FDI Flows and Sudden Stops in Small Open Economies *

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Abstract

Why are balance of payments crises, characterized by Sudden Stops of capital inflows, more frequent in emerging economies than advanced economies? This paper argues that differences in the composition of the financial account flows explain 30 percent of the gap in the probability of a crisis. I document that although advanced economies have, on average, zero net foreign direct investment (FDI), they have sufficient FDI outflows to act as buffer savings during financial distress. To quantify the effect of this FDI channel on the probability of a crisis, I propose a small open economy model with a loan-to-value collateral constraint and foreign investment subject to government confiscation risk. The calibrated model suggests that if an emerging economy increases its capital-to-GDP ratio and eliminates government confiscation risk, it would reduce the probability of a Sudden Stop from 2.9 to 2.7 percent, while increasing its debt-to-GDP ratio from 47 to 65 percent.

JEL CLASSIFICATION: E21, F21, F32, G01.

KEY WORDS: Sudden Stops, foreign direct investment, government confiscation risk.

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1 Introduction

Balance of payments crises, characterized by Sudden Stops of capital inflows, are not a phenomenon exclusive to emerging economies.[1] However, the composition of the financial account flows is different between advanced and emerging economies.[2] While advanced economies invest and receive capital from abroad, most emerging economies receive only foreign investments. This difference motivates my study of the components of the balance of payments' financial account to understand why the probability of having a Sudden Stop in advanced economies is 0.6 percentage points lower than in emerging economies.[3]

To address this question, this paper quantifies the effect that foreign direct investment (FDI) has on the probability of a crisis through the lens of a small open economy model. Specifically, I explore the complementarities between FDI and portfolio investment (PI) flows, which are the two largest components of the financial account. The mechanism through which both accounts interact is the following. As FDI enters an economy, the borrowing capacity of the economy increases because the amount of available collateral increases through two channels. First, a direct (quantity) effect in emerging economies is that a fraction of the foreign stock of capital is subject to government confiscation risk and thus can be used as collateral. Second, an indirect (pecuniary) effect is that FDI flows affect the domestic price of capital and thus change the market value of all the available collateral in the economy (both domestic and foreign capital stocks).[4] Both channels move the borrowing capacity in the same direction: more (less) foreign capital loosens (tightens) the borrowing capacity of the domestic economy. This transmission effect from FDI to the debt capacity amplifies the effect that shocks have on an economy, making Sudden Stops more frequent in emerging economies.

At the aggregate financial account level, every economy that experiences a Sudden Stop shows similar dynamics. However, after decomposing the financial account into its main components, there are significant differences between emerging and advanced economies

[1] See Bianchi and Mendoza (2020) for a recent survey and review of the stylized facts of Sudden Stops in both groups of economies.

[2] The terms emerging (advanced) and upper-middle (high) income will be used interchangeably. The income threshold is taken from the World Bank classification.

[3] Specifically, using the panel database constructed in this paper, the probability of a Sudden Stop in an advanced economy is 2.3 percent while in an emerging economy it is 2.9 percent. Bianchi and Mendoza (2020) find a similar probability for emerging economies and a lower probability in advanced economies of 1.7 percent.

[4] Discussion and evidence of the fact that government confiscation risk is only present in emerging economies will be presented in Sections 3 and 5.2.

(Figures 2 and 3 show the decomposition of the financial account for a small sub-sample of economies from both groups). The empirical contribution of this paper is to document that advanced economies have net FDI flows as a percentage of GDP that fluctuate around zero, while emerging economies tend to have only negative net FDI flows, i.e., more inflows than outflows of capital. Moreover, during a crisis, net FDI flows in emerging economies show large contractions (capital stops entering and/or leaves the economy), while advanced economies' net FDI flows remain constant around zero. The latter behavior is due mainly to the FDI outflows that act as buffer savings for advanced economies during Sudden Stops, which are close to zero in emerging economies

To quantify the effect of this FDI channel on the probability of a Sudden Stop, I propose a small open economy model with an endogenous, occasionally binding constraint and foreign investment subject to government confiscation risk in emerging economies. The model introduces a loan-to-value debt constraint in which international debt cannot exceed a fraction of the market value of the capital stock. In emerging economies, foreign capital serves as collateral due to the possibility of government confiscation and increases the debt capacity of the economy. However, international investors internalize this risk and optimally choose lower levels of investments, decreasing the price of capital and tightening the debt constraint through both direct (quantity) and indirect (price) effects. I calibrate the model using data for a large sample of advanced and emerging economies and find that the FDI channel has a meaningful impact on the probability of a crisis. The model predicts that, on average, an emerging economy that increases its capital-to-GDP ratio and eliminates government confiscation risk would reduce the annual probability of a Sudden Stop from 2.9 to 2.7 percent, while increasing its debt-to-GDP ratio from 47 to 65 percent, which is consistent with the data.

After reviewing the literature in Section 2, Section 3 describes the panel database constructed for this paper and shows empirical evidence on the importance of the FDI channel. In Section 4, I propose a small open economy model with financial frictions that incorporates both types of international capital flows: portfolio investment and direct investment subject to government confiscation risk. Then, Section 5 presents quantitative results from the calibrated model. I quantify how the probability of a Sudden Stop observed in the data can be accounted by the FDI channel and also perform an impulse response analysis to quantify the effects of a temporary increase in government confiscation risk. Lastly, Section 6 concludes.

2 Related Literature

This paper contributes to a sizable literature, starting more than 30 years ago with Backus, Kehoe, and Kydland (1992) and Baxter and Crucini (1995), that has documented how international financial markets are a transmission mechanism of business cycles among economies. A strand of this literature, closely related to this paper, has studied business cycles in small open economies (see Heathcote and Perri (2002) and Garcia-Cicco, Pancrazi, and Uribe (2010)). However, the main focus of this paper is considerably narrower. I measure the effect of the different characteristics of international capital flows, between emerging and advanced economies, on the dynamics and probability of a balance of payments crisis. I focus in particular on the differences between FDI and PI flows. Regarding the FDI flows, Albuquerque, Loayza, and Servén (2005) study how an increase in FDI is related to global factors and higher integration in capital markets. In that paper, the authors argue that FDI may look similar to equity flows, but the former does not depend on the existence of developed stock markets. For this reason, it seems more appropriate to use FDI given that capital liberalization has occurred in different stages of development for each country. The authors find that global factors have become more relevant and that these factors can explain better the dynamics of FDI because the increase in financial liberalization allows some local factor risks to be hedged. In line with the authors' findings about the importance of global factors, my analysis includes the international interest rate as an exogenous global factor. Additionally, regarding local factors, this paper documents the importance of the government confiscation risk for FDI and its effect during crises.

