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

Katherine A. Smith†       Diego Valderrama‡
U.S. Naval Academy        FRB of San Francisco

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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

Key Words: Capital Inflow Composition, Financing Premium, Financial Frictions, Small Open Economy

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†Department of Economics, 589 McNair Road, Annapolis, MD 21402, USA. Email: ksmith@usna.edu

‡Economic Research, 101 Market Street, MS 1130, San Francisco, CA 94105, USA. Telephone: +1 (415) 974-3225. Facsimile: +1 (415) 974-2168. Email: Diego.Valderrama@sf.frb.org
1 Introduction

This work attempts to explain patterns in capital inflows to emerging markets economies 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 to emerging markets can be characterized by three stylized facts. First, the composition of inflows varies significantly by country. If you break down private inflows into three major categories, foreign direct investment, 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 Figure 1, Latin American and East Asian countries tend to primarily use FDI, while Eastern European countries use more debt. Second, within a country the ranking of flows does not vary significantly in the long run. For the past twenty five years FDI has made up roughly 1% of Mexico’s GDP. Third, at the business cycle frequency 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 1 lists the correlation between flows for various countries. Last, as Table 2 shows flows tend to move with the business cycle. However, each type of flow has a different correlation.

Theoretically (e.g., 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. If financing constraints are present, firms are forced to optimize over the array of financing choices. A firm in a SOE facing financial frictions chooses not only the type of financing instrument but the owner of that instrument by choosing to raise capital among domestic agents or foreigners.
Our model focuses on 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 multi-national 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 not only decide how much to invest but must also choose 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 Singapore’s tough intellectual property rights, for instance, it is less costly for a multinational to set up shop in Singapore 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 translates 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 countercycliclical 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 it is 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. While most people would agree that Chase will not lend an Argentinean firm an infinite amount of money; what exactly is the debt limit? Likewise 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 literature on capital flow composition has focused on forms of flows in isolation rather than the optimal structure of capital flows. 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 unable to explain
why the various types of capital flows in the short run tend to be so volatile.

The volatility of capital flows in the short run has been looked at extensively in the empirical push/pull literature. Since the early 1990s there has been a surge in empirical work trying to establish whether changes in capital flows are due to shifts in demand by domestic consumers (pull) or supply changes by foreign investors (push). 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 if conditions changed in the emerging market.

Campion and Neumann (2004) conduct an empirical study of the factors that determine the volume and composition of capital flows. 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 supply and demand factors (push and pull) as well as a capital control index. The main emphasis of the study is on the capital controls, which they find affect the composition of flows but not so much 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. Montiel and Reinhart (1999) also find that capital controls influence the composition of capital inflows but not the volume of flows. Meanwhile, sterilized interventions affect both volume and composition. Their empirical study uses annual data from the IMF’s WEO database on capital flows at regional and country level (15 countries). The focus is on flow maturity (long term/short term). 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. 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.

The empirical literature has identified various supply and demand factors that may affect flow composition. 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 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 multi-national firms are unconstrained but 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:

$$U = \sum_t \beta^t U(c - G(l)) \quad (2.1)$$

where $U$ is a concave, continuously differentiable instantaneous utility function. Households receive utility from the composite commodity made up of perishable goods, $c$, and labor, $l$. The composite
good, \( c - G(l) \), 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:

\[
s_t(\gamma_t \text{div}_t + p_t) + (1 + r_t^d)b_t + w_t l_t + \Theta_t V^\text{NASH} = c_t + s_{t+1}p_{t+1} + b_{t+1}
\]  

(2.2)

The household receives income from labor, \( w_t \), dividends that are owned by domestic residents, \( \gamma_t \text{div}_t \), and interest on money lent to other domestic households. \( \gamma_t \) 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. \( b_t \) and \( b_{t+1} \) 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 they receive the income from that sale \( \Theta_t V^\text{NASH} \). \( \Theta_t \) is the change in foreign ownership and \( V^\text{NASH} \) is the sale price.

The first-order conditions of the optimization problem of domestic household are as follows:

\[
\frac{\partial G(l)}{\partial l_t} = G_l = w_t \quad (2.3)
\]

\[
1 + r_t^d = \mathbb{E} \left[ \beta \frac{U_{ct+1}}{U_{ct}} \right] \quad (2.4)
\]

\[
E \left[ \beta \frac{U_{ct+1}}{U_{ct}} \left( \frac{\gamma_{t+1} \text{div}_{t+1} + p_{t+1}}{p_t} \right) \right] = 1 \quad (2.5)
\]

where \( U_{ct} \) represents the marginal utility of period-\( t \) consumption.

### 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 \( \exp(e_t)F(k_t, l_t) \), where \( e_t \) is a Markov productivity shock.
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, 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, $\text{div}_t$, by the dilution that arises from the secondary equity issuance, sec: (See Appendix).

$$\text{div}_t \equiv \text{div}_t - \text{sec}_t$$

(2.6)

where $\text{div}_t$ is the measure of adjusted dividends.

The total value of the firm, $V^D_t$, 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.

$$V^D_t = \text{div}_t + \frac{1}{1 + r^d_t} (V^D_{t+1})$$

(2.7)

Every period the firms in the SOE have some probability, $\Theta_t$ of being bought by a foreigner (non-greenfield FDI). Firms take that time varying probability as given. If each firm faces a probability of $\Theta$ of being purchased, for the economy as whole we assume $\Theta$ sales go through.

$$V^D_t = \left(\gamma_t \text{div}_t + \Theta_t V^{\text{NASH}}_t\right) + \frac{1}{1 + r^d_t} \gamma_{t+1} V^D_{t+1}.$$  

(2.8)

The price of the sold firm, $V^{\text{NASH}}$, is determined by the Nash bargain between the emerging market firm and foreign firm.

Since the household owns the firms, the discount rate of the firm reflects the households’ marginal rate of substitution:

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

(2.9)

Iterating forward on (2.8), the value of the firm is driven by the discounted post-offering dividends and the probability of being bought out:

$$V^D_t = E_t \sum_{j=0}^{\infty} M_{t+j} \left(\gamma_{t+j} \text{div}_{t+j} + \Theta_{t+j} V^{\text{NASH}}_{t+j}\right).$$
Given a sequence of adjusted discount factors, $M_{t+j}$, purchase probabilities, $\Theta_t$, and share of domestic firms owned by foreigners $\gamma_t$, in a decentralized competitive equilibrium, firms maximize:

$$V_t^D = \max_{l_t, \text{div}_t, k_{t+1}, b_{t+1, \text{sec}}} E_t \sum_{j=0}^{\infty} M_{t+j} \left( \gamma_{t+j} \text{div}_{t+j} + \Theta_{t+j} V_{t+j}^{\text{NASH}} \right)$$  \hspace{1cm} (2.10)

subject to:

$$[\lambda_t] \quad \text{div}_t = \exp(e_t)f(k_t, l_t) - w_t l_t + (1 - \delta) k_t - k_{t+1} - (1 + r^* \exp(z_t)) b_t$$

$$+ \sec \left( 1 - \omega_{\text{sec}} \left( \frac{\text{sec}}{k_t} \right) \right) + b_{t+1} \left( 1 - \omega_b \left( \frac{b_{t+1}}{k_t} \right) \right),$$

$$[\eta_t] \quad \text{div}_t \geq 0,$$  \hspace{1cm} (2.11)

$$[\mu_t] \quad \frac{(1 - \chi)}{\chi} b_{t+1} \leq \exp(e_t)f(k_t, l_t) - w_t l_t - (1 + r^* \exp(z_t)) b_t - (1 - \delta) k_t - \text{div}_t + \sec(1 - \omega_{\text{sec}, t}).$$

$$[\nu_t] \quad \text{sec}_t \geq 0.$$  \hspace{1cm} (2.13)

Note first that the associated lagrange multipliers are in brackets. The domestic firms choose sequences of labor, dividends, investment, and foreign borrowing to maximize the post-offering adjusted present value of dividends \textcolor{red}{(2.10)}. We assume that only firms have access to foreign capital markets, and can purchase bonds that pay an non-contingent interest rate $r^* \exp(z_t)$. $r^*$ is the mean international interest rate and $z_t$ is a Markov international 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. Dividends are given by equation \textcolor{red}{(2.11)} (with the associated lagrange multiplier $\lambda$).

Firms face adjustment costs when they want to access international capital markets to issue equity, $\omega_{\text{sec}} \left( \frac{\text{sec}}{k_t} \right)$, 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, $k_t$. We also assume that dividends issued by firms must be non-negative \textcolor{red}{(2.12)} (with the associated lagrange multiplier $\eta$). Finally, we assume that firms must finance a fraction, $\frac{1 - \chi}{\chi}$ of their debt payments out of free income \textcolor{red}{(2.13)} (with the associated lagrange multiplier $\mu$). This last friction implies that each domestic firm will face a debt ceiling.
that will be determined by its size:

$$\chi \geq \frac{b_{t+1}}{k_{t+1}}.$$  \hspace{1cm} (2.15)

Domestic firms thus 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.

2.2.1 Domestic Firm Behavior

When firms want to invest they can use internal resources, which reduces dividends, borrow from
the world credit market, or issue new equity. 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:

$$\lambda_t + \mu_t = 1 + \eta_t$$  \hspace{1cm} (2.16)

$\lambda_t$ can be interpreted as the marginal value of increasing dividends, $\mu_t$ as the marginal value of
relaxing the debt constraint, and $\eta_t$ as the marginal value of relaxing the dividend constraint.

Defining the marginal cost of using internal resources as $q_t \equiv \lambda_t + \mu_t$, if follows that the marginal
cost of using internal resources is one as long as the dividend constraint does not bind.

The marginal cost of using debt is driven by the world interest rate and an endogenous financing
premium:

$$q_t = 1 + \nu_t$$  \hspace{1cm} (2.18)

The marginal return to investing, $q$, is driven by discounted return to capital tomorrow. This
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.

2.2.2 The Domestic Interest Rate

Taking the household’s FOC for bonds and the firm’s FOC for debt we can express the domestic economies gross return on bonds \( r_d^* \) as a function of the world’s gross return on bonds \( r_d^* \) and the financial frictions.

\[
q_t = E \left[ M_{t+1} q_{t+1} \frac{\gamma_{t+1}}{\gamma_t} (F_{k+1} + (1 - \delta) + \omega_{k+1}(b') + \omega_{k+1}(sec)) \right] + \mu_t \tag{2.19}
\]

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.

2.3 Foreign Firms (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 foreigner is unconstrained (outside opportunity for foreigner is zero), the surplus that the foreigner would receive, \( S \), from buying the firm is the difference between the

stochastic discount factor is impacted by the financial frictions.

\[
r_t^d = r_t^* \frac{E \left[ M_{t+1} \times \frac{\gamma_{t+1}}{\gamma_t} \times \frac{\tau_{t+1}}{\tau_t} \right]}{E [M_{t+1}]} + \frac{\mu_t}{E [M_{t+1}]} \tag{2.20}
\]

If the financing costs are trivial and the constraints never bind then \( r_t^d = r_t^* \). The 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 \( \omega^{b'} \) 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.
constrained and unconstrained value of the firm.

\[
\text{Surplus}_t \equiv S_t = \psi \left[ V_t^F - V_t^D \right] \geq 0 \quad (2.21)
\]

The Nash bargaining solution divides the surplus based on the multinational firm’s bargaining power, \( \psi \).

\[
V_t^{\text{NASH}} = P = \psi \left[ V_t^F - V_t^D \right] + V_t^D \quad (2.22)
\]

Knowing that this is the price if a foreigner is matched with a domestic firm, foreigners will choose search effort, \( e_t \), in order to maximize the following.

\[
\max_{e_t} \Theta(e_t) \left[ V_t^F - V_t^{\text{NASH}} \right] - e_t \quad (2.23)
\]

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

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

\[
\gamma_{t+1} = \gamma_t + (1 - \gamma_t) \kappa - \Theta(e_t) \quad (2.24)
\]

Domestic ownership for the entire economy falls as the probability that multinationals will match rises. However, multinational face an exogenous separation rate \( \kappa \). 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 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 \([c_t, l_t, b_{t+1}, k_{t+1}, \sec_t, \Theta_t]\) and prices \([w_t, p_t, r^d_t]\) 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 multi-national firms maximize their surplus, and (d) the market-clearing conditions for equity, labor, and goods markets hold.

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).

3 Recursive Equilibrium and Numerical Solution Method

Due to the distortions, the central planning solution will not equal the competitive equilibrium. 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 equilibrium in recursive form, define $k$ and $b$ as the endogenous state variables and $\epsilon$ as the exogenous state. Given these, the value of the firm if sold, the international interest rate, domestic wages, the domestic interest rate (the domestic households' marginal rate of substitution),
the domestic firms’ recursive problem is given by:

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

(3.1)

subject to:

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

\[ b' \leq k' \chi \]

\[ 0 \leq \text{sec} \]

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

The solutions of this problem are represented by the optimal decision rules \( k'(k, b, \epsilon) \), \( b'(k, b, \epsilon) \) and \( \text{sec}(k, b, \epsilon) \). The domestic household’s marginal rate of substitution \( M \), the probability of being taken over by a multi-national firm \( \Theta \), and the Nash Equilibrium price of the firm if bought \( V^{\text{NASH}} \) are taken as given by the domestic firm.

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). If one defines the internal resources of the firm as the following

\[ x = \exp(\epsilon) f(k, l) - \omega l + (1 - \delta)k - (1 + r^* \exp(z))b \]  

(3.2)

Given this new state variable the firm’s recursive problem would be as follows:

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

(3.3)
subject to:

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

(3.4)

\[ b' \leq k' \chi \]  

(3.5)

\[ 0 \leq \sec \]  

(3.6)

Using the resource constraint to determine consumption, the firm’s decision rules are fed into the domestic agent’s Euler equation, to determine the stochastic discount factor. The decision rules that solve problem (3.1) 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.

3.1 A Step-by-step Algorithm

**Step 1** Initialize algorithm:

- **multinationals:** Make a guess of the value of the firm to multinationals, $V^Nash(x, \epsilon)$, 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 $V^{Nash}(x, \epsilon)$, 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, $V^{Nash}(x, \epsilon)$, 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 $V_{\text{NASH}}^N(x, \epsilon)$, return to Step 2 and repeat until the price of the firm, $V_{\text{NASH}}^N$, converges.

4 Quantitative Predictions of the Stochastic Competitive Equilibrium

The household’s problem and the foreign firm problem (2.23) are relatively simple problems that depend on the decision rules by domestic firms. The domestic firm’s problem, as given by the recursive equation (3.3), is solved by value function iteration. The 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.

4.1 Functional Forms and Baseline Calibration

\[ f(k, l) = A t^\alpha k^{1-\alpha} \quad (4.1) \]
\[ \omega^B = \frac{\omega_B}{2} \left( \frac{B'}{k} \right)^2 \quad (4.2) \]
\[ \omega^N = \frac{\omega_N}{2} \left( \frac{\text{sec}}{k} \right)^2 \quad (4.3) \]
\[ \Theta (\epsilon) = \frac{\gamma e}{1 + \gamma e} \quad (4.4) \]
\[ u(C) = \frac{e^{1-\sigma} - 1}{1 - \sigma} \quad (4.5) \]

4.2 Business Cycle Dynamics

4.3 Sensitivity Analysis
5 Conclusions
6 References


Figure 1: External Financing By Type of Flow Regional Averages 1996-2004

Source: World Bank Debtor Reporting System
Figure 2: Gross Market Based Capital Flows To Mexico

Source: World Bank Debtor Reporting System
B Tables

Table 1: Substitutability Between Inflows

<table>
<thead>
<tr>
<th>Country</th>
<th>( \rho(FDI_t, PE_t) )</th>
<th>( \rho(FDI_t, Debt_t) )</th>
<th>( \rho(PE_t, FDI_t) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>-0.74</td>
<td>0.24</td>
<td>0.05</td>
</tr>
<tr>
<td>Brazil</td>
<td>-0.03</td>
<td>-0.22</td>
<td>0.50</td>
</tr>
<tr>
<td>Mexico</td>
<td>-0.12</td>
<td>-0.13</td>
<td>0.24</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>0.52</td>
<td>-0.11</td>
<td>-0.32</td>
</tr>
<tr>
<td>Korea</td>
<td>0.38</td>
<td>-0.11</td>
<td>0.09</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.27</td>
<td>-0.41</td>
<td>-0.09</td>
</tr>
<tr>
<td>Hungary</td>
<td>0.12</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>Poland</td>
<td>0.56</td>
<td>0.02</td>
<td>-0.20</td>
</tr>
<tr>
<td>Turkey</td>
<td>-0.25</td>
<td>-0.07</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Source: IFS

Table 2: The Cyclical Behavior of Capital Flows Contemporaneous correlations with investment and private capital inflows

<table>
<thead>
<tr>
<th>Region</th>
<th>( \rho(I_{t}, All) )</th>
<th>( \rho(I_{t}, Debt) )</th>
<th>( \rho(I_{t}, FDI) )</th>
<th>( \rho(I_{t}, PortEq.) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America/Caribbean</td>
<td>0.49</td>
<td>0.27</td>
<td>0.44</td>
<td>0.19</td>
</tr>
<tr>
<td>East Asia/Pacific</td>
<td>0.45</td>
<td>0.32</td>
<td>0.18</td>
<td>0.32</td>
</tr>
<tr>
<td>Europe/Central Asia</td>
<td>0.45</td>
<td>0.35</td>
<td>0.32</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Note: Average country correlation per region.
Table 3: International Financing for Private Firms (Million real US dollars)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>East Asia and the Pacific</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Net inward FDI</td>
<td>305.063</td>
<td>16.017</td>
<td>81.772</td>
<td>671.017</td>
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<tr>
<td>Net portfolio equity inflow</td>
<td>75.813</td>
<td>2.293</td>
<td>13.814</td>
<td>172.612</td>
</tr>
<tr>
<td>Net debt inflows</td>
<td>87.313</td>
<td>70.132</td>
<td>184.269</td>
<td>30.330</td>
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<tr>
<td><strong>China</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net inward FDI</td>
<td>216.266</td>
<td>0.000</td>
<td>6.782</td>
<td>340.843</td>
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<tr>
<td>Net portfolio equity inflow</td>
<td>12.259</td>
<td>0.000</td>
<td>0.000</td>
<td>22.289</td>
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<tr>
<td>Net debt inflows</td>
<td>24.096</td>
<td>0.000</td>
<td>34.821</td>
<td>33.648</td>
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<tr>
<td><strong>Indonesia</strong></td>
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<tr>
<td>Net inward FDI</td>
<td>8.442</td>
<td>0.000</td>
<td>4.802</td>
<td>11.386</td>
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<td>Net portfolio equity inflow</td>
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<td>0.000</td>
<td>0.000</td>
<td>-1.097</td>
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<td>Net debt inflows</td>
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<td>0.000</td>
<td>41.999</td>
<td>5.517</td>
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<tr>
<td><strong>South Korea</strong></td>
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<tr>
<td>Net inward FDI</td>
<td>18.384</td>
<td>1.716</td>
<td>5.146</td>
<td>32.602</td>
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<tr>
<td>Net portfolio equity inflow</td>
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<td>0.000</td>
<td>58.592</td>
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<tr>
<td>Net debt inflows</td>
<td>49.309</td>
<td>27.475</td>
<td>19.486</td>
<td>86.206</td>
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<td><strong>Thailand</strong></td>
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<tr>
<td>Net inward FDI</td>
<td>17.901</td>
<td>1.807</td>
<td>7.080</td>
<td>31.379</td>
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<tr>
<td>Net portfolio equity inflow</td>
<td>6.739</td>
<td>0.046</td>
<td>3.502</td>
<td>11.441</td>
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<td>Net debt inflows</td>
<td>11.021</td>
<td>11.160</td>
<td>24.491</td>
<td>1.300</td>
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<tr>
<td><strong>Latin America and the Caribbean</strong></td>
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<tr>
<td>Net inward FDI</td>
<td>201.248</td>
<td>24.690</td>
<td>82.190</td>
<td>412.401</td>
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<tr>
<td>Net portfolio equity inflow</td>
<td>30.317</td>
<td>-0.004</td>
<td>1.020</td>
<td>72.902</td>
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<td>Net debt inflows</td>
<td>114.849</td>
<td>143.316</td>
<td>20.789</td>
<td>161.701</td>
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<tr>
<td><strong>Argentina</strong></td>
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<tr>
<td>Net inward FDI</td>
<td>35.250</td>
<td>3.247</td>
<td>8.634</td>
<td>63.405</td>
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<tr>
<td>Net portfolio equity inflow</td>
<td>1.095</td>
<td>0.000</td>
<td>0.000</td>
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<td>Net debt inflows</td>
<td>17.718</td>
<td>6.366</td>
<td>-12.203</td>
<td>47.198</td>
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<td><strong>Brazil</strong></td>
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<tr>
<td>Net inward FDI</td>
<td>81.872</td>
<td>41.696</td>
<td>26.554</td>
<td>135.734</td>
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<td>Net portfolio equity inflow</td>
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<td>-0.008</td>
<td>0.277</td>
<td>31.282</td>
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<td>Net debt inflows</td>
<td>16.923</td>
<td>74.562</td>
<td>-36.673</td>
<td>14.034</td>
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<tr>
<td><strong>Chile</strong></td>
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<tr>
<td>Net inward FDI</td>
<td>19.964</td>
<td>2.132</td>
<td>6.782</td>
<td>35.747</td>
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<tr>
<td>Net portfolio equity inflow</td>
<td>2.093</td>
<td>0.000</td>
<td>0.114</td>
<td>4.253</td>
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<tr>
<td>Net debt inflows</td>
<td>9.897</td>
<td>8.449</td>
<td>-3.454</td>
<td>20.467</td>
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<tr>
<td><strong>Mexico</strong></td>
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<tr>
<td>Net inward FDI</td>
<td>79.196</td>
<td>26.882</td>
<td>31.268</td>
<td>117.167</td>
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<td>Net portfolio equity inflow</td>
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<td>0.000</td>
<td>0.629</td>
<td>30.419</td>
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<td>Net debt inflows</td>
<td>45.307</td>
<td>11.282</td>
<td>58.244</td>
<td>60.369</td>
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</tbody>
</table>

Source: IFS. East Asia and the Pacific consists of China, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, and Thailand, and Latin America and the Caribbean consists of Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.
Table 4: International Financing for Private Firms (% of GDP)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Net inward FDI</strong></td>
<td>1.669%</td>
<td>0.455%</td>
<td>0.781%</td>
<td>3.170%</td>
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<tr>
<td><strong>Net portfolio equity inflow</strong></td>
<td>0.379%</td>
<td>0.067%</td>
<td>0.138%</td>
<td>0.774%</td>
</tr>
<tr>
<td><strong>Net debt inflows</strong></td>
<td>1.102%</td>
<td>1.564%</td>
<td>1.845%</td>
<td>0.240%</td>
</tr>
</tbody>
</table>

**China**
- **Net inward FDI** 2.284% 0.000% 2.031% 3.774%
- **Net portfolio equity inflow** 0.087% 0.000% 0.000% 0.156%
- **Net debt inflows** 0.527% 0.000% 0.769% 0.392%

**Indonesia**
- **Net inward FDI** 0.294% 0.000% 0.344% 0.468%
- **Net portfolio equity inflow** -0.092% 0.000% 0.000% -0.224%
- **Net debt inflows** 0.998% 0.000% 3.225% 0.119%

**South Korea**
- **Net inward FDI** 0.390% 0.077% 0.265% 0.702%
- **Net portfolio equity inflow** 0.501% 0.000% 0.000% 1.216%
- **Net debt inflows** 2.136% 2.711% 2.242% 1.649%

**Thailand**
- **Net inward FDI** 1.377% 0.197% 0.967% 2.512%
- **Net portfolio equity inflow** 0.461% 0.004% 0.428% 0.811%
- **Net debt inflows** 1.328% 2.219% 3.684% -0.990%

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net inward FDI</strong></td>
<td>1.472%</td>
<td>0.614%</td>
<td>1.015%</td>
<td>2.411%</td>
</tr>
<tr>
<td><strong>Net portfolio equity inflow</strong></td>
<td>0.173%</td>
<td>0.000%</td>
<td>0.007%</td>
<td>0.415%</td>
</tr>
<tr>
<td><strong>Net debt inflows</strong></td>
<td>1.490%</td>
<td>3.699%</td>
<td>0.150%</td>
<td>0.868%</td>
</tr>
</tbody>
</table>

**Argentina**
- **Net inward FDI** 1.516% 0.000% 0.338% 2.381%
- **Net portfolio equity inflow** 0.051% 0.000% 0.000% 0.088%
- **Net debt inflows** 0.115% 0.000% -0.492% 0.556%

**Brazil**
- **Net inward FDI** 1.848% 0.000% 0.398% 2.187%
- **Net portfolio equity inflow** 0.380% 0.000% 0.016% 0.459%
- **Net debt inflows** -0.238% 0.000% -1.967% -0.008%

**Chile**
- **Net inward FDI** 2.760% 0.319% 2.031% 5.024%
- **Net portfolio equity inflow** 0.279% 0.000% 0.033% 0.654%
- **Net debt inflows** 0.775% 2.181% -3.817% 3.051%

**Mexico**
- **Net inward FDI** 1.371% 0.099% 1.125% 2.456%
- **Net portfolio equity inflow** 0.308% 0.000% 0.022% 0.733%
- **Net debt inflows** 1.102% 0.415% 1.285% 1.462%

Source: IFS. East Asia and the Pacific consists of China, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, and Thailand, and Latin America and the Caribbean consists of Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.