Why Do Emerging Economies Import Direct Investment and Export Savings? A Story of Financial Underdevelopment*

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Abstract

The net foreign asset positions (NFAP) of developing countries and emerging markets tend to be short equity and either short or long debt, while most industrial nations are long equity and short debt. This paper proposes that financial system inefficiencies associated with underdeveloped financial markets can explain this difference in the NFAPs. Financial system imperfections typically found in emerging markets and developing countries raise the cost of debt financing for domestic firms. This in turn leads to three distinct effects; a greater need for firms to precautionary save, increased vulnerability to foreign multinationals buy-outs, and a drastic limitation on the purchase of foreign firms. We extend a small open economy framework to study the financing decisions of firms operating under financial frictions. In equilibrium, we can obtain a large negative net equity position and a smaller negative net debt position as a result of incremental financing decisions of the firms, rationalizing the observed NFAP in most non-industrial economies.

JEL Codes: F41, F21, F23, G15

Key Words: Net foreign asset position, financial underdevelopment, foreign direct investment, reserves

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1 Introduction

The net foreign asset positions (NFAP) of emerging markets and developing countries differs starkly from that of most industrial countries. The data in Lane and Milesi-Ferretti (2006) suggest a clear pattern in the choice of capital financing which is evident in the NFAP composition. Emerging markets and developing countries use equity financing rather than debt financing for capital accumulation: 93% of these countries are have a negative (short) net equity position, see Figure 1. Of the countries that are short equity, 70% are short debt and 13% are long debt. According to Lane and Milesi-Ferretti (2006), in 2004 no emerging market or developing economy was concurrently long equity and short debt, a common characteristic shared by most major industrial countries.

This pattern of equity financing in emerging markets is also present at a regional level. Looking at Table 1, emerging Asia, Europe and Latin America all had important net negative equity positions, both in terms of foreign direct investment (FDI) (-18.5% of gross domestic product for Asia, -21.5 % for Europe, and -22.8% for Latin America) and in terms of other equity positions (-4.6%, -7.7%, and -6.2%). All three regions have large negative net equity positions. In terms of debt, the three regions hold negative positions if one does not consider reserves (-1.6%, -19.1%, and -23.6%). For emerging Asia, the net debt position is close to zero, reflecting the fact that many countries in the region have positive debt positions. In is also true that many emerging markets and developing economies have sizeable (positive) official reserve positions (34.1% for emerging Asia, 20.2% for emerging Europe, and 11.0% for Latin America). These reserves are mostly held in terms of debt securities. Including official reserves does not change the pattern of equity financing but does move the distribution of debt holdings towards the positive (see Figure 2).

This paper argues that capital market imperfections can rationalize why emerging markets and developing countries (hereafter referred to as emerging market (EM) economies) depend on FDI to finance domestic capital accumulation. At the same time, these frictions can rationalize why these same countries may have concurrently positive net debt positions. Transactions costs, monitoring costs, and moral hazard all generate inefficiencies/imperfections in developing countries' financial markets. While others have looked at weak "domestic institutions" more generally (including property rights issues and corporate governance concerns) the focus here is to isolate the impact of financial market inefficiencies on the NFAP composition.[1]

We present a model to theoretically and quantitatively rationalize the existing NFAP composition in EM economies. The key assumption in the model is that it is costlier for EM firms to borrow internationally than it is for industrialized country firms. This is not to say that financial frictions are not important in industrialized countries. However, we argue that financial frictions are much greater in emerging markets and developing economies than in major industrial countries. If financial systems in emerging markets are significantly more inefficient, then debt financing should be more costly in the emerging markets and developing countries than industrial countries.[2] Zervos (2004) documents that international debt primary issuance direct costs in the United States for Brazil, Chile, and Mexico are in the order of 2% of the issue size for a $100 issue, falling to 1% for a $400 million issue. These costs appear to be larger on average than those paid by issuers in more advanced economies; Melnik and Nissim (2003) document that the average issue costs in the Eurobond market is about 0.37 percent of the issue size. While these numbers are not directly comparable, they fit with the commonly held belief that firms in emerging markets pay higher costs to issue international debt.

In our framework, firms in a small open economy (SOE) make financial decisions to finance productive investment. A firms cost of borrowing depends on the firm's current state: its size (amount of capital it holds) and its desired indebtedness. The more it wants to borrow, relative to the size of the firm, the bigger the marginal cost of borrowing. Given the financial frictions faced by the firm, the financing decision is not trivial, domestic firms decide whether to use internal resources and reduce dividend payments to households or to use international bonds to finance investment. Equity and foreign debt financing are imperfect substitutes for one another due to the capital market imperfections. As firms decide to use more external resources to finance investment, they become more constrained, depressing the value of the firm relative to the fundamental value of the firm. The fundamental value of the firm is the value of a hypothetical firm with the same level of capital, international indebtedness, and productivity level that does not face costlier external

[1] More specifically, we do not explicitly consider any default, expropriation, or corporate governance issues. To weave a more complex story one must add at least one other weak institution to distinguish between portfolio equity and FDI.

[2] Miller and Puthenpurackal (2002) examine costs of public debt issues made by non-U.S. firms in the U.S. bond market. They find that investors demand premium on bonds issued by firms that are located in countries that do not protect investor's rights and do not have a prior history of on-going disclosure.

financing.

Foreign multinationals can purchase domestic firms by engaging in costly search. The market for multinational purchases of domestic firms is not Walrasian. This opens up the possibility that the value of the constrained firm and the fundamental value of the firm are different from each other since arbitreurs cannot eliminate this different instantaneously. The incentive for a multinational to purchase domestic firms will depend on the price paid for the domestic firm relative to the value of the same firm to the multinational. We assume that once a purchase occurs, control of the firm is transferred to the multinational, which in turn relaxes the financial constraints of that firm. This is consistent with the notion of foreign direct investment (FDI) as a result of a merger and acquisition (M&A) transaction that changes corporate control presented in Head and Ries (2008).[3] In our model, as domestic firms become more constrained, the wedge between the value of the firm and the unconstrained value of the firm grows, and more FDI occurs.