In terms of structural modeling, some characteristics of the FDI on which this paper focuses on have been previously documented in the literature. In Albuquerque (2003), the author argues that FDI is less volatile than other financial flows and that non-FDI flows are shorter-term investments facing fewer physical constraints to moving, thus making it easier to flee a jurisdiction. The author proposes a model with enforcement constraints in which FDI is partly inalienable to the extent that it comprises intangible assets, and portfolio flows are subject to government confiscation due to the lack of international enforcement mechanisms. The author finds that more financially constrained economies should borrow relatively more through FDI. Complementary to Albuquerque (2003), the model in the present paper assumes that portfolio flows are subject to a loan-to-value constraint, and I study the mechanism through which the risk of government confiscation of FDI in emerging economies affects the debt capacity of an economy. Hence, in this paper, the risk of government confiscation

is one of the key elements that explains the difference in the probability of a crisis between advanced and emerging economies.

With respect to the government confiscation risk studied by Cole and English (1991), Thomas and Worrall (1994), Antras, Desai, and Foley (2009), and Hajzler (2012), among others, I contribute to this literature by analyzing the effects of the risk on the probability of a Sudden Stop crisis. In particular, I study the complementarities between FDI and portfolio flows, the relation between FDI and the debt capacity of the domestic economy, and the different exposure to crises between advanced and emerging economies. In line with this research, Fan and Luo (2019) have also explored the considerations faced by multinational firms when determining production locations and financing strategies in the presence of imperfect capital markets. Lastly, this paper builds on the work of Mendoza (2010), who introduced the debt-deflation mechanism to study Sudden Stop episodes. This paper contributes to the understanding of causes of financial crises by analyzing the FDI channel during Sudden Stop episodes. In particular, this paper studies the different characteristics of capital flows between advanced and emerging economies and their effects on the dynamics of the economies during crises.

3 Empirical Evidence

3.1 Sudden Stops are a Global Phenomenon

The first point this paper aims to make is that Sudden Stop crises also happen in advanced economies. To accomplish this aim, I construct a panel database of 37 advanced and 75 emerging economies from 1990 to 2016. The economies were selected according to the World Bank's classification of high-income economies (advanced) and upper-middle-income economies (emerging).[5] Following Calvo, Izquierdo, and Talvi (2006), I identify a Sudden Stop episode as a large outflow of capital from an economy – specifically, a change in the financial account as a percentage of GDP of two standard deviations above its historical mean in a year. Under this definition, there have been 50 and 16 crises in emerging and advanced economies, respectively, implying a 2.9 and 2.3 percent probability of a crisis. This evidence suggests that Sudden Stops are not a phenomenon exclusive of emerging economies, although they are more probable than in advanced economies. In line with these results, Bianchi and

[5]See the Appendix for a list of countries in each group.

Mendoza (2020) document a similar crisis probability of 2.9 percent for emerging economies and 1.7 percent for advanced economies. Given this evidence, let Fact 1 be.

Fact 1: The probability of a Sudden Stop in advanced economies is 0.6 percentage points smaller than in emerging economies.

3.2 Decomposition of the Financial Account

Although a Sudden Stop crisis seems similar between advanced and emerging economies at the aggregate level, a decomposition of the financial account (FA) suggests fundamental differences between both groups of economies. Figure 1 shows the median GDP, FA, FDI, and portfolio plus other investments during crisis episodes for both groups of economies. The plots are centered around period 0, which corresponds to the period identified as a Sudden Stop. Even when the method to identify a crisis does not directly include a drop in GDP, Figure 1.a shows a drop in the cycle component of GDP for both groups.[6] Sudden Stops are accompanied by declines in production that are 1.5 percentage points more severe in emerging economies. We can see in Figure 1.b that at the aggregate level, the FA as a percentage of GDP follows a similar movement in both economies, although, before the Sudden Stop, emerging economies have a larger negative position of around 4 percentage points more than advanced economies. However, after decomposing into FDI and PI (which also includes other investments), we can see a clear difference between both groups. On the PI side (Figure 1.c), although both groups show similar movements, advanced economies have a larger negative position before the Sudden Stop. Moreover, the contraction during the crisis is larger too. Figure 1.d shows two differences between both groups of economies: the FDI flows before a Sudden Stop account for almost half of the FA deficit in emerging economies (4 percent) while for advanced economies the flows are close to zero, and emerging economies experience a large correction in FDI the year of the Sudden Stop (1.5 percentage points) while advanced economies smooth it out.

This second difference might suggest that multinational corporations behave differently depending on whether they have invested in an emerging or in an advanced economy. Whenever there is a crisis in an emerging economy, international investors might move their FDI investments out of that economy, whereas in an advanced economy they might be more resistant to moving their investments. However, Figure 1.e suggests that this is not the case. The figure shows the FDI inflow event study analysis for both groups of economies and suggests

[6]The cycle component is obtained by removing a linear trend around the crisis episode.

that multinational corporations react in the same way in both groups of economies. When a crisis hits the domestic economy, FDI investments are pulled out, regardless of whether it is an advanced or emerging economy. Hence, the difference in the net flows between both groups of economies comes from the domestic investors. This difference relies on the fact that advanced economies have outflow FDI investments of the same magnitude as the inflows they receive, and these outflows react and move in opposite ways to the inflows such that the net FDI is around zero, even when the crisis hits the advanced economy. In this sense, FDI outflow investments serve as buffer savings in advanced economies that let them smooth their financial account whenever the economy enters a Sudden Stop episode and prevents them from experiencing more severe and frequent crises.

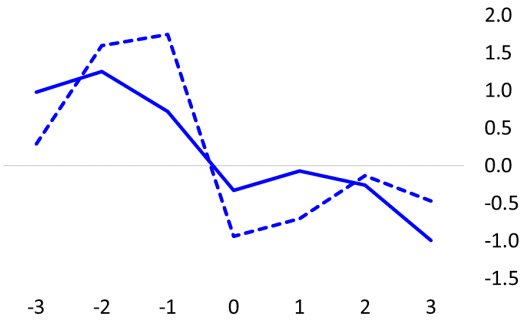
Additionally, these differences can be seen not only during crises, but also at a business-cycle level among the whole sample. The mean net FDI to GDP flow in emerging economies is -3.9 percent, while in advanced economies it is -0.3 percent, and the mean inflow FDI to GDP in both emerging and advanced economies is -5.1 percent.[7] These percentages suggest that net FDI and FDI inflows are similar in emerging economies but very different in advanced economies. Moreover, net FDI flows in emerging economies are mainly inflows: capital is only flowing into the economy. In advanced economies, however, similar magnitudes of inflows and outflows of capital are registered such that the net FDI is around zero. To summarize, emerging economies have mostly inflows of capital, while advanced economies attract capital and invest abroad approximately in the same magnitudes, possibly due to diversification motives (Fillat, Garetto, and Oldenski (2015)).

Figures 2 and 3 show the decomposition of the financial account for a sub-sample of 4 economies in each group. Emerging economies (Figure 2) consistently have more inflow than outflow FDI, which means that capital from abroad is flowing into the economy. As a global resource constraint would imply, this capital is coming from another economy, which most likely is an advanced economy. Figure 3 gives evidence that advanced economies have both positive and negative large net flows of FDI. Hence, let Fact 2 be:

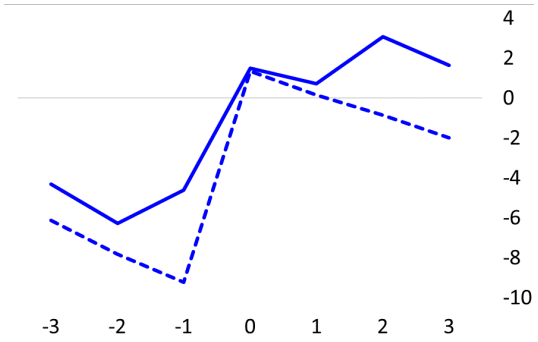
Fact 2: The mean net FDI as a percentage of GDP flow in emerging economies is -3.9 percent and in advanced economies is -0.3 percent.

Lastly, estimates of the total stock of capital in each group of economies also show significant differences. Advanced economies have a stock of capital to GDP ratio that is 15

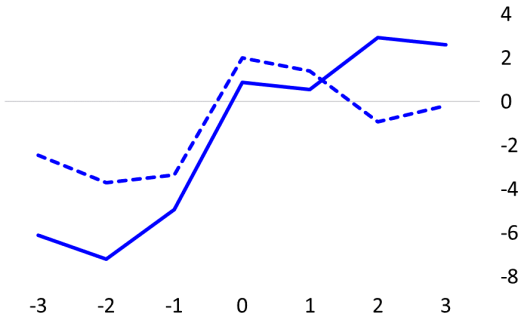
[7]To obtain the moments, I averaged each country across time and then took the mean across countries.



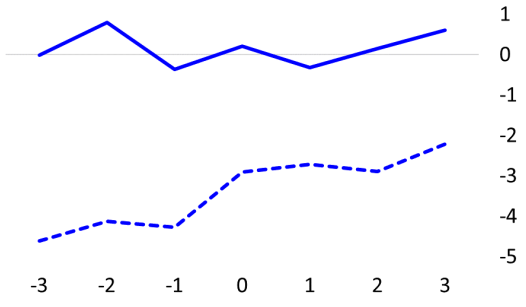
(a) GDP cycle in percent



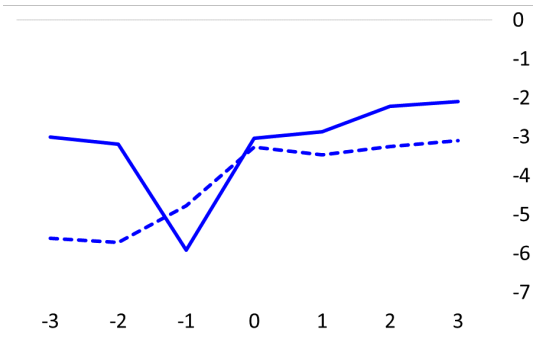
(b) Financial account as a percentage of GDP



(c) Portfolio and other inv. as a percentage of GDP

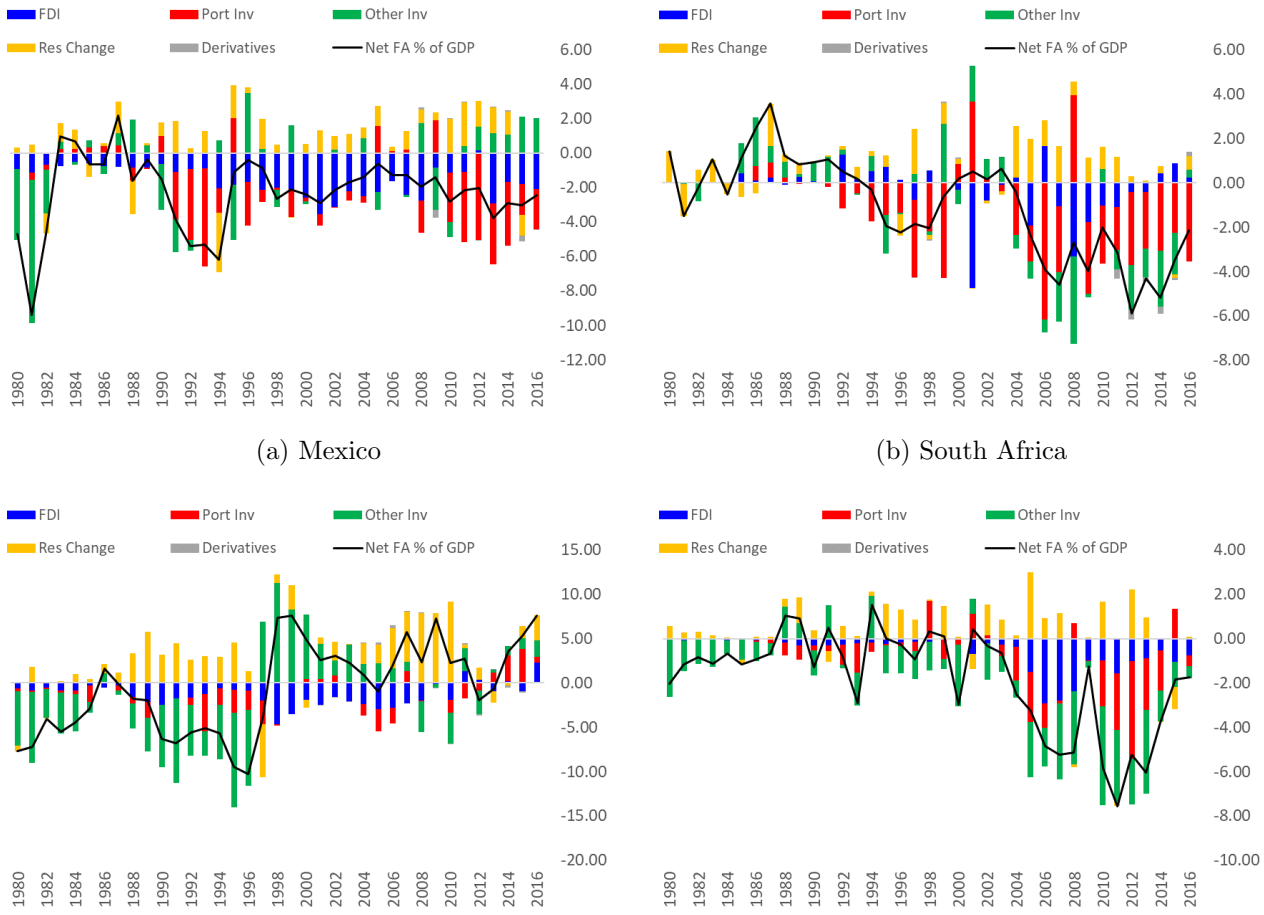


(d) Net FDI as a percentage of GDP



(e) FDI Inflow as a percentage of GDP

Figure 1: Event Study of a Sudden Stop. Solid (dashed) lines correspond to advanced (emerging) economy. Source: World Bank WDI and IMF.



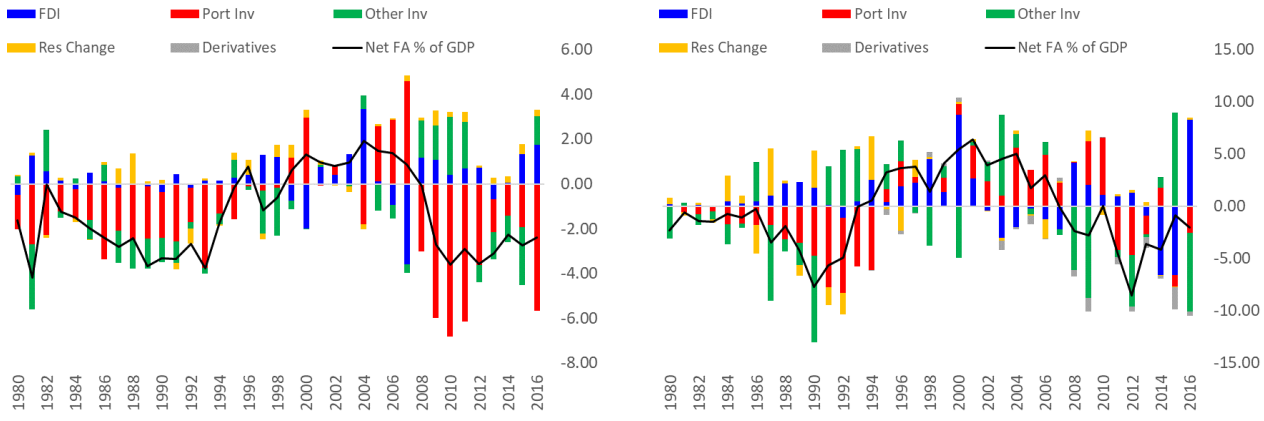
(a) Mexico

(b) South Africa

(c) Thailand

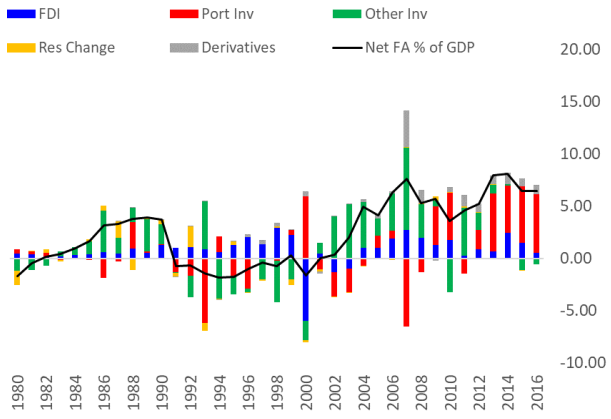
(d) Turkey

Figure 2: Financial Account in Emerging Economies. Source: World Bank WDI and IMF.

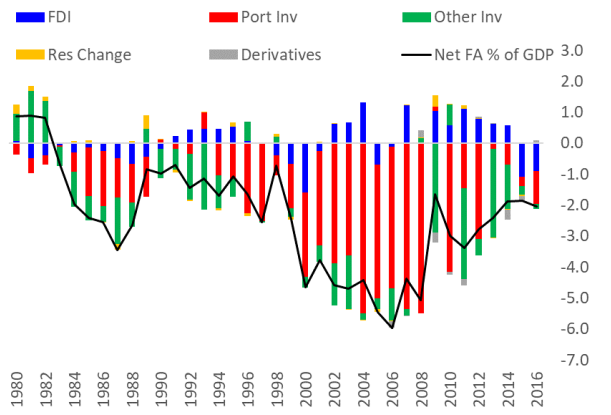


(a) Canada

(b) Finland



(c) Germany



(d) United States

Figure 3: Financial Account in Advanced Economies. Source: World Bank WDI and IMF.

percent larger than emerging economies.[8] Given this evidence, let Fact 3 be:

Fact 3: The mean capital to GDP ratio in advanced economies is 2.4 and in emerging economies is 2.1.

3.3 FDI and the Government Confiscation Risk

The financial account records transactions that involve financial assets and liabilities that take place between residents and non-residents of an economy. Its two main components, FDI and PI, are different in nature. According to the (International Monetary Fund, 2013, p. 100, 110),

> *"Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy."*

and

> *"Portfolio investment is defined as cross-border transactions and positions involving debt or equity securities, other than those included in direct investment or reserve assets."*

Hence, these accounts involve international transactions of different assets. Portfolio investments are exchanges of financial securities, while direct investments are exchanges of control (ownership) of enterprises and physical capital.

From the point of view of international investors, these two accounts are also exposed to different risks. The World Bank, through the Global Investment Competitiveness group, surveyed executives of multinational corporations with investments in developing countries (see World Bank (2017)). They find that over 90 percent of all investors say that legal protections are critically important in the decision process of investing abroad. These guarantees include laws that protect against government confiscation, breaches of contract and arbitrary government conduct. Additionally, they document that 5 percent of foreign investment is confiscated by the government in emerging economies, and this risk is a major concern for multinationals when they choose where, when, and how much to invest abroad.

[8] Capital stock estimates are obtained from the IMF Investment and Capital Stock Dataset; see International Monetary Fund (2015).

When it comes to government confiscation risk, direct investment is more exposed to this risk than portfolio investment. This is because direct investment involves a direct and long-term investment in a foreign country, which make it more vulnerable to foreign government actions. On the other hand, portfolio investment is less exposed to government confiscation risk because it typically involves a more passive and short-term investment in securities, which are easier to liquidate or transfer in the event of foreign government action (see Cole and English (1991) and Cole and English (1992)).

Having documented the importance of the different behavior in FDI flows in studying Sudden Stop episodes, the next section will describe the proposed model. The small open economy model incorporates foreign investment subject to government confiscation risk and a loan-to-value debt constraint.

4 Model

4.1 Environment

This section describes the proposed real business cycle of a small open economy model (RBC-SOE). The model builds from Mendoza (2010) with a fixed domestic stock of capital and foreign investment subject to government confiscation risk. The economy is inhabited by an infinitely lived household with preferences defined over stochastic sequences of consumption and labor $\{c_t, L_t\}$ for $t = 0, ..., \infty$. The preference specification is

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_t, L_t) \right], \text{ where } u(c_t, L_t) = \frac{(c_t - \frac{L_t^{\omega}}{\omega})^{1-\nu}}{1-\nu}. \tag{1}$$

The GHH type utility function proposed by Greenwood, Hercowitz, and Huffman (1988) is commonly used in RBC-SOE models because the wealth effects on the labor supply are eliminated and a closed form expression for the labor supply can be obtained.

The representative household has access to a non-state-contingent bond, b_{t+1}, that pays one unit of consumption in the next period, with price equal to the inverse international interest rate factor, $q_t = (1+r_t)^{-1}$. The household chooses sequences of consumption, supply of labor and next-period bond holdings to maximize its lifetime expected utility subject to

the following budget constraint:

$$c_t + q_t b_{t+1} = w_t L_t + r_t^k \bar{k} + b_t + T_t. \tag{2}$$

The household's income comes from labor income, $w_t L_t$, plus capital income composed of the return from the fixed domestic stock of capital, $r_t^k \bar{k}$, plus the current bond position, b_t, plus transfers from the government, T_t. On the expenditure side, the household buys consumption goods (consumption is the numeraire good with normalized price equal to 1), c_t, plus next-period bond holdings, b_{t+1}, multiplied by its price, q_t. Additionally, next-period bond holdings are subject to a loan-to-value collateral constraint:

$$q_t b_{t+1} \geq -\kappa q_t^k \bar{k} - \kappa_t^f q_t^k k_t^f. \tag{3}$$

The household is not able to issue more debt (negative bond positions) than a constant fraction κ of the market value (the capital, both locally and foreign owned, has price q_t^k) of the fixed domestic capital stock, $\bar{k}$, plus a stochastic fraction κ_t^f of the market value of the foreign stock of capital in the economy, k_t^f.[9] The market value is the price of the capital multiplied by the corresponding stock of capital (i.e., for the domestic capital, the market value is $q_t^k \bar{k}$). The fraction κ_t^f corresponds to the exogenous probability that the government confiscates the foreign capital.[10]

The consumption good is produced by a single firm with a constant-returns-to-scale production function that uses labor and capital as production inputs and is exposed to a stochastic total factor productivity (TFP) shock, $y_t = \exp(\epsilon_t) A K_t^{\alpha} L_t^{1-\alpha}$. Total capital

[9] Following Mendoza (2010) and Mendoza and Villalvazo (2020), in the competitive equilibrium the price of capital can be obtained from Tobin's Q investment optimal condition: $q_t^k = \partial \tilde{I}_t / \partial K_{t+1}$.

[10] The micro-foundations of the collateral constraint are similar to the ones presented by Bianchi and Mendoza (2018) extended to an economy with foreign direct investment. Specifically, in an economy where debt contracts are signed with creditors in a competitive environment and households can always switch to another creditor at any point, the loan-to-value collateral constraint is derived from an incentive compatibility constraint resulting from a limited enforcement problem. At the beginning of the period, credit and capital markets open, production happens, and households choose b_{t+1} with a given price q_t and take as given $\bar{k}$, k_t^f, and the capital's price q_t^k. Then, markets close, and households decide to divert resources from the credit and default. When households default, the government immediately confiscates a fraction κ_t^f of the foreign capital in the economy. Local and foreign competitive financial intermediaries costlessly monitor who diverts resources and seize a fraction κ of the domestic stock of capital and all the foreign capital confiscated by the government. Foreign financial intermediaries are able to recover the government-confiscated foreign capital due to a stronger international rule of law. After defaulting, the household regains access to credit markets instantaneously and repurchases the assets that investors sell in open markets at a price q_t^k. In this environment, a household that borrows $-q_t b_{t+1}$ and engages in diversion activities gains $-q_t b_{t+1}$ and loses $\kappa q_t \bar{k} + \kappa_t^f q_t^k k_t^f$. Hence, households repay if and only if $-q_t b_{t+1} \leq \kappa q_t^k \bar{k} + \kappa_t^f q_t^k k_t^f$.

demanded by the firm, K_t, is composed of the exogenously fixed domestic capital stock, $\bar{k}$, and an endogenous foreign capital stock, k_t^f, which are additive perfect substitutes: $K_t = \bar{k} + k_t^f$. The firm, which is owned by the household and has zero profits, chooses every period how much capital to rent at the competitive rate, r_t^k, and how much labor to demand for a competitive wage, w_t. Both input prices are taken as given by the firm. The TFP and the interest rate shocks, ϵ_t and r_t, follow independent first-order Markov processes, which will be specified at the end of this section.

There is also an international investor that chooses sequences of foreign capital, k_{t+1}^f for $t = 0, ..., \infty$, to invest in the economy and rent to the domestic firm (note that the rental rate will be such that the foreign capital market will clear) as to maximize the expected present discounted value of profits paid to their global shareholders, with the addition that the international investor takes into account the government confiscation risk.[11] Hence, in this economy, foreign direct investment flows are defined as $FDI_t = -(k_{t+1}^f - (1-\delta)k_t^f)$ and the financial account flows as $FA_t = b_{t+1} - b_t + FDI_t$.[12] The objective function of this investor is

$$\sum_{t=0}^{\infty} \mathbb{E}_0 \left[M_t \left(r_t^k k_t^f (1-\kappa_t^f) - (k_{t+1}^f - (1-\delta)(1-\kappa_t^f)k_t^f + \Phi(k_{t+1}^f, k_t^f)) \right) \right], \quad \text{given } k_0^f,$$

where M_t is the stochastic discount factor used by the international financial institution (I will assume $M_t = \Pi_{s=1}^t \left(\frac{1}{1+r_s} \right)$ and $M_0 = 1$). The function $\Phi(k_{t+1}^f, k_t^f) = \frac{\phi}{2} \frac{(k_{t+1}^f - k_t^f)^2}{k_t^f}$ corresponds to a standard quadratic adjustment cost function incurred by the international investor to move capital globally.

Lastly, the government will play a simple but crucial role of confiscating a κ_t^f fraction of foreign capital each period and transferring these resources to the agent in a lump-sum transfer T_t every period.

As noted above, there are three exogenous stochastic shocks in the model: the TFP shock ϵ_t, the international interest rate r_t, and the government confiscation fraction κ_t^f. The TFP and interest rate shocks will follow standard independent AR1 processes:

$$\epsilon_t = \rho_\epsilon \epsilon_{t-1} + \sigma_\epsilon \varepsilon_{\epsilon,t} \ , \quad \varepsilon_\epsilon \sim N(0,1),$$

$$r_t = (1-\rho_{\sigma_r})\bar{r} + \rho_r r_{t-1} + \sigma_r \varepsilon_{r,t} \ , \quad \varepsilon_r \sim N(0,1).$$

[11] A similar setup was introduced in Mendoza and Smith (2006).

[12] In this framework only net FDI is modeled. See Lee (2022) for a recent paper that develops a model of gross capital flows.

Finally, the probability of government confiscation will follow a regime-switching process between periods of low and high probability of confiscation (independent of all the other processes).

4.2 Recursive competitive equilibrium

In a recursive formulation, the individual state variables are today's bond holdings, b, the foreign-owned capital stock in the economy, k^f, and the exogenous state vector of shocks composed by the TFP shock, the international interest rate and the probability of government confiscation: $s = (\epsilon, r, \kappa^f)$. Additionally, the aggregate state variable is today's aggregate total capital K. As usual, variables with a prime, $'$, correspond to the next period. Let the problem of the household be

$$\begin{aligned} v(b,s;K) = &\max_{c,L,b'} \quad u(c,L) + \beta \mathbb{E}_{s'|s}[v(b',s';K')] \quad s.t. \\ & c + q(s)b' = w(s;K)L + r^k(s;K)\bar{k} + b + T(s;K), \text{ budget constraint,} \\ & q(s)b' \geq -\kappa q^k(s;K)\bar{k} - \kappa^f(s)q^k(s;K)k^f, \text{ debt constraint,} \\ & K' = H_K(s;K), \text{ consistent expectations of the household.} \end{aligned}$$

Let $\lambda(b,s;K) > 0$ be the multiplier on the budget constraint and $\mu(b,s;K) \geq 0$ the multiplier on the debt constraint; then, first-order conditions are

$$\begin{aligned} \left(c - \frac{L^\omega}{\omega}\right)^{-\nu} &= \lambda(b,s;K), \\ \left(c - \frac{L^\omega}{\omega}\right)^{-\nu}(-L^{\omega-1}) &= \lambda(b,s;K)w(s;K), \\ \beta \mathbb{E}_{s'|s}[v_{b'}(b',s';K')] &= \lambda(b,s;K)q(s) - \mu(b,s;K)q(s), \\ 0 &= \mu(b,s;K)(q(s)b' + \kappa(q^k(s;K)\bar{k}) + \kappa^f(s)(q^k(s;K)k^{f'}(s;K))). \end{aligned}$$

We can see from the last first-order condition how the introduction of government confiscation loosens the constraint on the maximum amount of debt that the economy can hold.

Let the problem of the firm be

$$\begin{aligned}
&\max_{K,L} \ \exp(\epsilon(s))AK^{\alpha}L^{1-\alpha} - w(s;K)L - r^k(s;K)K \\
&\qquad \Rightarrow \text{F.O.C.:} \\
r^k(s;K) =& \alpha \exp(\epsilon(s))AK^{\alpha-1}L^{1-\alpha}, \\
w(s;K) =& (1-\alpha)\exp(\epsilon(s))AK^{\alpha}L^{-\alpha},
\end{aligned}$$

and the problem of the foreign investor be

$$\begin{aligned}
v^f(k^f, s; K) = &\max_{k^{f'}>0} \ r^k(s;K)k^f(1-\kappa^f(s)) - I + \frac{1}{1+r(s)}\mathbb{E}_{s'|s}[v^f(k^{f'}, s'; K')] \quad s.t. \\
&I = k^{f'} - (1-\delta)k^f(1-\kappa^f(s)) + \Phi(k^{f'}, k^f), \\
&K' = H_K(s;K), \\
&\Rightarrow \text{F.O.C.:} \\
1 + \Phi_1(\cdot) = &\frac{1}{1+r(s)}\mathbb{E}_{s'|s}[r^k(s';K')(1-\kappa^f(s')) + (1-\delta)(1-\kappa^f(s')) + \Phi_2(\cdot')],
\end{aligned}$$

where $\Phi(k^{f'}, k^f) = \frac{\phi}{2}\frac{(k^{f'}-k^f)^2}{k^f}$, and $\Phi_n(\cdot)$ corresponds to the first derivative of the adjustment cost function with respect to the n argument.

From the first-order condition of the foreign investor's problem, we can see how the introduction of government confiscation risk distorts the optimal decision of the international investor. In the current period, the investor takes into account that if there is a positive probability of being in a state with positive κ^f in the future, the expected return on the investments will be lower. Hence, optimality is achieved with a lower level of foreign capital: less FDI flows into the economy.

Finally, the recursive competitive equilibrium is given by the allocation functions $\{c(b,s;K)$, $L(b,s;K)$, $b'(b,s;K)$, $k^{f'}(k_f,s;K)$, $T(s;K)\}$, the price functions $\{w(s;K)$, $r^k(s;K)$, $q^k(s;K)$, $q(s)\}$ and the functions $\{v(b,s;K)$, $v^f(k_f,s;K)$, $H_K(s;K)\}$ such that

1. Given the prices and transfers, the functions $\{c(b,s;K)$, $L(b,s;K)$, $b'(b,s;K)\}$ solve the household's problem.

2. Given the prices, the firm maximizes profits.

3. Given the prices, the function $k^{f'}(k^f,s;K)$ solves the foreign investor's problem.

4. The price of the bonds satisfies $q(s) = (1 + r(s))^{-1}$ and the price of the capital satisfies Tobin's Q optimality condition $q^k(s; K) = \partial I(K', K)/\partial K'$.

5. The capital market clearing condition is satisfied:
   $K = \bar{k} + k^f$.

6. The representative agent's condition is satisfied:
   $K' = H_K(s; K) = \bar{k} + k^{f'}(K - \bar{k}, s; K)$.

7. The government's budget is balanced:
   $T(s; K) = \kappa^f(s)k^f(r^k(s, K) + 1 - \delta)$.

5 Quantitative Analysis

This section presents the findings of the model calibrated to an emerging economy, as well as a counterfactual calibration with a higher capital-to-GDP ratio and no government confiscation risk. The latter calibration serves as a proxy for analyzing advanced economies.

5.1 Calibration

The parameters of the utility function and the capital depreciation rate were taken from the literature and have been commonly used in studies of both emerging and advanced economies. In particular, the risk aversion coefficient, ν, equal to 2, and the labor parameter that determines the wage elasticity of labor supply, ω, equal to 1.85, come from Mendoza (2010). The annual depreciation rate, δ, equal to 8.8 percent, was taken from Garcıa-Verdú (2005).

Regarding the parameters that were calibrated to match specific moments of the data, the discount factor, β, equal to 0.874, was calibrated to match the average probability of a Sudden Stop of 2.9 percent in emerging economies.[13] The fixed domestic capital stock, $\bar{k}$, for an emerging (advanced) economy was set to 1.93 (2.82) to match the average FDI to GDP percentage of -3.9 (-0.3). The share of capital, α, was set to 0.218 to match the average capital to GDP ratio for an emerging economy of 2.1. The domestic collateral debt limit, κ, was set to 0.285 to match the median foreign debt to GDP ratio of -46 percent in

[13] Although the implied discount factor seems low, Uribe and Schmitt-Grohé (2017) also use a low discount factor to match the probability that the collateral constraint binds.

emerging economies. Lastly, the FDI adjustment cost coefficient, ϕ, equals 4.34 to match the median ratio of portfolio flows' standard deviation to FDI flows' standard deviation of 1.85 in emerging economies.

With respect to the exogenous processes, the international interest rate and the TFP shock were taken from Bianchi, Liu, and Mendoza (2016). The regime-switching process of the international interest rate captures the global liquidity phases identified by Calvo, Izquierdo, and Talvi (2006) and Shin (2014). Specifically, the gross interest rate takes the values $R \in \{R^l, R^h\} = \{0.967, 1.014\}$ with transition probabilities $Pr[R' = R^l | R = R^l] = 0.6$ and $Pr[R' = R^h | R = R^h] = 0.9333$. Next, the TFP shock was discretized with a Tauchen-Hussey quadrature algorithm to approximate a three-state Markov process with autocorrelation and standard deviation of 0.54 and 0.059, respectively.

Finally, the debt fraction of foreign collateral κ_f is assumed to follow a two-state regime-switching process. The parameter κ_f will take the value of 0 for low-risk periods and 0.05 for high-risk periods, following the evidence documented in World Bank (2017). The transition matrix calibration is set to capture the common length of a presidential term in emerging economies of 5 years for high-risk periods and 20 years for low-risk periods. This calibration suggests that, on average, every four presidential terms there is a political wave that elects a riskier government.[14]

Table 1 shows the calibrated parameters.

5.2 Quantitative results

This paper explores the role of FDI during Sudden Stop episodes. In particular, the analyzed mechanism has two effects: the direct effect that comes from having a positive probability of government confiscation and hence increases the debt capacity of the economy, and the indirect effect that comes from movements in the FDI account during a crisis that affects the price of capital and hence the market value of all the total collateral.

To account for the role of FDI, I compare the results from an emerging economy with the results from a counterfactual calibration that proxies an advanced economy, both following the calibration proposed in Section 5.1. To discipline the quantitative results, the advanced economy will differ in only two ways from the emerging economy calibration. First,

[14] Anecdotal evidence of these political waves can be seen in Latin American economies that have moved from neoliberal to socialist and then to conservative governments throughout the 20th and beginning of the 21st centuries.

Table 1: Calibrated Parameters

Parameter		Value	Source or Target	Model	Data
Common in the literature					
ν	Risk aversion	2	Mendoza (2010)		
ω	Determine wage elasticity	1.85	Mendoza (2010)		
δ	Depreciation rate (%)	8.8	Garcıa-Verdú (2005)		
A	TFP level	1.0	Normalized value		
Matched moments					
β	Discount factor	0.874	SS probability in EE (%)	2.9	2.9
$\bar{k}_{EE}$	Capital stock for EE	1.93	FDI/GDP in EE (%)	-3.9	-3.9
$\bar{k}_{AE}$	Capital stock for AE	2.82	FDI/GDP in AE (%)	-0.3	-0.3
α	Share of capital	0.218	K/GDP in EE	2.1	2.1
κ	Domestic collateral limit	0.285	Debt/GDP in EE (%)	-47	-47
ϕ	FDI adj. cost	4.34	s.d.(PI)/s.d(FDI) in EE	1.85	1.85
Exogenous process					
R	Gross interest rate	{0.967, 1.014}	Bianchi, Liu, and Mendoza (2016)		
ρ	TFP autocorrelation	0.54	Bianchi, Liu, and Mendoza (2016)		
σ	TFP s.d.	0.059	Bianchi, Liu, and Mendoza (2016)		
κ_f	Foreign collateral limit	{0, 0.05}	World Bank (2017)		

as noted in Section 3.2, the advanced economy will have a larger stock of domestic capital, and, second, following the World Bank (2017), the advanced economy will not be exposed to any government confiscation risk. To additionally validate that advanced economies have no government confiscation risk, I use the Investment Profile (*inv*) variable, from the International Country Risk Guide (ICRG) database, to document any correlation evidence between government confiscation risk and FDI flows in both groups of economies.[15] The *inv* variable takes values from 0 (very high risk) to 12 (very low risk). Column (1) of Table 3 shows the results from a descriptive panel regression model that includes as explanatory variables the US interest rate level, the lagged FDI to GDP ratio, the interaction of the *inv* variable with both a dummy variable for advanced economies and a dummy variable for emerging economies and country fixed effects. From the coefficients of the interaction of the investment profile variable, I get two results. First, focusing on the effect of investment risk in advanced economies (*-inv * Dummy Adv*), the regression coefficient is not statistically different from zero, suggesting that the confiscation risk is only present in emerging economies. Second, the coefficient for the emerging economies (*-inv * Dummy Eme*) is highly significant and negative, meaning that higher risk decreases the FDI flows into the economy (because the regression is done with *-inv*, higher numbers mean higher risk). Hence, as expected,

[15]The ICRG database is a well-known source for political and economic risk measures and has been used by Herrera, Ordonez, and Trebesch (2020), among others.

government confiscation risk increases the cost of FDI, disincentives multinationals to invest in the domestic economy, and is only present in emerging economies.

After solving the model calibrated to both groups of economies, I simulated 200,000 periods and dropped the first 10,000 points.[16] Table 5.2 shows the moments of the simulated data for both groups of economies. With respect to the probability of a Sudden Stop (Fact 1), the model suggests that an emerging economy that increases its capital-to-GDP ratio and eliminates government confiscation risk would reduce the probability of a Sudden Stop from 2.9 to 2.7 percent. Hence, the FDI channel accounts for 30 percent of the observed difference in the probability of a Sudden Stop between emerging and advanced economies. Moreover, the FDI channel accounts for 66.7 percent of the difference in total capital to GDP ratios and 29 percent of the net foreign asset position in emerging and advanced economies.

Table 2: Simulated Statistics

	Emerging Eco. Matched	Advanced Eco. Simulation	Advanced Eco. Data
Sudden Stops			
Long-run prob. of SS (%)	2.9	2.7	2.3
Capital and Net Foreign Asset Position			
Mean Capital / GDP	2.1	2.3	2.4
Mean Debt / GDP (%)	47	65	109

Figure 4 shows the results of a Sudden Stop event analysis following the same methodology as in Section 3.1. A Sudden Stop event is defined as a period in which the collateral constraint binds and the change in the financial account as percentage of GDP is two standard deviations above its historical mean. With respect to the price of the capital (Tobin's Q), the drop in the emerging economy model is about 12 percent, which is 2.5 percentage points larger than in the advanced economy model. In terms of the financial account, advanced economies have smaller deficits in the FA, while emerging economies show a larger contraction in the FA, which is consistent with the data presented in Figure 1. This difference is due mainly to the FDI channel, as both groups show similar dynamics in the portfolio flows. It is worth noting that advanced economies encounter a larger portfolio flows deficit and experience a stronger contraction during a Sudden Stop. This behavior is primarily due to the fact that advanced economies have a higher debt-to-GDP ratio. Finally, there

[16] I use the *FiPIt* algorithm proposed by Mendoza and Villalvazo (2020). Note that a global solution method is required due to the high non-linearities that models with occasionally binding constraints are characterized to show in the policy functions.

is a large contraction in FDI flows in the emerging economies and almost no movement in advanced economies, which is also consistent with the evidence presented in Section 3.2. