraints, as well as the explicit financing costs generate a financing premium, raising the cost of capital above the world interest rate. This financing premium can be decomposed into two components, one fixed and one variable. The fixed portion depends on institutional factors within an economy. Given South Korea's enforcement of property rights, for instance, it is less costly for a multinational to set up shop in South Korea than in Brazil. The variable component of the financing premium is a function of the state of the economy and past financing decisions. For instance, a firm is much less likely to bump up against a debt limit if its current debt level is low and the economy is experiencing a boom.

The fixed and variable parts of the financing premium work to explain all three stylized facts on emerging market capital flows. The fixed component accounts for the fact that the breakdown of flows in the long run remains fairly consistent but may differ substantially across countries. The variable component explains why there is much volatility in the short run. The cost of each type of capital varies with the business cycle, causing the firm to use different financing instruments at different points in the cycle. While reconciling to U.S. accounting standards and listing on the New York Stock Exchange during an economic downturn may seem prohibitively expensive for a Mexican firm, during an expansion, given the firm may have already taken on a large amount of debt, this may be the cheapest option.

The key to the model's ability to explain not only the short and long term patterns of capital flows but also the countercyclical interest rates and current account observed in most emerging markets lies in the fact that the financing premium is countercyclical. When the economy is in a slump, its financing premium is high because the firm has to pay interest on money borrowed during the boom and its desired capital stock is relatively low. As the economy starts to expand, however, the desired capital stock increases thus lowering the cost of capital. At the peak of the boom, since the capital stock is likely to be falling in the future as productivity slows, financing costs once again become relatively expensive. The relatively low financing premium during an economic expansion causes an increase in demand for foreign capital, which translate into a decline in the current account. The domestic interest rate, which depends on the marginal rate of substitution as well as the financing premium, moves with the financing premium generating a countercyclical interest rate for the emerging markets. More foreign capital flows into the emerging economy when it is cheap, resulting in a more procyclical capital account (and a more countercyclical current account) consistent with what is observed for many emerging market economies (Neumeyer and Perri, 2005).

To test the ability of these financial frictions to explain observed patterns in capital flows, the theoretical model is calibrated to the Mexican economy and then simulated. The challenge in having these financial constraints and costs that are faced by firms but only occasionally binding at the heart of the model, is how to calibrate them correctly. For instance, the cost of doing an international equity tranche bears both explicit and implicit costs. Because these constraints and costs are not always observable, we instead ask how big must these costs and constraints be in order to match the observed decomposition and volatility of capital flows. We find for reasonable values of the costs and constraints we are able to match quite well Mexico's private capital inflow structure over time.

Much of the existing theoretical literature on capital flow composition has focused on forms of flows in isolation rather than the optimal structure of capital flows.[1] In terms of explaining why the types of capital flow may differ and potentially why some may be "better" for a country in the long run, the theoretical literature has focused on info asymmetries (Razin et al., 1999, 2001), varying degrees of the enforceability of claims (Albuquerque, 2003), and risk sharing properties (Hull and Tesar, 2001). While these factors may favor some types of flows over others, they are unlikely to be able to explain why the various types of capital flows in the short run are so volatile. Moreover, these different stories focus the suppliers of funds to determine the resulting capital structure. Importantly, our model, in contrast, focuses on the demand considerations of the domestic firms given the constraints it faces.

Since the early 1990s there has been a surge in empirical work trying to establish whether changes in composition and volatility of capital flows are due to shifts in the supply of funds by foreign investors (push) or in the demand by domestic residents (pull). The concern being that if capital is being pushed into emerging markets, it would be optimal for emerging market economies to design policies that encouraged certain kinds of flows (e.g. long-term debt vs. short-term debt, FDI vs. portfolio flows) so that it would be more difficult for foreigners to reduce the supply dramatically

[1] An exceptions is the paper by Razin, Sadka, and Yuen (Razin et al., 1998). They focus on the long-run composition of capital inflows while we focus on the business cycle properties of the composition.

if conditions changed in the emerging market. In our model, an optimal capital structure arises given the existing financial frictions. Thus, government policy that would target the flows directly may lead to a welfare reduction if it does not deal with the underlying financial frictions.

Campion and Neumann (2004) conduct an empirical study of the factors that determine the volume and composition of capital flows. The main emphasis of the study is on the capital controls. They use a sample of seven Latin American economies, using quarterly data, looking at gross inflows (FDI, portfolio equity, and debt) as dependent variables. On the right hand side, they use both push and pull factors as well as a capital control index. Campion and Neumann find that capital controls significantly affect the composition of flows but not the volume of flows. Capital controls tend to reduce the debt/equity external financing of firms, and reduce non-FDI flows. Unfortunately, the paper does not control for domestic output as one of the factors, so it is hard to draw business cycle implications from the analysis. Montiel and Reinhart (1999) study the role of capital controls and sterilized interventions in determining the composition of capital flows. The focus is on flow maturity (long term/short term). The empirical study uses annual data from the IMF's WEO database on capital flows at regional and country level (15 countries). The empirical specification regresses volumes of flows and composition of flows on different supply and demand factors, a measure of capital controls, and sterilized interventions. Montiel and Reinhart find that capital controls influence the composition of capital inflows but not the volume of flows. Meanwhile, sterilized interventions affect both volume and composition. Capital controls tend to reduce short term flows and increase FDI flows. The study by Lane and Milesi-Ferretti (2000) looks at composition of private and total capital flows. Unfortunately, it uses only cross-sectional variation for a sample of countries in 1997 which makes it hard to draw business cycle implications[2]

The goal of this paper is to provide a theoretical model to help disentangle the co-movement between different types of capital flows across the business cycle as well as in the long run. We start with a canonical model of firm financing decision and we augment it to fit in an international framework appropriate for emerging markets.

[2]Faria and Mauro (2004) provide empirical evidence on the importance of institutions in determining the external capital structure of a country.

2 An equilibrium model of capital flow determination

The model can be summarized as a SOE model with financial frictions and two sets of agents: foreign and domestic. The domestic SOE consists of a representative firm which is subject to non-diversifiable productivity shocks as well as a representative household which receives income by working for the firm in addition to receiving dividends. The residents of this economy are risk averse. Domestic agents take the international interest rate as given. The firm invests in profitable projects and has the power to trade bonds and equity with the rest of the world. Domestic firms face borrowing limits on their debt, a lower bound on their dividends, as well as a short selling constraint on their equity holdings. At any point in time, they have the potential to be bought out by a multi-national firm. Foreign agents are made of two entities: the aforementioned multi-national firms who are attempting to purchase firms in the SOE and the usual global credit market of non-state-contingent, one-period bonds that determines the world's real interest rate via the standard SOE assumption. Unlike the domestic firms that are limited by financial frictions, the multinational firms are unconstrained. However, they face search costs in finding a firm to purchase in the domestic economy.

2.1 Domestic households

A large number of identical, infinitely-lived households inhabit the SOE. Households choose labor, consumption, and purchase shares in domestic companies to maximize the present value of lifetime utility:

$$\mathcal{U} = \sum_t \beta^t U\left(c_t - G(l_t)\right) \tag{2.1}$$

where U is a concave, continuously differentiable instantaneous utility function. Households receive utility from the composite commodity made up of perishable goods, c_t, and labor, l_t. The composite good, $c_t - G(l_t)$, is defined as in Greenwood et al. (1988) (GHH). $G(l)$ is a concave, continuously differentiable function that measures the disutility of labor. The GHH composite good neutralizes the wealth effect on labor supply by making the marginal rate of substitution between consumption and labor supply depend on the latter only.

Households maximize utility subject to the following period budget constraint:

$$s_t\left(\gamma_t\widetilde{\mathrm{div}}_t + p_t + \Theta_t V_t^{\mathrm{NASH}}\right) + \left(1 + r_t^d\right) b_t^d + w_t l_t = c_t + s_{t+1} p_t + b_{t+1}^d \tag{2.2}$$

The household receives income from labor, $w_t l_t$, dividends that are owned by domestic residents, $\gamma_t\widetilde{\mathrm{div}}_t$, and interest on domestic bonds, $\left(1 + r_t^d\right) b_t^d$. γ_t is the share of the firm that is owned by domestic households. s_t and s_{t+1} are beginning and end-of-period shares of the domestic stock that are traded between households. b_t^d and b_{t+1}^d are holdings of one-period domestic bonds, p_t is the price of equity, and r^d is the net domestic real interest rate. If a domestic firm is sold to a multinational, domestic residents receive the income from that sale $\Theta_t V^{\mathrm{NASH}}$, where Θ_t is the change in foreign ownership and V^{NASH} is the sale price.

Domestic household's optimality conditions

The first-order conditions of the optimization problem of domestic household (2.1) with respect to labor, domestic bonds, and domestic share purchases are:

$$\frac{\partial G(l_t)}{\partial l_t} \equiv G_{l_t} = w_t \tag{2.3}$$

$$1 + r_t^d = \mathcal{E}\left[\beta\frac{U_{c_{t+1}}}{U_{c_t}}\right] \tag{2.4}$$

$$E\left[\beta\frac{U_{c_{t+1}}}{U_{c_t}}\left(\frac{\gamma_{t+1}\mathrm{div}_{t+1} + p_{t+1}}{p_t}\right)\right] = 1 \tag{2.5}$$

where U_{c_t} represents the marginal utility of period-t consumption. The first condition equates the marginal disutility of working with the wage rate. Note that with the GHH assumption, G_{l_t} is independent of the level of consumption. The second condition is the usual Euler equation that determines the dynamics of domestic bond demand. The third condition equates the marginal returns of saving (buying bonds) and investing in the domestic firms (buying domestic shares).

2.2 Domestic firms

There are a large number of identical firms in the SOE producing a single tradable good using a variable labor input, l_t, and variable capital, k_t. Firms produce the single tradeable good using a constant-returns-to-scale (CRS) technology $y_t = \exp(e_t) f(k_t, l_t)$, where e_t is a Markov productivity shock and y_t is net output.

The value of the domestic firm is derived from the discounted value of returns on labor and capital. In addition, the value reflects both the possibility that new shares, sec_t, may be issued and that there is some chance the firm will be purchased by a foreigner. To incorporate the impact of new issuance on firm value, we follow Fazzari et al. (1988) and adjust dividends, div_t, by the dilution that arises from the secondary equity issuance, sec_t:

$$\widetilde{\mathrm{div}}_t \equiv \mathrm{div}_t - \mathrm{sec}_t$$

where $\widetilde{\mathrm{div}}_t$ is the measure of adjusted dividends. Without taking into account the probability of being bought, the total value of the firm, V_t^D, is the present value of dividends adjusted for the present value of new shares issues that would have to be bought by current equity holders to maintain a proportional claim on the firm.

$$V_t^D = \widetilde{\mathrm{div}}_t + \frac{1}{1 + r_t^d} V_{t+1}^D.$$

Every period the firms in the SOE have some time-varying probability, Θ_t, of being bought by a foreigner (i.e., non-greenfield FDI). Firms take that probability as given. If each firm faces a probability of Θ of being purchased, for the economy as whole we assume Θ sales go through. The price of the sold firm, V^{NASH}, is determined by the Nash bargain between the emerging market firm and foreign firm, to be discussed later. Thus, the value of the firm at any point in time, V_t^D, is given by:

$$V_t^D = \left(\gamma_t \widetilde{\mathrm{div}}_t + \Theta_t V_t^{\mathrm{NASH}}\right) + \frac{1}{1 + r_{t+1}^d} V_{t+1}^D. \tag{2.6}$$

In the decentralized equilibrium, since the household owns the firms, the discount rate of the firm reflects the households' marginal rate of substitution:

$$M_{t+i} \equiv \frac{1}{1+r^d_{t+i}} = \beta^i \frac{U'(c_{t+i})}{U'(c_t)}. \tag{2.7}$$

Taking the discount factor as given, and iterating forward on (2.6), the value of the firm is driven by the discounted post-offering dividends and the probability of being purchased:

$$V_t^D = E_t \sum_{j=0}^{\infty} M_{t+j} \left(\gamma_{t+j} \widetilde{\mathrm{div}}_{t+j} + \Theta_{t+j} V_{t+j}^{\mathrm{NASH}}\right).$$

⋈There should be a 1-Θ around here somewhere and in the following equations. Review.

Given a sequence of adjusted discount factors, M_{t+j}, purchase probabilities, Θ_t, and share of domestic firms owned by foreigners $(1-\gamma_t)$, in a decentralized competitive equilibrium, firms maximize:

$$V_t^D = \max_{l_t, \mathrm{div}_t, k_{t+1}, b_{t+1}, \mathrm{sec}_t} E_t \sum_{j=0}^{\infty} M_{t+j} \left(\gamma_{t+j} \widetilde{\mathrm{div}}_{t+j} + \Theta_{t+j} V_{t+j}^{\mathrm{NASH}}\right) \tag{2.8}$$

subject to:

$$\begin{aligned}
[\lambda_t] \quad \mathrm{div}_t =& \exp(e_t) f(k_t, l_t) - w_t l_t + (1-\delta) k_t - k_{t+1} - (1 + r^* \exp(z_t))\, b_t \\
&+ \mathrm{sec}\left(1 - \omega_{\mathrm{sec}}\left(\frac{\mathrm{sec}_t}{k_t}\right)\right) + b_{t+1}\left(1 - \omega_b\left(\frac{b_{t+1}}{k_t}\right)\right),
\end{aligned} \tag{2.9}$$

$$[\eta_t^{\mathrm{div}}] \quad \mathrm{div}_t \geq 0, \tag{2.10}$$

$$\begin{aligned}
[\eta_t^b] \quad \frac{(1-\chi)}{\chi} b_{t+1} \leq& \exp(e_t) f(k_t, l_t) - w_t l_t - (1 + r^* \exp(z_t)) b_t - (1-\delta) k_t - \mathrm{div}_t \\
&+ \mathrm{sec}\left(1 - \omega_{\mathrm{sec}}\left(\frac{\mathrm{sec}_t}{k_t}\right)\right),
\end{aligned} \tag{2.11}$$

$$[\eta_t^{\mathrm{sec}}] \quad \mathrm{sec}_t \geq 0. \tag{2.12}$$

Note that the associated lagrange multipliers are in brackets. The domestic firms choose sequences of labor demand, l_t dividends, div_t, investment, $k_{t+1} - k_t(1-\delta)$, and foreign borrowing, b_{t+1}, to maximize the post-offering adjusted present value of dividends given by (2.8). Dividends are given by (2.9) (with the associated lagrange multiplier λ_t).

We assume that only domestic firms and not domestic households have access to foreign capital markets. Domestic firms can issue international bonds that pay a non-contingent interest rate $r^* \exp(z_t)$. The mean international interest rate is denoted by r^* and z_t is a Markov international interest rate shock. Thus, domestic firms not only to issue debt and equity abroad to finance domestic projects but they also do the international saving for domestic households.

Domestic firms face frictions in financing domestic investment projects. As long as some of these constraints bind (i.e., the firm is constrained) the value of the firm will be lower than if there were no constraints. Firms face adjustment costs when they want to access international capital markets to issue equity, $\omega_{\text{sec}}\left(\frac{\text{sec}_t}{k_t}\right)$, and debt, $\omega_b\left(\frac{b_{t+1}}{k_t}\right)$. We assume these costs to be increasing in the size of the offering relative to the size of the firm, k_t. [$\bowtie$this does not fully characterize our assumption. need to make it concave]We also assume that dividends issued by firms must be non-negative, as given by (2.10) (with the associated lagrange multiplier η_t^{div}). Finally, we assume that firms must finance a fraction, $\frac{1-\chi}{\chi}$ of their debt payments out of free income, as given by (2.11) (with the associated lagrange multiplier η_t^b). This last friction implies that each domestic firm will face a debt ceiling that will be determined by its size:

$$\left(\chi \geq \frac{b_{t+1}}{k_{t+1}}\right). \tag{2.13}$$

Domestic firms' behavior

When firms want to invest, they can use either internal resources (which reduces dividends), borrow from the world credit market, or issue new equity. The firm chooses its optimal capital stock and source of financing to minimize costs and maximize returns. Both the marginal cost of financing and the type of funds used will fluctuate over the business cycle.

Define the marginal cost of investing as $q_t \equiv \lambda_t + \eta_t^b$. In equilibrium, the marginal cost of investing, q, must equal the marginal return of investing:

$$q_t = E\left[M_{t+1}q_{t+1}\frac{\gamma_{t+1}}{\gamma_t}\left(f_{k+1} + (1-\delta) + \frac{\partial\omega_b}{\partial k_{t+1}} + \frac{\partial\omega_{\text{sec}}}{\partial k_{t+1}}\right)\right] + \eta_t^b \tag{2.14}$$

The marginal return to investing in the firm is driven by discounted return to capital tomorrow, which is given by the marginal product of next period's capital net of financial costs, and the marginal value of relaxing the debt constraint. The stochastic discount factor that prices the firm is given by the interaction of the household's marginal rate of substitution and the financial frictions.

The marginal cost of investing using these various sources of funds is reflected in the following euler condition expressed in terms of the lagrange multipliers:

$$q_t = \lambda_t + \eta_t^b = 1 + \eta_t^{\text{div}}. \tag{2.15}$$

λ_t can be interpreted as the marginal value of increasing dividends, η_t^b as the marginal value of relaxing the debt constraint, and η_t^{div} as the marginal value of relaxing the dividend constraint. It follows that the marginal cost of investing is equal to unity as long as the dividend constraint does not bind.

If firms issue debt, then marginal cost of investment is driven by the world interest rate and an endogenous financing premium:

$$q_t = \frac{E\left[M_{t+1} q_{t+1} \frac{\gamma_{t+1}}{\gamma_t}\right]}{\left(1 - \omega_b - \frac{\partial \omega_b}{\partial b}\right)}(1 + r*) + \frac{\eta_t^b}{\chi}. \tag{2.16}$$

There are two components of the financing premium: one is driven by the debt issuance costs that increases marginal costs of issuing new debt, ω_b, and the other driven by the debt constraint, η_t^b. If the dividend constraint and the debt constraint do not bind (i.e., $q_t = 1$ and $\eta_t^b = 0$) then one of two things must be true: either the firm does not issue new debt or, if the firm does issue debt, then the expected value of the marginal cost of investing tomorrow q_{t+1} must be greater than one.

If the firm issue equity, then the marginal cost of using internal resources must equal to marginal cost of issuing equity is given by:

$$q_t = \frac{1 + \eta_t^{\text{sec}}}{\left(1 - \omega - \frac{\partial \omega_{\text{sec}}}{\partial \text{sec}_t}\right)}, \tag{2.17}$$

where η_t^{sec} is the marginal value of relaxing the non-negativity constraint on secondary issuance . Because international equity issuance is costly, the marginal cost of using internal resources will be above one if firms issue equity. Putting this last result together with observation that the marginal cost of investing is equal to unity as long as the dividend constraint does not bind, it follows that the dividend constraint must be binding in order for the firm to issue new equity. Additionally, if the non-negativity constraint on secondary issuance binds, then the dividend constraint must bind as well.

The domestic interest rate

Taking the household's FOC for bonds (2.4) and the firm's FOC for debt (2.16), we can express the domestic economies return on bonds r_t^d as a function of the world's return on bonds r_t^* and the financial frictions:

$$1 + r_t^d = (1 + r_t^*) \frac{E\left[M_{t+1} \times \frac{q_{t+1}}{q_t} \times \frac{\gamma_{t+1}}{\gamma_t}\right]}{E\left[M_{t+1}\right]} + \frac{\eta_t^b}{E\left[M_{t+1}\right]\chi} \tag{2.18}$$

If the financing costs are trivial and the constraints never bind then the domestic interest rate and the international interest rate are equalized, $r_t^d = r_t^*$.

The financing frictions generate a wedge between the two rates of return. This wedge varies with the business cycle. If the domestic economy is in a recession and receives a positive productivity shock, domestic firms would like to invest. However, since their capital stock is low, the costs of borrowing abroad $\frac{\partial \omega_b}{\partial b_{t+1}}$ is high and this drives the domestic interest rate up. Due to these costs and the fact that domestic dividends are likely to hit their constraint, the value of the firm to foreigners who do not face costs and constraints would be higher than to the domestic households. Therefore, multinationals are willing to exert more effort to increase their probability of matching, which raises FDI. As the economy starts to expand the financing premium falls and the domestic interest rate approaches the world interest rate, causing the interest rate to be countercyclical.

2.3 Foreign multinationals

Let V_t^F be the unconstrained value of domestic firms and V_t^D be the constrained value of domestic firms. Assuming that the foreign multinational are unconstrained and zero outside opportunity for foreigner, the surplus of a sale of a constrained firm, $\mathcal{S}$, is the difference between the constrained and unconstrained value of the firm:

$$\text{Surplus}_t \equiv \mathcal{S}_t = \psi \left[V_t^F - V_t^D \right] \geq 0. \tag{2.19}$$

The Nash-bargaining price, V_t^{NASH}, divides the surplus (2.19) between the domestic firm and the multinational based on the multinational firm's bargaining power, ψ.

$$V_t^{\text{NASH}} = \psi \left[V_t^F - V_t^D \right] + V_t^D \tag{2.20}$$

Foreign firm know that this is the price they will pay if it finds a domestic firm. Foreign firms will choose search effort, e, in order to maximize the expected value of the surplus that it receives minus its effort costs (we assume that these costs are in paid in terms of tradable units):

$$\max_{e_t} \Theta(e_t) \left[V_t^F - V_t^{\text{NASH}} \right] - e_t, \tag{2.21}$$

where $\Theta(e_t)$ is the probability of a match, which depends on the effort spent on searching.

The multinationals optimization determines the optimal effort level, e_t and $\Theta(e_t)$, which in turn impacts the transition equation for domestic ownership, or the stock of FDI:

$$\gamma_{t+1} = \gamma_t + (1 - \gamma_t)\kappa - \Theta(e_t) \tag{2.22}$$

Domestic ownership for the entire economy falls as the probability that multinationals will match rises. However, multinational face an exogenous separation rate κ. Although the probability of matching is typically positive because the value of a domestic firm is always greater to the unconstrained multinational, net FDI inflows may be zero or even negative due to the exogenous separation.

2.4 Market clearing conditions

For the domestic economy, it must be the case the domestic bonds are in net zero supply across all individuals i: $\sum_i b_t^d = \sum_i b_{t+1}^d = 0, \quad \forall i$. Moreover, the sum of domestic shares in domestic firms,

$\sum_i s_t$, must equal one. With some abuse of notation but without loss of generality we refer to the aggregate consumption demand as c_t and to the aggregate labor supply as l_t. Then it follows from the household budget constraint, (2.2) that:

$$c_t = \gamma_t \widetilde{\text{div}}_t + w_t l_t + \Theta_t V_t^{\text{NASH}}. \tag{2.23}$$

Define gross investment $i_t \equiv k_{t+1} - k_t (1-\delta)$. Substituting into into the aggregate household budget constraint (2.23) the definition of investment and dividends (2.9) and ignoring issuance costs, we derive the following expression:

$$\underbrace{\underbrace{y_t - c_t - i_t}_{\text{net exports}} + \underbrace{-(1-\gamma_t)\text{div}_t - r_t^* b_t}_{\text{net factor payments}}}_{\text{current account}} + \underbrace{\underbrace{\overbrace{\Delta b_{t+1}}^{\text{bonds}} + \overbrace{\Theta_t V_t^{\text{NASH}}}^{\text{FDI}} + \overbrace{(1-\gamma_t)\text{sec}_t}^{\text{portfolio flows}}}_{\text{capital flows}}}_{\text{financial account}}. \tag{2.24}$$

2.5 Stochastic processes

To complete the model, we specify the stochastic process for the productivity shocks, e_t, and the international interest rate shocks, z_t. We assume that both of this shocks follow a first-order autoregressive process and they are possibly correlated. We discretize the process for the two shocks using the method of Tauchen and Hussey (1991).

2.6 Competitive equilibrium

Given a stochastic process of productivity shocks, interest rate shocks, and initial conditions, a competitive equilibrium is defined by stochastic sequences of allocations $[c_t, l_t, b_{t+1}, k_{t+1}, \text{sec}_t, \Theta_t, e_t]$ and prices $[w_t, r_t^d]$, and value functions, $[V_t^{\text{NASH}}, V_t^D, V_t^F]$, such that: (a) domestic firms maximize dividends subject to the constant returns-to-scale technology, taking factor and goods prices as given, (b) households maximize utility subject to the budget constraint and financing constraints taking as given factor prices, goods prices, the world interest rate and asset prices, (c) foreign multinational firms maximize their surplus, and (d) the market-clearing conditions for equity, labor, and goods markets hold.

3 Recursive equilibrium and numerical solution method

The model's competitive equilibrium is solved by reformulating it in recursive form and applying a numerical solution method in a similar manner to Mendoza and Smith (2004). The challenge of the numerical solution is to keep track of all four agents optimizations: the domestic households, the domestic firms, foreign investors (debt and equity holders), and the foreign multinational firms.

The general outline of the algorithm is, given prices, to first solve the domestic firm's problem using standard dynamic programming techniques. The firm's optimal allocations of investment and financing are then plugged into the foreign multinationals and domestic agents first order conditions to determine the price they would be willing to receive for supplying that particular amount of capital. The new prices that emerge are then plugged back into the firm's problem and the domestic firms update their allocations. This process continues until the price the households are willing to buy a particular financial asset is approximately equal to the price the producers is willing to sell.

To represent the domestic firms problem in recursive form, define capital, k, and international borrowing, b, as the endogenous state variables, γ is the share of the domestic firms owned by domestic residents which is also a state, and ϵ and z as the exogenous states. The state variables for the domestic firm are the probability of being taken over by a multi-national firm Θ, the value of the firm if sold, V^{NASH}, the international interest rate, r^*, domestic wages w, the domestic household's marginal rate of substitution, M. Variables without tildes are current period's variables, and those with tildes are next-period's variables. Given the state variables the domestic firms' recursive problem is given by:

$$V^D(k, b, \gamma, \epsilon) = \max_{k', b', \mathrm{sec}} \left[\gamma_t \widetilde{\mathrm{div}} + \Theta_t V^{\mathrm{NASH}} + E\left[M_{t+1} V^D\left(k', b', \gamma', \epsilon'\right)\right]\right] \tag{3.1}$$

subject to:

$$0 \leq \text{div}(\epsilon, k, b, b', k')$$

$$b' \leq k'\chi$$

$$0 \leq \sec$$

$$\text{div}_t = \exp(\epsilon)f(k,l) - wl + (1-\delta)k - k' - (1 + r^* \exp(z))b + b'\left(1 - \omega_b\left(\frac{b'}{k}\right)\right) - \sec \times \omega_{\sec}\left(\frac{\sec}{k}\right)$$

The solutions of this problem are given by a set of optimal decision rules $k'(k, b, \gamma, \epsilon)$, $b'(k, b, \gamma, \epsilon)$ and $\sec(k, b, \gamma, \epsilon)$, and a value function, $V^D\,(k, b, \gamma, \epsilon)$.

To reduce the dimensionality of the problem, the state variables can be combined into a simple internal resource variable for the firm in a similar manner to Gross (1995). Define a new state variable as the internal resources of the firm, x:

$$x \equiv \exp(\epsilon)f(k,l) - wl + (1-\delta)k - (1 + r^* \exp(z))\, b \tag{3.2}$$

Given the new state variable, x, the firm's recursive problem can be restated as follows:

$$V^D\,(k, b, \epsilon) = \max_{k', b', \sec}\left[\gamma_t(x_t - k' + b'\,(1 - \omega_b) + \sec\omega_{\sec}) + \Theta_t V^{\text{NASH}} + E\left[M_{t+1}V^D\left(k', b', \epsilon'\right)\right]\right] \tag{3.3}$$

subject to:

$$0 \leq x - k' + b'\left(1 - \omega_b\left(\frac{b'}{k}\right)\right) + \sec\left(1 - \omega_{\sec}\left(\frac{\sec}{k}\right)\right) \tag{3.4}$$

$$b' \leq k'\chi \tag{3.5}$$

$$0 \leq \sec. \tag{3.6}$$

Given the solution to the domestic firm's problem (3.3), the problems of the household and the foreign multinational are relatively straight forward. To solve the domestic households's problem we use the resource constraint to determine consumption. Thus, given the firm's decision rules , it is easy to obtain a sequence of consumption levels that are state dependent. These are fed into the domestic agent's Euler equation (2.4) to determine the stochastic discount factor. The decision rules that solve the domestic firm's problem (3.3) maximize the utility of domestic agents taking into account the economy's resource constraint, the dividend and debt constraints, the optimal rules determining wages, the foreign multinationals demand function and the market-clearing condition of the asset market. The solution for the foreign multinational is also relatively straightforward and simply solves (2.21) each period.

3.1 A step-by-step algorithm

Step 1 Initialize algorithm:

> **multinationals:** Make a guess of the value of the firm to multinationals, $V^{\text{NASH}}(x, \epsilon)$, and the probability that the domestic firm is taken over, $\Theta(x, \epsilon)$.
>
> **households:** Make a guess of the domestic households marginal rate of substitution, $M(x, \epsilon)$.

Step 2 Given $\Theta(x, \epsilon)$, $(1 + r^* \exp(z))$, $M(x, \epsilon)$, and $V^{\text{NASH}}(x, \epsilon)$, solve the domestic firm's problem to obtain the value of the domestic firm $V^D(x, \epsilon)$. This will be time consuming because you do not want to allow the firm to think they can impact next period's prices by their choice of k', b', and sec.

Step 3 Given $k'(x, \epsilon)$, $b'(x, \epsilon)$, and $\sec(x, \epsilon)$:

> **multinationals:** Using $V^D(x, \epsilon)$, calculate the Nash equilibrium price of the firm, $V^{\text{NASH}}(x, \epsilon)$, multinationals will pay and the probability of being taking over a domestic firm, $\Theta(x, \epsilon)$ from the FOC of the multinational.
>
> **households:** Use the households Euler equation to compute the households marginal rate of substitution, $M(x, \epsilon)$.

Step 4 With updated $\Theta(x, \epsilon)$, $(1 + r^* \exp(z))$, $M(x, \epsilon)$, and $V^{\text{NASH}}(x, \epsilon)$, return to **Step 2** and repeat until the price of the firm, V^{NASH}, converges.

3.2 Solution method

The domestic firm's problem, as given by the recursive equation (3.3), is solved by value function iteration. The solution algorithm creates a discrete grid for capital (NK elements), international bonds (NB elements) and secondary offerings (NSEC elements). The value function is iterated, alternating between a full optimization, and a recursion of the decision rules, until the value function does not change over successive iterations. Once the process converges, we have decision rules for future capital k', bonds b', and secondary offerings, sec. Also, we obtain a guess of the value of the domestic firm. These decision rules are fed back into the problems of the household and the foreign agents, following the algorithm described in section 3.1 until all decision rules converge. The household's problem and the foreign firm problem are relatively simple problems that depend on the decision rules by domestic firms.

3.3 Functional forms and baseline calibration

To evaluate the model numerically, we make assumptions regarding the functional forms of the production function, the instantaneous utility function, the financial frictions, and the search intensity process. For the production function, we use the usual constant-returns-to-scale Cobb-Douglas form:

$$f(k,l) = Al^{\alpha}k^{1-\alpha}. \tag{3.7}$$

The labor share of income is given by α, and A is a simple scaling parameter that we assume equal to unity.

We assume that the instantaneous utility function is of the constant relative risk aversion (CRRA) form:

$$u(C) = \frac{\left(c - \frac{l^{\xi}}{\xi}\right)^{1-\sigma} - 1}{1-\sigma}. \tag{3.8}$$

The CRRA parameter equal to σ. The intra-temporal labor elasticity of substitution is equal to $\frac{1}{1+\xi}$.

The functional forms for the adjustment costs of bonds and secondary offerings are quadratic:

$$\omega_b = \frac{\omega_b}{2}\left(\frac{b' - b}{k}\right)^2 \qquad \text{and} \tag{3.9}$$

$$\omega_{\text{sec}} = \frac{\omega_{\text{sec}}}{2}\left(\frac{\text{sec}}{k}\right)^2. \tag{3.10}$$

The new bond issuance cost equation (3.9) also defines the deterministic steady-state level of international bonds, b^{ss}.

Finally, we assume that the probability of a match for the foreign firms is given as a logistic function of effort, e:

$$\Theta\left(e\right) = \frac{\pi e}{1 + \pi e}. \tag{3.11}$$

4 Quantitative results

4.1 Business cycle dynamics

We solve the model using the algorithm described in Section 3.1 and functional equations. One of the products of the solution algorithm is the marginal distribution for all endogenous variables, given the stochastic process. From the marginal distribution, we obtain business cycle statistics.

The key to this model being able to capture the dynamics of the capital inflows is that financial frictions alter how a firm finances its investment but not necessarily the magnitude of the investment. The easiest way to verify the impact of these financial frictions is to look at the limiting distributions of both bonds and capital in a nearly frictionless model compared to one in which the frictions are relevant. Figure 5 compares the distribution of capital when issuing costs are high for debt and equity versus low. In general, these costs do not have a tremendous impact on the distribution. In Figure 6, on the other hand, inflows of bonds are dramatically curtailed by the presence of the frictions.

Table 6 reports several moments from simulated macro aggregates. In the baseline model investment and the current account tend to be overly volatile and consumption not quite volatile enough relative to output. As expected, the financing frictions force the current account to be counter-cyclical consistent with the story that capital is flowing in during expansions. Although the correlation to GDP is much lower than the correlation with investment.

Table 7 examines the relationship between the individual inflows and investment as well as the importance of these flows relative to GDP. Comparing the baseline model to the actual data for Mexico, the model generates too much bond flow and too little FDI and portfolio equity flows. In terms of their relationship to investment, bonds and portfolio equity tends to move with investment while FDI is highest when investment is desired but firms are constrained. The model is able to capture the countercyclical behavior of FDI in large part due to the fact FDI tends to rise when firms are most constrained (undervalued) which is in a recession.

Table 8 captures how issuing costs for debt and equity, debt limits, and search costs for multinationals work to generate a large degree of substitutability between FDI and portfolio equity as well as FDI and debt, but a high degree of complementarity between portfolio equity and debt inflows.

4.2 Sensitivity analysis

Table 9 shows some standard business cycle statistics for the model solved for differing levels of the bond and equity issuance cost parameter. Several results are worth noting. As the financial frictions rise, saving and investment become more correlated. Thus, financial frictions internal to the domestic economy may drive up the time series correlation of savings and investment, as Feldstein and Horioka (1980) conjecture. The correlation of investment with debt and FDI varies slightly with the degree of financial frictions. Finally, and more importantly, the correlation between the two types of financial inflows can change sign depending on the magnitude of the financial frictions. Thus, depending on the domestic and foreign institutions, different flows may appear to be either "complements" or "substitutes."

It is interesting to note that some standard business cycle statistics are relatively unaffected by the degree of domestic financial development captured by the cost of issuing debt. The correlation of consumption, capital, and, to a lesser degree, investment are relatively unaffected by the level of financial frictions. Also, the relative volatility of those series is also relatively unaffected. This suggests that we can calibrate the model to obtain dynamics for the composition of capital inflows while retaining the basic business cycle properties that are more common across countries.

5 Conclusions

This paper provides a theoretical model to disentangle the co-movement between different types of capital flows across the business cycle. We augment the canonical model of a firm financing decision to fit an international framework appropriate for the emerging markets. After calibrating the model to Mexico, the simulation results suggest that the model is successful at matching several key stylized facts. First, we show issuing costs for debt and equity, debt limits, and search costs for multinationals work to generate a large degree of substitutability between FDI and portfolio equity as well as FDI and debt, but a high degree of complementarity between portfolio equity and debt inflows. Second, since firms are using the inflow of capital to finance investment, the sum of the flows tend to be highly correlated with investment, consistent with the data. Third, while bonds and portfolio equity tend to be pro-cyclical, FDI tends to be counter-cyclical, rising when firms are most constrained (undervalued) which is in a recession. Last, from the sensitivity results it is clear why there seems to be such heterogeneity in the composition of flows across countries. Changes in the magnitude of the financial frictions (due to institutional differences between countries) have significant impacts on the composition of flows.

The important next step is to use the framework we have constructed here to consider the policy implications of various measures used to control the flow of capital to the emerging markets. If, as this work suggests, flows are an equilibrium outcome of firms' financing decisions, then shutting down one type of flow is certain to have both long and short run welfare implications.

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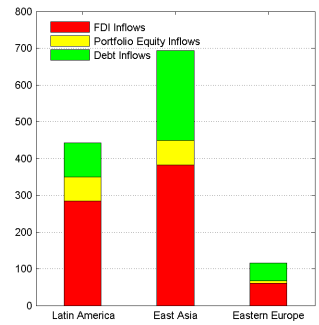
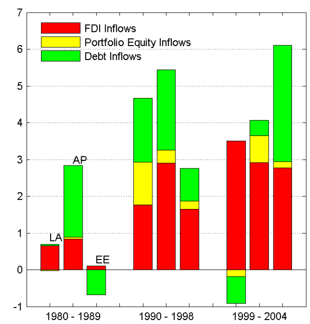
A Figures

Figure 1: External financing by type of flow
regional averages, real dollars



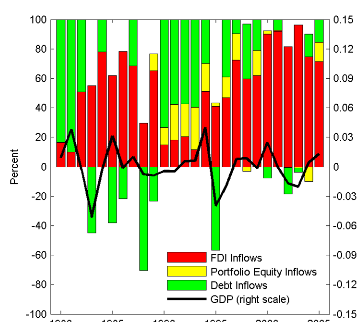
Notes: Annual gross inflows in millions real U.S. dollars. Latin America and the Caribbean is comprised of Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela; East Asia and the Pacific is comprised of China, Indonesia, Malaysia, Philippines, Singapore, and Thailand; and Eastern Europe and Central Asia is comprised of Hungary, Malta, Poland, Romania, and Turkey. Source: IFS.

Figure 2: External financing by type of flow
regional averages, % of GDP



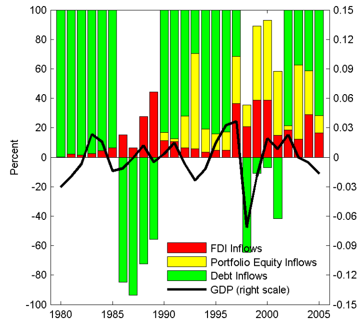
Notes: Annual gross inflows in millions of U.S. dollars, expressed as a percentage of GDP. LA refers to Latin America and the Caribbean (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela), AP refers to East Asia and the Pacific (China, Indonesia, Malaysia, Philippines, Singapore, and Thailand), EE refers to Eastern Europe and Central Asia (Hungary, Malta, Poland, Romania, and Turkey). Source: IFS.

Figure 3: Composition of market-based capital flows to Mexico



Notes: Annual gross inflows shown as a share of total inflows. GDP shown as percent deviation from trend. Source: IFS.

Figure 4: Composition of market-based capital flows to South Korea



Notes: Annual gross inflows shown as a share of total inflows. GDP shown as percent deviation from trend. Source: IFS.

Figure 5: Endogenous distribution of capital

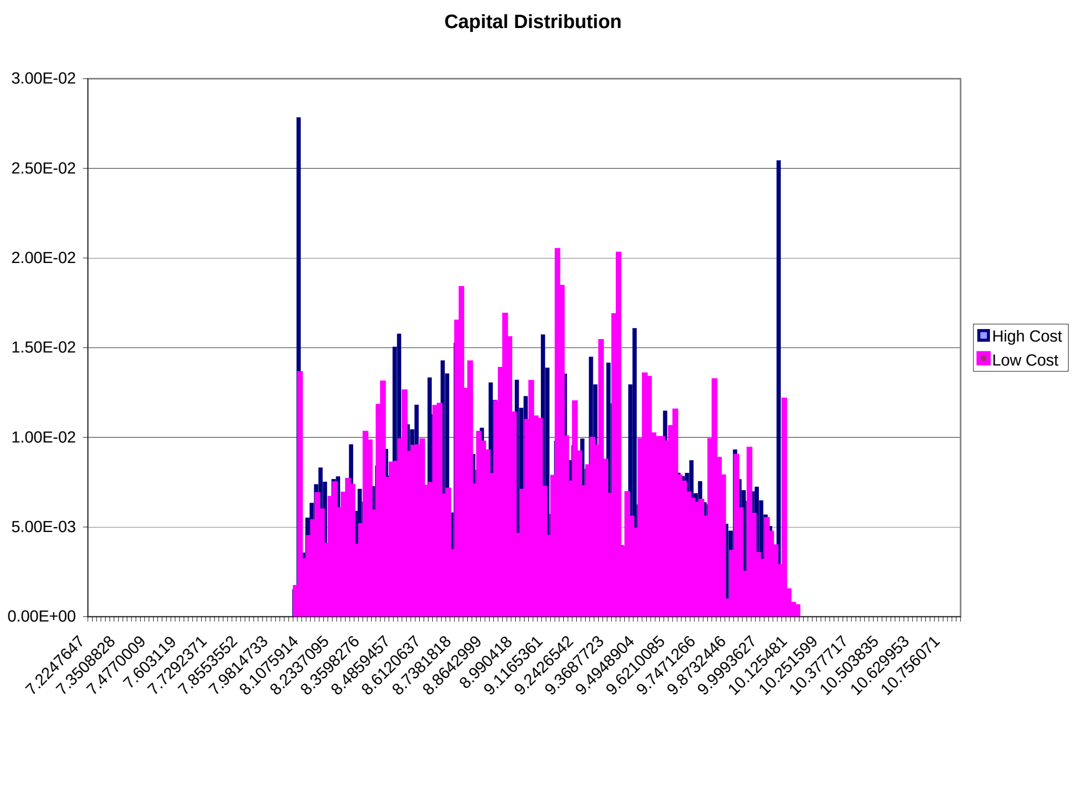
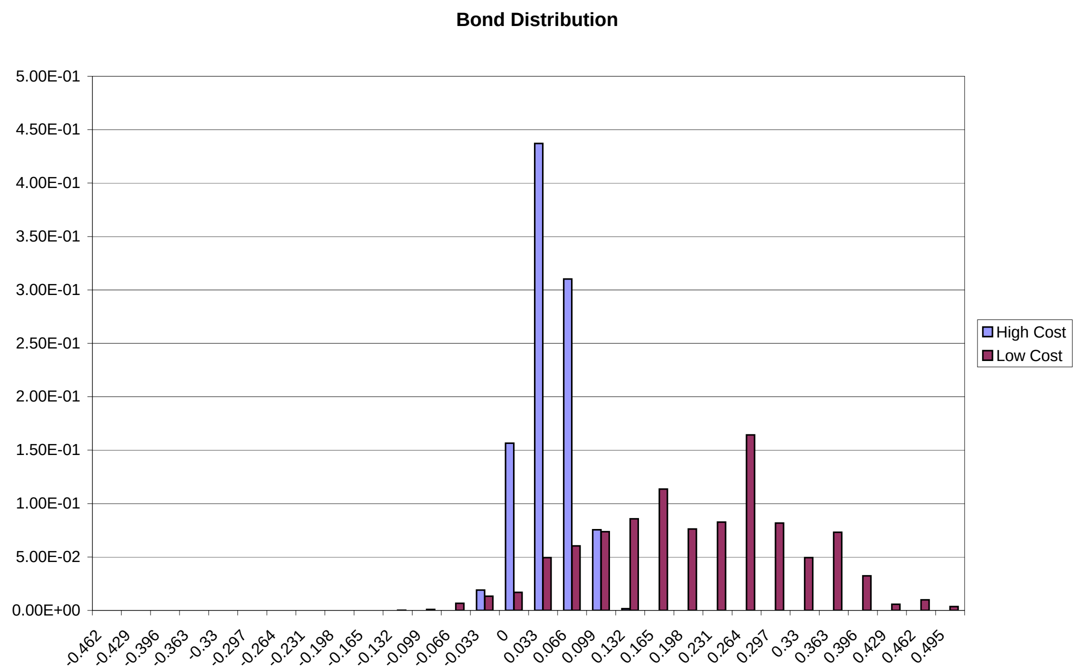


Figure 6: Endogenous distribution of international bonds



B Tables

Table 1: International financing for private firms
% of GDP

	1980–2004	1980–1989	1990–1998	1999–2004
East Asia and the Pacific				
FDI	2.08%	0.83%	2.90%	2.92%
portfolio equity	0.33%	0.06%	0.36%	0.73%
debt	1.67%	1.95%	2.18%	0.42%
China				
FDI	2.61%	0.53%	3.86%	3.50%
portfolio equity	0.12%	0.00%	0.08%	0.34%
debt	0.66%	0.96%	0.40%	0.64%
Indonesia				
FDI	0.45%	0.38%	1.39%	−0.88%
portfolio equity	−0.08%	0.00%	−0.32%	0.14%
debt	1.41%	3.56%	1.11%	−1.34%
South Korea				
FDI	0.55%	0.27%	0.46%	1.17%
portfolio equity	0.74%	0.00%	0.80%	1.87%
debt	1.9%	2.24%	2.49%	0.44%
Thailand				
FDI	1.78%	0.97%	2.30%	2.34%
portfolio equity	0.62%	0.44%	0.84%	0.62%
debt	1.1%	3.70%	3.76%	−7.21%
Latin America and the Caribbean				
FDI	1.74%	0.66%	1.76%	3.50%
portfolio equity	0.37%	−0.02%	1.17%	−0.19%
debt	0.46%	0.03%	1.73%	−0.73%
Argentina				
FDI	1.59%	0.35%	1.91%	3.15%
portfolio equity	0.05%	0.00%	0.69%	−0.84%
debt	−0.16%	−0.36%	3.54%	−5.35%
Brazil				
FDI	1.60%	0.65%	1.11%	3.93%
portfolio equity	0.57%	−0.06%	1.78%	−0.20%
debt	−0.26%	−0.48%	0.77%	−1.45%
Chile				
FDI	3.91%	2.02%	4.00%	6.94%
portfolio equity	0.38%	0.03%	1.04%	−0.03%
debt	0.19%	−3.82%	2.97%	2.69%
Mexico				
FDI	1.95%	1.13%	2.17%	3.00%
portfolio equity	0.40%	0.02%	1.04%	0.08%
debt	1.35%	1.28%	2.22%	0.16%

Notes: All financial instruments are annual gross inflows. East Asia and the Pacific consists of China, Indonesia, Malaysia, Philippines, Singapore, and Thailand. Latin America and the Caribbean consists of Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. Source: IFS.

Table 1: International financing for private firms (continued)
% of GDP

	1980–2004	1980–1989	1990–1998	1999–2004
Eastern Europe and Central Asia				
FDI	1.30%	0.11%	1.65%	2.78%
portfolio equity inflow	0.12%	0.00%	0.22%	0.16%
debt inflows	0.81%	−0.68%	0.89%	3.17%
Hungary				
FDI	3.62%	0.00%	5.70%	5.35%
portfolio equity	0.36%	0.00%	0.51%	0.59%
debt	3.27%	3.83%	0.93%	6.03%
Poland				
FDI	1.59%	0.02%	1.94%	3.67%
portfolio equity	0.08%	0.00%	0.22%	0.02%
debt	−1.55%	−3.56%	−2.14%	2.67%
Romania				
FDI	1.39%	0.00%	1.33%	3.77%
portfolio equity	0.06%	0.00%	0.09%	0.11%
debt	1.27%	−1.14%	2.35%	3.67%
Turkey				
FDI	0.58%	0.38%	0.45%	0.88%
portfolio equity	0.14%	0.01%	0.15%	0.21%
debt	1.76%	1.03%	1.94%	1.84%
G7 Countries				
FDI	0.94%	0.57%	0.77%	1.82%
portfolio equity	0.52%	0.16%	0.48%	1.20%
debt	4.43%	3.58%	3.83%	6.73%
United States				
FDI	1.05%	0.76%	0.91%	1.76%
portfolio equity	0.36%	0.15%	0.20%	0.96%
debt	3.85%	2.65%	3.55%	6.32%
Canada				
FDI	1.76%	0.98%	1.50%	3.45%
portfolio equity	0.66%	0.25%	0.57%	1.49%
debt	3.43%	4.49%	4.01%	0.79%
United Kingdom				
FDI	2.53%	1.67%	2.39%	4.18%
portfolio equity	1.75%	0.83%	1.38%	3.84%
debt	16.30%	13.01%	13.58%	25.86%
Japan				
FDI	0.07%	0.02%	0.04%	0.19%
portfolio equity	0.49%	−0.06%	0.63%	1.18%
debt	1.10%	2.52%	0.23%	0.04%

Notes: All financial instruments are annual gross inflows. Eastern Europe and Central Asia consists of Hungary, Malta, Poland, Romania, and Turkey. Source: IFS.

Table 2: Substitutability between inflows

	ρ(FDI, PE)	ρ(FDI, Debt)	ρ(PE, Debt)
Latin America/ Caribbean	-0.077	-0.131	0.219
Argentina	-0.871	0.015	0.197
Brazil	-0.149	-0.351	0.448
Chile	0.377	-0.105	0.271
Mexico	-0.135	-0.245	0.347
East Asia/ Pacific	0.141	-0.080	0.242
Hong Kong	0.277	0.196	0.373
Indonesia	0.164	0.266	0.781
South Korea	0.324	-0.188	-0.018
Thailand	0.077	-0.515	-0.309
Europe/ Central Asia	-0.196	-0.431	0.143
Hungary	-0.100	-0.353	0.215
Turkey	-0.293	-0.508	0.071

Notes: All flows are quarterly gross inflows as a percent of GDP, filtered using Christiano and Fitzgerald (2003) band pass filter. Latin America and the Caribbean consists of Argentina, Brazil, Chile, Colombia, Mexico, and Peru. East Asia and the Pacific consists of Hong Kong, South Korea, Indonesia, Philippines, and Thailand. Europe and Central Asia consists of Hungary and Turkey. Source: IFS.

Table 3: The cyclical behavior of capital inflows
contemporaneous correlation with investment

	ρ(I, Total)	ρ(I, Debt)	ρ(I, FDI)	ρ(I, PE)
Latin America/ Caribbean	0.254	0.285	−0.009	0.097
Argentina	0.793	0.733	0.271	0.009
Brazil	0.243	0.106	0.178	0.354
Chile	−0.486	−0.008	−0.541	0.015
Mexico	0.330	0.389	−0.313	0.016
East Asia/ Pacific	0.225	0.287	−0.109	−0.049
Hong Kong	0.333	0.354	0.413	−0.313
Indonesia	−0.129	0.100	−0.132	−0.243
South Korea	0.457	0.494	−0.171	−0.012
Thailand	0.424	0.483	−0.706	0.197
Europe/ Central Asia	0.338	0.548	−0.533	0.142
Hungary	0.028	0.434	−0.627	0.132
Turkey	0.649	0.663	−0.439	0.151

Notes: All flows are quarterly gross inflows as a percent of GDP, filtered using Christiano and Fitzgerald (2003) band pass filter. Investment expressed as percent of GDP and filtered using band pass filter. Latin America and the Caribbean consists of Argentina, Brazil, Chile, Colombia, Mexico, and Peru. East Asia and the Pacific consists of Hong Kong, South Korea, Indonesia, Philippines, and Thailand. Europe and Central Asia consists of Hungary and Turkey. Source: IFS.

Table 4: Summary Statistics: Mexico

	σ_i	σ_i/σ_y	$\rho(i,Y)$	$\rho(i,I)$	$\rho(i,Debt)$	$\rho(i,FDI)$
GDP	0.021	1.000	1.000	0.760	0.337	−0.266
Investment	0.077	3.705	0.760	1.000	0.389	−0.313
Consumption	0.033	1.599	0.854	0.549	0.366	−0.102
Current account (% GDP)	0.005	0.232	−0.716	−0.611	−0.393	0.068
Debt (% GDP)	0.008	0.369	0.337	0.389	1.000	−0.246
FDI (% GDP)	0.001	0.053	−0.266	−0.313	−0.246	1.000
PE (% GDP)	0.001	0.067	0.125	0.016	0.348	−0.135

1981Q1-2006Q1

Data span: 1981Q1–2006Q1. BP filter by Christiano and Fitzgerald (2003) removes trend, assumes a random walk, and is symmetric and stationary. First and last 12 observations are lost due to filtering. σ_i is standard of deviation. σ_i/σ_y is standard of deviation ratio with GDP. $\sigma_{i,y}$ is correlation with GDP.

Table 5: Summary Statistics: South Korea

	σ_i	σ_i/σ_y	$\rho(i,Y)$	$\rho(i,I)$	$\rho(i,Debt)$	$\rho(i,FDI)$
GDP	0.023	1.000	1.000	0.823	0.363	−0.275
Investment	0.115	4.909	0.823	1.000	0.494	−0.171
Consumption	0.033	1.431	0.748	0.657	0.573	−0.564
Current account (% GDP)	0.024	1.007	−0.649	−0.735	−0.768	0.451
Debt (% GDP)	0.025	1.085	0.363	0.494	1.000	−0.188
FDI (% GDP)	0.003	0.126	−0.275	−0.171	−0.188	1.000
PE (% GDP)	0.007	0.306	−0.083	−0.012	−0.018	0.324

1976Q1-2006Q1

Data span: 1976Q1-2006Q1. BP filter by Christiano and Fitzgerald (2003) removes trend, assumes a random walk, and is symmetric and stationary. First and last 12 observations are lost due to filtering. σ_i is standard of deviation. σ_i/σ_y is standard of deviation ratio with GDP. $\sigma_{i,y}$ is correlation with GDP.

Table 6: Simulated Business Cycle Moments

	$\sigma **$	σ/σ_y	ρ with I	ρ with Y
GDP	3.401	1.000	0.562	1.000
Investment	16.020	4.710	1.000	0.562
Consumption	1.991	0.585	-0.245	0.483
Current Account	7.229	0.962	-0.794	-0.002

Note: **σ (standard deviation) is in percentage terms.

Table 7: Capital Inflows and the Business Cycle

	% of Y	ρ with I
Model		
FDI	0.02	-0.26
Bonds	2.41	0.77
Portfolio Equity	0.04	0.70
Data for Mexico		
FDI	1.95	-0.31
Bonds	1.35	0.39
Portfolio Equity	0.40	0.02

Table 8: Simulated Inflow Substitutability

	$\rho(FDI, PE)$	$\rho(FDI, Debt)$	$\rho(PE, debt)$
Model	-0.328	-0.346	0.336
Data (Mexico)	-0.135	-0.245	0.347

Table 9: Sensitivity Analysis

	Mexico	Baseline	$\omega_B = 0.1$	$\omega_B = 0.7$	$\omega_{sec} = 0.7$
ρ **with Y**					
Investment	0.76	0.56	0.212	0.744	0.558
Consumption	0.85	0.48	0.495	0.456	0.482
σ **relative to** σ_y					
Consumption	1.60	0.585	0.545	0.601	0.584
Investment	3.71	4.710	8.923	3.595	4.737
ρ **with I**					
Debt	0.39	0.786	0.944	0.558	0.787
FDI	-0.31	-0.266	-0.500	-0.192	-0.261
PE	0.016	0.701	0.481	0.755	0.692
Saving	0.65	0.75	0.412	0.902	0.746
Current Account	-0.611	-0.794	-0.945	-0.581	-0.795
ρ **with Debt**					
FDI	-0.245	-0.347	-0.513	-0.289	-0.339
PE	0.347	0.336	0.255	0.282	0.331

Note: For baseline $\omega_b = .4 = \omega_{sec}$.