The financial frictions faced by domestic firms and the probability of domestic firms being bought by foreign multinationals increases the volatility of payoffs from domestic firms to risk-averse domestic residents. In our framework, domestic agents are unable to diversify this risks as international markets are assumed to be incomplete[4]. Thus, the increased risk faced by domestic residents encourages a powerful precautionary savings motive. In the model, the building up of reserves is not an attempt to generate a "war chest" to protect against future "Sudden Stops" but rather it is an optimal outcome given that debt is costly. That is not to say that the stockpiling of reserves is not related to the crisis prevention in practice.

Thus, external financing costs have three major impacts on capital flows which work to explain the NFAP composition observed in emerging markets. First, the direct effect of higher debt costs is to lower debt inflows. Second, these costs raise debt outflows as countries tend to use pre-cautionary saving to self finance future investment prospects rather than going to costly debt markets. Third, equity assets in emerging markets and developing countries appear relatively cheap to industrial countries encouraging the inflow of foreign direct investment (FDI). In equilibrium, we obtain an endogenous capital structure that partly represents the cumulation of financing decisions by the

[3]Nocke and Yeaple (2007) document that in 1999 the ratio of the value of cross-border M&A to the value of global FDI was about 80%. Head and Ries (2008) state that from 1987 to 2001 about 2/3 of FDI activity was M&A and the rest was greenfield investment.

[4]Market incompleteness is a standard feature in the SOE literature.

domestic firm, which chooses the cheapest form of financing at each point in time. The type of financing that the firm chooses determines, one the one hand, the amount of FDI done by multinationals. On the other hand, it also determines the amount of precautionary savings done by households. In our model economy, it is possible for countries hold a positive savings position in which the SOE buys bonds from the rest of the world while FDI flows into the SOE at the same time.

Risk plays an important role in generating the observed NFAP. In a world of incomplete financial markets households face shocks that they cannot diversify and thus hold precautionary savings. Without risk, the precautionary savings motive would disappear. Domestic firms face increasing costs of accessing international capital markets, reducing their investment and dividends to domestic households, which further strengthens precautionary savings. Adverse productivity shocks to domestic firms reduce their value relative to the fundamental value of the firm, and induces foreign purchases of domestic Firms. Thus, without risk, FDI would not happen in equilibrium in our model.

Our paper is closely related to the papers that study reserve accumulation in EM economies. Durdu et al. (2007) study the accumulation of reserves in a small open economy in response to "sudden stops" and financial globalization. Relative to that paper, we share a similar feature that risk faced by domestic agents can encourage the domestic accumulation of reserves. In contrast to that paper, we develop a model where we can study the joint determination of the bond position and the FDI position for an EM. Moreover, in our model, we do not have any "sudden stops" and the domestic and international interest rates would equilibrate in the absence of uncertainty.

Our paper is also related to the rapidly growing literature on global imbalances.[5,6]. Perhaps the paper closest in spirit is Ju and Wei (2007) which develops a two-country two-period model where two-way capital flows (savings flowing out and FDI flowing in) as a consequence of weak domestic financial institutions. Significantly, our paper differs from Ju and Wei because we provide a quantitative evaluation of our study in addition to providing a theoretical explanation for global imbalances. Our model is also different in three important ways: First, Ju and Wei get the stylistic

[5] A partial list of papers on global imbalances is Caballero et al. (2008), Choi et al. (2007), Devereux and Sutherland (2007), Durdu et al. (2007), Fogli and Perri (2006), Ju and Wei (2007), Mendoza et al. (2007), Tille and van Wincoop (2007).

[6] In addition to the theoretical work there has been substantial empirical work tries to isolate the impact of domestic institutions on capital flows. See, for example, Wei (2000a), Wei (2000b), and Alfaro et al. (2005)

result that domestic markets are completely bypassed as the result of financial integration while our model still allows a domestic capital market to emerge. Indeed, in our framework, the domestic capital market is perfect at insuring domestic idiosyncratic shocks for domestic residents and is still used as a source of financing. Second, Ju and Wei explore domestic institutions more generally rather than simply focusing on the financial market inefficiencies. In our paper, we focus on imperfect access to international borrowing. Thirdly, in their model, agents are risk neutral. Thus, their model cannot asses the importance of risk on saving and financing decisions. In our model, risk plays and important role.

More recent papers on the global imbalances literature focus on the composition of the capital flows. Devereux and Sutherland (2007) use two-country model to study the joint determination of net inflows of FDI into EM economies from developed countries and the net outflows of savings from EM economies into developed countries. In their framework, an EM economy needs FDI to grow, and the advanced economy produces risk free bonds. The EM chooses an optimal portfolio which consists of a short position in FDI equity and long position in the risk-free bond. Relative to their model, we study the degree that FDI is determined as a result of financial imperfections and not due to the transfer of technology. Indeed, the evidence of Chari et al. (2004) suggests that once FDI occurs, the purchased firm receives a one-time boost to its value, but then the returns from that firm are similar to other ones in the economy. Consistent with that view, purchased firms in a SOE will receive a one-time boost to their value as corporate control changes, but will behave similarly to other firms in the SOE as they have access to the same technology.

2 An equilibrium model of firm financing

The goal of the paper is to rationalize the observed emerging markets NFAP composition: they depend on FDI to finance capital accumulation while concurrently having either a negative or a positive net debt position. The model extends the basic international real business cycle (IRBC) SOE to incorporate meaningful financing decisions by domestic firms. The model follows closely the model in Smith and Valderrama (2009).

The domestic SOE is inhabited by domestic households and firms. The model also features foreign multinationals that seek to purchase domestic firms. The household's decision problem is straightforward. The domestic household is risk averse. It consumes and receives income from working and from owning domestic shares on domestic firms. The household receives income from the domestic shares either in the form of dividends or in the form of a payment if the domestic firms are sold internationally.

The domestic firms make all intertemporal decisions: they decide how much to invest, to pay in dividends, and to borrow internationally. The domestic firms take the stochastic discount factor and the international interest rate as given. There are two frictions that the domestic firm faces. The first friction, a financial friction, arises because external financing is costly. The more debt that a firm issues relative to the firm size, the costlier the debt. The second friction is a search friction in the sale of domestic firms to foreign multinationals. The market for FDI transactions is not Walrasian. Instead, we characterize it as a matching process between a constrained firm and financially unconstrained multinationals. The domestic firms take as given the probability that the firm will be matched with an international multinational which would allow for a FDI transaction to occur. In this matching process, the probability of a match is increasing in the effort exerted by multinationals and the price depends on the relative bargaining power between the multinational and the domestic firm. Given the matching assumption, the price will be higher than the domestic share price and lower than the unconstrained value of the firm.

2.1 Domestic households

The domestic household makes consumption, c_t plans, works l_t, and purchases shares, s_t, in a mutual fund that holds shares in domestic firms to maximize the expected present discounted value of lifetime utility given by a stationary cardinal utility (SCU) index, $\mathcal{U}_t$:

$$\mathcal{U}_t = \mathbf{E}_t \sum_t \left[\exp\left(- \sum_{\tau=0}^{t-1} \Upsilon(c_t) \right) U\left(c_t\right) \right]. \tag{2.1}$$

U is a concave, continuously differentiable, instantaneous utility function. The SCU index (Epstein, 1983; Mendoza, 1991) features an endogenous discount factor which is given by the terms in parenthesis. SCU preferences have been extensively used in the SOE literature. Labor is supplied inelastically. We normalize the labor supply to be equal to unity.

The use of the discount factor allows the model to determine endogenously the non-stochastic net foreign asset position of the SOE. An endogenous stochastic distribution of net foreign assets also emerges. Because of the SOE assumption of incomplete markets, the model features precautionary savings. Precautionary savings will lead to the mean of the net foreign asset position being greater than the non-stochastic steady state net foreign assets position. Thus, when domestic agents face greater risk, they will tend to hold a larger amount of foreign assets. In our model, the domestic household faces risk due to productivity shocks and because of their ability to self-insure by using complete financial markets. In our model, the financial frictions increase risk to the domestic household resulting in a larger net foreign asset position and potentially explaining the positive net debt position observed in emerging market economies.

The representative household faces the following period-t budget constraint:

$$s_t \left(\mathrm{div}_t + \phi_t V_t^{\mathrm{NASH}} + (1-\phi_t) p_t \right) + w_t = c_t + s_{t+1} p_t. \tag{2.2}$$

Households enter into the period owning shares in the domestic firm mutual fund, s_t. The payoff on equity consists of three components proportional to their share holdings. As usual, the domestic households receives dividend payments, div_t, from the domestic firms that are forwarded by the mutual fund. The domestic household cannot sell domestic shares abroad directly. However, fraction of domestic firms, ϕ_t, will be sold to a multinational through a matching process. The domestic household receives V_t^{NASH} in payment for the sale of the shares per share. For the firms that were not sold to multinationals, $(1-\phi_t)$, households can sell the share s_t with price p_t to domestic households. In addition to the equity income, a domestic households receives income from labor, w_t. Households make expenditures on consumption c_t, and new shares $p_t s_{t+1}$.

The optimality condition for the purchase of domestic shares is given by the following equation:

$$p_t = \mathbf{E}_t \left[\exp\left(-\Upsilon(c_t)\right) \frac{\mathcal{U}_{c_{t+1}}}{\mathcal{U}_{c_t}} \left(\mathrm{div}_{t+1} + \phi_{t+1} V_{t+1}^{\mathrm{NASH}} + (1-\phi_{t+1}) p_{t+1} \right) \right].$$

$\mathcal{U}_{c_t}$ represents the marginal utility of period-t consumption. The optimality condition equates the marginal cost of buying a share of equity and the marginal benefit that share provides, adjusted for the fraction of firms sold to foreigners.

We iterate on the optimality condition to determine the price of a share in a domestic firm, p_t:

$$p_t = \frac{1}{1-\phi_t}\mathbf{E}_t\left[\sum_{i=1}^{\infty}\left(\prod_{j=0}^{i}\exp\left(-\Upsilon(c_{t+j})\right)\frac{\mathcal{U}_{c_{t+j+1}}}{\mathcal{U}_{c_{t+j}}}\left(1-\phi_{t+i-1}\right)\right)\left(\mathrm{div_{t+i}}+\phi_{t+i}V_{t+i}^{\mathrm{NASH}}\right)\right] \tag{2.3}$$

As usual, the price of a domestic firm share is the discounted stream of dividends. However, we also need to adjust for the time-varying fraction of domestic firms sold to multinationals in FDI transactions.

2.2 Domestic firms

Domestic firms produce a homogeneous tradable good, y_t, using labor, l_t, and capital, k_t, using a constant returns to scale technology $y = \exp(\varepsilon_t)f(k_t)$. ε_t is a productivity shock that follows a Markov process. The objective of the domestic firm is to maximize its value, which is the net discounted payoff made to domestic households, either in the form of dividends div_t or in the proceeds of an FDI sale. The firm takes as given the probability, Θ_t, of being matched with a foreign multinational. The sale price V_t^{NASH} is determined by a Nash bargain between the domestic firm and the foreign multinational. Domestic firms face frictions in financing domestic investment projects; therefore, the value of the firm will be lower than if there were no constraints. We make the assumption that the domestic firm is taken over after dividends to households are paid.

We can characterize the value of the domestically owned firm, V_t^D, at any point in time in a recursive way as the sum of dividends, expected FDI receipts and the discounted continuation value of the firm:

$$V_t^D = \mathrm{div}_t + \Theta_t V_t^{\mathrm{NASH}} + (1-\Theta_t)\mathbf{E}_t\left[M_{t+1}V_{t+1}^D\right],$$

where M_{t+1} is the stochastic discount factor that is taken as given by the domestic firm.

Thus, we can state the optimization problem of the firm as follows: Given a sequence of stochastic discount factors, M_{t+j} and purchase probabilities, Θ_t, in a competitive equilibrium, domestic firms choose sequences of dividends, div_t, desired capital stock, k_{t+1}, and foreign borrowing, b_{t+1}, to maximize the value of the firm:

$$V^D(k_t, b_t; \varepsilon_t, \zeta_t) = \max_{\mathrm{div}_t, k_{t+1}, b_{t+1}} \mathrm{div}_t + \Theta_t V_t^{\mathrm{NASH}} + (1 - \Theta_t)\, \mathbf{E}_t[M_{t+1} V^D(k_{t+1}, b_{t+1}; \varepsilon_{t+1}, \zeta_{t+1})] \quad (2.4)$$

where

$$\mathrm{div}_t = \exp(\varepsilon_t) f(k_t) - w_t + (1-\delta)k_t - k_{t+1} - b_t(1 + r_t^*) + b_{t+1}\left(1 - \eta_b\left(\frac{b_{t+1}}{k_t}\right)\right).$$

Dividends, div_t, are given by the residual value of output, y_t, after paying for wages, w_t, investment, $k_{t+1} - k_t(1-\delta)$, where δ is the depreciation rate. We also assume that the domestic firms and not households can access international capital markets to issue one-period bonds, b_t, to finance domestic projects. International bonds pay an interest rate $r_t^* = r^* \exp(\zeta_t)$. The mean world interest rate is denoted by r^*, and ζ_t is a Markov world interest rate shock. The world interest rate is only contingent on the shock ζ_t and not on any domestic state variable.

Firms face issuance costs when they want to access international capital markets to issue debt, $\eta_b\left(\frac{b_{t+1}}{k_t}\right)$. The bond issuance cost function is increasing and strictly positive for $b_{t+1} \neq 0$. We initially just make a reduced form assumption regarding the form of this issuance cost and do not derive it from micro foundations. However, while the form of this function will differ depending on the source of market imperfection, Gomes et al. (2006) find that most models exhibit increasing marginal costs after controlling for the existing firm size as proxied by the capital stock, k_t.[7] Moreover, Gomes et al. (2006) find that empirically, a quadratic issuance costs does a good job in rationalizing firms financing decisions.

Domestic firms' optimality conditions

The optimality conditions for the domestic firm's solution to its maximization problem in equation (2.4) are given by the following two conditions:

$$1 = (1 - \Theta_t)\, \mathbf{E}_t\left[M_{t+1}\left(\exp(\varepsilon_{t+1}) \frac{\partial}{\partial k} f(k_{t+1}) + (1-\delta) + b_{t+2} \frac{\partial}{\partial k} \eta_b\left(\frac{b_{t+2}}{k_{t+1}}\right)\right)\right] \quad (2.5)$$

[7]Qualitatively, we could have other firms of financial frictions that worked in a similar way to the reduced form we assume for η_b. If the domestic firm faced a debt limit similar to that used in Mendoza (2002) or if the firm face a constraint in the spirit of the financial accelerator framework of Bernanke et al. (1999), the qualitative results would be similar. Whether the quantitative results would still hold is left for future research.

and

$$1 - \eta_b\left(\frac{b_{t+1}}{k_t}\right) - b_{t+1}\frac{\partial}{\partial b}\eta_b\left(\frac{b_{t+1}}{k_t}\right) = (1-\Theta_t)\,\mathbf{E}_t\left[M_{t+1}\left(1+r_t^*\right)\right]. \tag{2.6}$$

The first condition in equation (2.5) equates the cost of postponing dividend payments today with the discounted marginal return to investing those dividends in capital and producing more in the next period. The marginal return to investing in capital, in turn, is given by three terms. The first is the expected marginal product of capital. The second, is the proceeds from the sale of the depreciated capital after production has taken place. The third is the reduction in issuance costs that is attained when a firm has a larger capital stock, $b_{t+2}\frac{\partial}{\partial k}\eta_b\left(\frac{b_{t+2}}{k_{t+1}}\right)$. These three terms are discounted by the stochastic discount factor, M_{t+1}, and contingent on the firm remaining domestically owned, $1-\Theta_t$. If the probability of being sold to a multinational is higher, then this effect depresses the return to capital accumulation, reducing investment. This probability is also time-varying and makes investment (and dividend payments) more volatile. The financial friction impacts the discount rate indirectly through the marginal rate of substitution. Costly external financing lowers consumption via the resource constraint, raising the intertemporal price of consumption.

The second condition in equation (2.6) equates the marginal benefit of borrowing net of the cost of issuance and the marginal expected cost of borrowing. The marginal cost is simply given by the additional interest payments. As in the first equation, the costs are discounted by the stochastic discount factor, M_{t+1}, and are conditional on the firm remaining locally owned, $1-\Theta_t$. In this way, the search friction reduces the effective cost of borrowing for firms because there is a probability that the domestic owners will not have to pay for this debt.

The search and financial frictions jointly affect the domestic firm's investment decisions. Define the effective marginal product of capital, $\widetilde{\mathrm{MPK}}_{t+1}$ as follows:

$$\widetilde{\mathrm{MPK}}_{t+1} \equiv \exp(\varepsilon_{t+1})\frac{\partial}{\partial k}f\left(k_{t+1}\right) + (1-\delta) + b_{t+2}\frac{\partial}{\partial k}\eta_b\left(\frac{b_{t+2}}{k_{t+1}}\right).$$

Then, we combine the domestic firms' optimality conditions for bonds in equation (2.6) and capital in equation (2.5) to obtain the following expression:

$$\mathbf{E}_t\left[\widetilde{\mathrm{MPK}}_{t+1}\right]=\frac{\mathbf{E}_t\left[1+r^*_{t+1}\right]+\frac{\mathbf{COV}_t\left(M_{t+1},1+r^*_{t+1}\right)}{\mathbf{E}_t[M_{t+1}]}}{1-\eta_b\left(\frac{b_{t+1}}{k_t}\right)-b_{t+1}\frac{\partial}{\partial b}\eta_b\left(\frac{b_{t+1}}{k_t}\right)}-\frac{\mathbf{COV}_t\left(M_{t+1},\widetilde{\mathrm{MPK}}_{t+1}\right)}{\mathbf{E}_t\left[M_{t+1}\right]}. \tag{2.7}$$

Examining the first term, costly debt finance directly raises the effective interest rate faced by the firm, $\frac{E\left(1+r^*_{t+1}\right)}{1-\eta_b\left(\frac{b_{t+1}}{k_t}\right)-b_{t+1}\frac{\partial}{\partial b}\eta_b\left(\frac{b_{t+1}}{k_t}\right)}$. Risk induced by the foreign interest rate shocks $\mathbf{COV}_t\left(M_{t+1},1+r^*_{t+1}\right)$ also increases the effective borrowing rate. Both of these terms raise the expected marginal product of capital in the next period and depress desired investment.

By rewriting equation (2.7), we can see how this condition relates to the standard frictionless model;

$$\begin{aligned}\mathbf{E}_t\left[\widetilde{\mathrm{MPK}}_{t+1}\right]=\mathbf{E}_t\left[1+r^*_{t+1}\right]-\mathbf{COV}_t\left(M_{t+1},\widetilde{\mathrm{MPK}}_{t+1}\right)&\\+\frac{\left[1+r^*_{t+1}\right]\left(\eta_b\left(\cdot\right)+b_{t+1}\frac{\partial}{\partial b}\eta_b\left(\cdot\right)\right)+\frac{\mathbf{COV}_t(M,r)}{\mathbf{E}_t[M_{t+1}]}}{1-\eta_b\left(\cdot\right)-b_{t+1}\frac{\partial}{\partial b}\eta_b\left(\cdot\right)}&.\end{aligned} \tag{2.8}$$

The first two terms of (2.8) are the usual terms that determine the returns to investing. Due to the frictions, the third term shows that an increase in the magnitude of the financial friction will drive the investment return above the world interest rate. Because the returns to investing are driven by the domestic firms' financing decisions, investment and consumption are correlated.

2.3 Domestic market clearing conditions

Following Pissarides (1985), given the large number of identical domestic firms, the probability a firm is taken over, Θ_t, is equal to the portion of domestic firms taken over, ϕ_t. For the domestic economy, we normalize the sum of domestic shares in domestic firms, $\sum_i s^i_t=1$.

Considering that some firms are owned by domestic agents and some by foreigners, the sum of all dividends paid out to domestic agents equals $\gamma_t\mathrm{div_t}$. Likewise, the payout to the households by the multinationals equals $\gamma_t\phi_tV^{\mathrm{NASH}}_t$. Using these market clearing conditions and the household budget constraint, equation (2.2), we can define the resource constraint for the economy:

$$c_t = \left(\gamma_t \text{div}_t + \gamma_t \phi_t V_t^{\text{NASH}} - V_t(1-\gamma_t)\kappa\right) + w_t.$$

Aggregate consumption equals the sum of the share of dividends paid to domestic residents, net proceeds from FDI sales to multinationals, and wage income.

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

$$\exp\left(-\Upsilon(c_t)\right) \frac{\mathcal{U}_{c_{t+1}}}{\mathcal{U}_{c_t}} = M_{t+1}.$$

The domestic interest rate is defines as the expected discount rate, $\frac{1}{1+r_{t+1}^d} \equiv \mathbf{E}M_{t+1}$.

We define the fraction of firms operating in the SOE and owned by foreign multinationals as γ_t. We assume that matches dissolve by an exogenous separation rate, κ. When a merger falls apart, and the multinational separates from the domestic firm, the foreign ownership is assumed back into the domestic capital stock. Given the exogenous separation rate, the law of motion for the stock of FDI, $(1-\gamma_t)$, is given by:

$$\gamma_{t+1} = \gamma_t\left(1-\phi_t\right) + (1-\gamma_t)\kappa,$$

The share of domestically owned firms falls as the portion of domestic firms that match increases.

2.4 Domestic social planner

The challenge of problem is to keep track of three optimizations: domestic households, domestic firms, and foreign multinational firms. To simplify the problem, following **?**, the domestic agents problems are reformulated as a social planner's problem. We express the reformulated domestic agents' problem in recursive form. For convenience, we drop the time subscripts and indicate next period variables by a prime (e.g. $k' = k_{t+1}$).The domestic social planner makes investment and international borrowing decisions. We further simplify the problem by assuming that once a foreign firm takes over a domestic firm, it behaves like a domestic firm. This allows us to keep track of a single representative domestic agent.

The domestic social planner faces the following state variables: capital, k, and international borrowing, b, as the endogenous state variables and ϵ and ζ as the exogenous states. The domestic social planner takes as given V^{NASH} and Θ, which are the price that the agents receive if part of the capital stock is sold to multinationals and the portion of domestic assets sold, respectively. The optimal allocation for the domestic social planner is characterized by the value function, $\mathbb{V}^S$, that solves the following recursive problem:

$$\mathbb{V}^S(k, b; \epsilon, \zeta) = \max_{k', b'} \frac{c^{1-\sigma} - 1}{1 - \sigma} + E \exp\left(-\Upsilon(c_t)\right) \mathbb{V}^S(k', b'; \epsilon', \zeta'), \tag{2.9}$$

subject to

$$\begin{aligned} c \leq & \gamma \left[\exp(\epsilon) f(k) - w + (1-\delta)k - k' - b(1 + r^* \exp(\zeta)) + b' \left(1 - \eta_b\left(\frac{b'}{k}\right)\right)\right] \\ & + w + \gamma\phi(k, b; \epsilon, \zeta) V^{\text{NASH}}(k, b; \epsilon, \zeta) \\ & \gamma' = \gamma\left(1 - \phi(k, b; \epsilon, \zeta)\right) + (1 - \gamma)\kappa. \end{aligned}$$

The first order condition with respect to debt accumulation can be expressed in the following way:

$$\mathcal{U}'(c) = \mathbf{E}_t \left[\frac{1}{1 - \eta_b\left(\frac{b_{t+1}}{k_t}\right) - b_{t+1}\frac{\partial}{\partial b}\eta_b\left(\frac{b_{t+1}}{k_t}\right)} \times \frac{\gamma'}{\gamma} \times \exp\left(-\Upsilon(c)\right) \mathcal{U}'(c')\right]$$

where $\mathcal{U}'(c)$ is the first derivative of the SCU index (2.1) with respect to consumption. This equation is analogous to the bond euler equation for the domestic firm (2.6) using the household's marginal rate of substitution instead of the stochastic discount factor. Given that marginal utility is always non-negative, the term on the right hand side is a supermartingale which results in agents engaging in precautionary savings.

Costly finance, costly search, and the probability of being bought also affect the path of consumption and saving through the resource constraint and through the impact on the effective interest rate faced by the firm. The search and financial frictions make investment, dividends, and consumption more volatile. As in a standard SOE model, given that domestic households cannot smooth their consumption through access to complete financial markets, households engage in precautionary savings. Given the increased risk to the household from search and financial frictions, the need for precautionary savings will be greater, thus increasing leading to greater international capital accumulation and less international debt.

2.5 Foreign multinationals

There is a search friction in the market of domestically owned firms and foreign multinationals. As is shown below, search and financial frictions depress the value of domestically owned firms. Multinationals are assumed to be financially unconstrained and to have no outside opportunity. Given the search friction, the value of the firm to the multinational and the value of the firm to the domestic shareholders differs. We show that the value of the firm to the domestic shareholders is below the value of the firm to the multinational. This gives an incentive to the multinationals to engage is costly search to match with a domestic firm. Once a domestic firm is found, the multinational and the domestic firm engage in bargaining to set the sale price of the domestic firm.

First, we determine the value of the domestic firm after it is taken over by the multinational. Define the value of the unconstrained firm as V_t^F. Given our assumption that multinationals are unconstrained (i.e., $\eta_b = 0$), the unconstrained value of the firm is given by:

$$V_t^F = \mathbf{E}_t \left[\frac{1}{1 + r_t^*} \left(\text{div} \left(k_{t+1}^f \right) + V_{t+1}^F \right) \right],$$

k^f represents the optimal capital stock for the unconstrained multinational. Notice that the multinational discounts dividends at the international interest rate. We can iterate this expression for the unconstrained value of the firm to obtain the usual result that the value of the firm to the foreigner is the discounted value of dividends:

$$V_t^F = \mathbf{E}_t \left[\sum_{i=0}^{\infty} \prod_{j=0}^{i} \left(\frac{1}{1 + r_{t+1+j}^*} \right) \text{div} \left(k_{t+1+i}^f \right) \right].$$

We now compare the expression for the unconstrained value of the firm, V_t^F with constrained value of the firm, V_t. The after-dividend value of the firm to the domestic agent, V_t, is simply given by its domestic share price, p_t. Recall the expression for the domestic share price from the domestic household's problem, (2.3):

$$V_t \equiv p_t =$$
$$\frac{1}{(1-\phi_t)}\mathbf{E}_t\left[\sum_{i=1}^{\infty}\left(\prod_{j=0}^{i}\exp\left(-\Upsilon(c_{t+j})\right)\frac{\mathcal{U}_{c_{t+j+1}}}{\mathcal{U}_{c_{t+j}}}\left(1-\phi_{t+i-1}\right)\right)\left(\mathrm{div_{t+i}}+\phi_{t+i}V_{t+i}^{\mathrm{NASH}}\right)\right].$$

The multinationals' valuation of the domestic firm and the domestic firms' own valuation differ for two reasons. First, the stochastic discount factors differ because the households in the emerging market do not have access to foreign capital. Second, because the foreign multinationals are not constrained they will make different choices concerning the optimal capital stock, so $k^f \neq k^d$, which is reflected in the dividend policy.

The surplus of a sale of a constrained firm, $\mathcal{S}$, is the difference between the constrained and unconstrained value of the firm:

$$\mathcal{S}_t = \left[V_t^F - V_t\right] \geq 0. \tag{2.10}$$

The inequality comes from the fact that the domestic value of firm is the constrained value of the firm, while the value of the firm to foreigners is unconstrained.

The Nash-bargaining price, V_t^{NASH}, divides the surplus from equation (2.5) between the domestic firm and the multinational based on the domestic firm's bargaining power, ψ;

$$V_t^{\mathrm{NASH}} = \psi\left[V_t^F - V_t\right] + V_t.$$

The foreign multinational knows that it will pay V_t^{NASH} if it finds a domestic firm.

We assume that the probability that a foreign multinational matches with a domestic firm,$\Theta_t\left(e_t\right)$, is an increasing function of search effort, e_t. Meanwhile, effort is costly for the firm. We assume that these effort costs $\chi(e_t)$ can be expressed in terms in terms of tradeable units. The problem of the multinational firm is to choose search effort, e, to maximize the expected value of the surplus they will receive minus their effort costs:

$$\max_{e_t}\Theta(e_t)\left[V_t^F - V_t^{\mathrm{NASH}}\right] - \chi(e_t),$$

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

We rearrange the multinational's firm optimality condition to arrive at the following expression:

$$\frac{\partial}{\partial e}\Theta(e_t)(V_t^F - V_t) = \frac{\partial}{\partial e}\chi(e_t). \tag{2.11}$$

The level of FDI is driven by the difference between the domestic and multinational firm values. As the domestic value of the firm $V_t \equiv p_t$ decreases, the valuation wedge, $(V_t^F - V_t)$, increases, thus inducing FDI transactions to take place. Thus, as the domestic firms become more constrained and their value falls, the share of domestic ownership also falls. If there were no frictions, the valuation wedge would be zero and there would be no FDI in equilibrium. Thus, in terms of our model, we need domestic households and firms to be constrained by the search and financial frictions in the stationary distribution to rationalize the observed negative FDI positions observed

2.6 Stochastic processes and competitive equilibrium

To complete the model, we specify the stochastic process for the productivity shocks, e_t, and the world interest rate shocks, z_t. We assume that both of these shocks follow a first-order autoregressive process and they are possibly correlated. We discretize the process for productivity shocks using a simple persistence rule (Backus et al., 1989).

Productivity shocks follow a two-point, symmetric Markov chain. This specification minimizes the size of the exogenous state space without restricting the variance and first-order autocorrelation of the shocks. The shocks take a high or low value, so $\varepsilon \in (\varepsilon_H, \varepsilon_L)$. Symmetry implies that $\varepsilon_L = \varepsilon_H$, and that the long-run probabilities of each state satisfy $\Pi(e_L) = \Pi(e_H) = 1/2$. Under these assumptions, the shocks have zero mean and their variance is $(\varepsilon_H)^2)$.

Given a stochastic process of productivity shocks, interest rate shocks, and initial conditions, a competitive equilibrium is defined by stochastic sequences of allocations $[c_t, l, b_{t+1}, k_{t+1}, e_t]$, prices $[w_t, r_t^d]$, and value functions, $[V_t^{\text{NASH}}, V_t, V_t^F]$, 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 taking as given factor prices, goods prices, and asset prices, (c) foreign multinationals maximize their surplus, and (d) the market-clearing conditions for equity, labor, and goods markets hold.

3 Nash equilibrium and numerical solution technique

To solve for the equilibrium problem between the domestic social planner and the foreign multinational, we follow Mendoza and Oviedo (2006) and Kehoe (1987) and set up the problem between these two agents as a two-player dynamic game as a perfect Nash equilibrium where both players formulate optimal plans taking as given a conjecture on the other's optimal plans. Conjectures are indicated by the use of a tilde over a variable.

The domestic social planner makes conjectures on the foreign multinational's effort, $\widetilde{e}$. Given this conjecture, the domestic social planner can also make conjectures on the probability of a match $\widetilde{\Theta}$ and the value of a FDI sale $\widetilde{V^{\text{NASH}}}$. The solutions of this problem are represented by the optimal decision rules for capital $\hat{k}'(k, b, \epsilon, \zeta)$ and bonds $\hat{b}'(k, b, \epsilon, \zeta)$. Using the decision rules, the value of the firm to domestic agents is determined by equation (2.3), giving us $\hat{V}(k, b, \epsilon, \zeta)$.

Simultaneously, the foreign multinational makes a conjecture on the domestic firm's plan for capital accumulation, $\widetilde{k'}$, dividend payments, $\widetilde{\text{div}}$, and international borrowing, $\widetilde{b'}$. Given these three conjectures, the multinational can also make a conjecture on the value of the domestic firm, $\widetilde{V}$. The multinationals use their conjecture of $\widetilde{V}(k, b; \epsilon, \zeta)$ to determine $\widehat{V^{\text{NASH}}}$ and then choose their effort level in matching, $\hat{e}(k, b; \epsilon, \zeta)$, to satisfy (2.11). Knowing how much effort the multinational is willing to exert directly determines the probability of a match $\hat{\Theta}(k, b; \epsilon, \zeta)$. In equilibrium, $\hat{\Theta} = \hat{\phi}$.

We solve for the decision rules of the domestic planner and the foreign multinational taken as given the conjecture's on each other's decision rules. We iterate this process until convergence. That is, until $\widehat{V^{\text{NASH}}}(k, b, \epsilon, \zeta)$=$\widetilde{V^{\text{NASH}}}(k, b, \epsilon, \zeta)$ and $\hat{\Theta}(k, b, \epsilon, \zeta)$=$\widetilde{\phi}(k, b, \epsilon, \zeta)$.

The equilibrium for the Nash perfect game, if it exists, is a competitive equilibrium. From the Bellman equation (2.9) for the domestic social planner, we can see the first order conditions that result from the standard Benveniste-Sheikman equation equal the Euler equations associated with the domestic firms' first order conditions with respect to capital and debt in equations (2.5) and (2.6).[8] On the multinationals side we use the first order conditions to determine the decision rule for search effort, e_t, guaranteeing the competitive equilibrium outcome.

The domestic social planner's problem, as given by the recursive equation (2.9), is solved by

[8]The first order conditions to the social planner's problem differ slightly from the competitive equilibrium in that the social planner takes into account the exogenous separation rate. As long as the separation rate and FDI stocks are small the difference is trivial.

value function iteration. 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. The state space for capital stock includes NK discrete nodes and the state space of bond positions includes NB discrete nodes. The state space of endogenous states is thus given by 90×40 elements.

3.1 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.

We assume that the production function has a Cobb-Douglas form:

$$f(k, l) = l^{\alpha} k^{1-\alpha} = k^{1-\alpha}$$

where labor share of income is given by α. Further, we assume that the instantaneous utility function is of the constant relative risk aversion (CRRA) form:

$$U(C) = \frac{c^{1-\sigma} - 1}{1 - \sigma}.$$

The CRRA parameter is equal to σ. We assume that the debt issuance cost is quadratic:

$$\eta_b = \frac{\eta_b}{2} \left(\frac{b' - b}{k} \right)^2$$

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

$$\Theta\left(e\right) = \frac{\pi e}{1 + \pi e},$$

where π determines the elasticity of the match probability with respect to effort. A low level of π means that the probability of a match is not very sensitive to search effort.

In terms of the calibration, we follow standard practice in the real business cycle (RBC) literature and set our model's parameters to match standard features of international data. We specify a labor share α equal to 0.65, which is in line with international evidence. In terms of preference parameters, we choose the coefficient of relative risk aversion σ equal to 2.0, roughly in line with other international RBC studies. The gross annual real interest rate is set to 6%. We set the rate of time preference, β equal to 0.984, which is the inverse of the real interest rate.[9] Our model yields a steady state consumption share equal to 0.687 and an investment share equal to 0.307. Our model does not consider government expenditures.

We now discuss the calibration of the financial frictions parameter (η_b). We set the debt issuance cost parameter η_b equal to 0.075 so that, in steady state, debt is roughly 13% of GDP. Then we discuss the search friction parameters ($\gamma, \pi, \psi, \kappa$). To set the equity issuance cost parameter, we appeal to the empirical evidence on transaction costs for public offerings. To launch an equity or debt offering, domestic firms pay direct and indirect transaction costs based on the firm size and the size of the offering. For the costs of equity issuance, the direct costs consist of administrative fees and underwriting costs. Data for the U.S. show that while administrative fees are minimal, the underwriting discount can be substantial. According to Lee et al. (1996) direct costs are 7% on average of the proceeds of seasoned equity offerings, 11% for IPOs, and $2-3\%$ for bonds issuances. International offerings tend to be significantly higher. Issuing American Depository Receipts on the New York Stock Exchange, for instance, requires costly conversion to U.S. accounting standards and many additional fees. In steady state, the domestic share of the capital stock γ is 0.92, which is consistent with the findings of Mendoza and Smith (2006). In terms of the search parameters, the bargaining power of the domestic household is $\psi = 0.1$, the elasticity of the matching probability is $\pi = 0.5$, and the rate of separation κ is set to 0.0788.

Given the Markov process of productivity shocks, the standard deviation and first-order autocorrelation of GDP match the standard deviation and first-order autocorrelation of the HP-filtered quarterly cyclical component of Mexico's GDP reported in Mendoza (2006). In terms of the simple persistence rule, this requires $\varepsilon_H = 0.0178$ and the autocorrelation of the shock equal to 0.683.

4 Quantitative results

The results for the baseline calibration as given in Table 2. As expected, the SOE features a negative FDI position (-3.744% of GDP) and a negative debt position (-0.037% of GDP). However,

[9]The functional form assumed for the debt issuance costs pins down the steady state debt level.

compare that to the net positions when the SOE faces almost no frictions. In that case the equity position is zero by definition and the debt position is about -13.254% of GDP. That is, our model can account for jointly for a small negative equity position and a large improvement in the debt position relative to the frictionless case. Table 2 also shows results for a variety of alternative parameter values for which we do not have much micro evidence to calibrate to (debt issuance costs, elasticity of matching, bargaining power). The results show that the model is robust to changes in those parameters.

5 Conclusions

We presented a model to rationalize the pattern of net foreign asset positions observed in emerging market economies. These economies share the pattern that the international equity position is negative, while the debt position can be either positive or negative. The model is a standard IRBC SOE model in which two frictions are introduced. A financial friction that makes international debt issuance costly and a search friction that encourages foreign multinationals to purchase domestic firms. Both of these frictions must be present to account for the joint FDI and debt positions. Absent of financial frictions, the unconstrained and the constrained value of the firm would be the same and no FDI would occur. Absent of the search frictions, the differences between the same two values would be arbitraged away instantaneously so that FDI would be zero in steady state. The model delivers positions of about -3 percentage points of GDP in FDI and about 13 percentage points of GDP in debt positions over a frictionless model. That is, our model predicts that in the presence of financial and search frictions, we can account for a significant negative FDI position and a significant improvement in the debt position.

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Table 1: NFAP composition: 2004

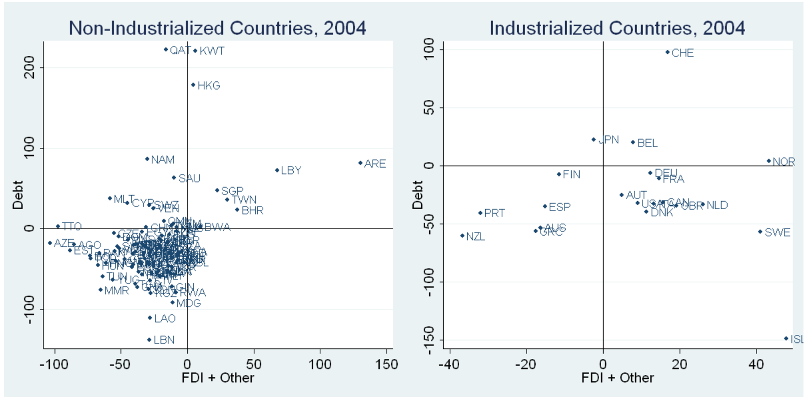
	NFAP	FDI	Debt	Other	Reserves
Emerging Asia	9.30	-18.50	-1.62	-4.64	34.06
Not including China	10.23	-11.83	-4.01	-5.73	31.79
Emerging Europe	-28.09	-21.48	-19.14	-7.69	20.22
Latin America	-41.54	-22.79	-23.59	-6.16	11.00
G7	-4.85	7.97	-18.17	1.12	4.23
U.S.	-22.64	5.12	-32.23	3.83	0.65
G7 not including U.S.	9.79	10.32	-6.61	-1.10	7.18

Notes: Source: Lane and Milesi-Ferretti (2006). Figures are for net stock as a percentage of the GDP of the respective country group. **Debt** includes portfolio debt and other investment. **Other** includes portfolio equity and financial derivatives. **NFAP** is the net foreign asset position, composed of FDI, Debt, Reserves, and Other.
Country groups: **G7**: US, UK, France, Germany, Italy, Japan, Canada. **G6**: G7 without the US. **Emerging Asia**: China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, Thailand, Vietnam. **Emerging Europe**: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovak Republic, Slovenia, Ukraine. **Latin America**: Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Paraguay, Peru, Uruguay, Venezuela.

Table 2: Results

	Benchmark	Nearly frictionless	High debt costs $\eta_b = 0.325$	Low matching elasticity $\pi = 20.5$	Low SOE bargaining power $\psi = 0.9$
FDI	-3.744	0.000	-3.570	-2.878	-3.009
Debt	-0.037	-13.254	-0.002	-0.051	-0.005

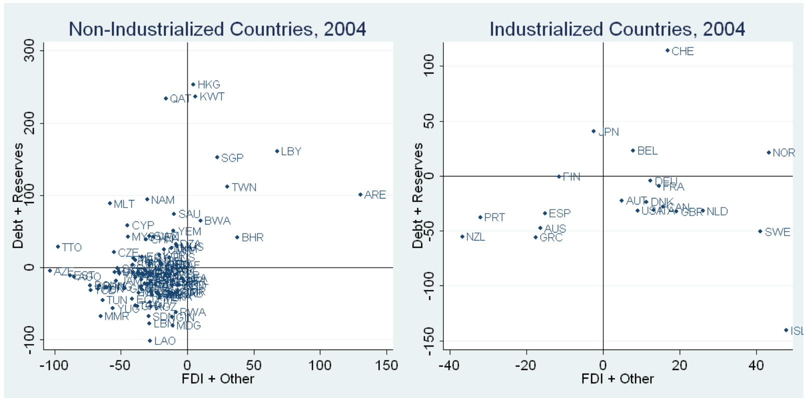
Notes: Net equity and debt positions as a share of GDP.



(a) Non-Industrialized Countries (b) Industrialized countries

Figure 1: Net foreign asset position composition

Notes: Data source: Lane and Milesi-Ferretti (2006). Figures are for net stock as a percentage of the GDP of the respective country. **Debt** includes portfolio debt and other investments. **Other** includes portfolio equity and financial derivatives.



(a) Non-Industrialized Countries (b) Industrialized countries

Figure 2: Net foreign asset position composition including official reserves

Notes: Data source: Lane and Milesi-Ferretti (2006). Figures are for net stock as a percentage of the GDP of the respective country. **Debt** includes portfolio debt and other investments. **Other** includes portfolio equity and financial derivatives.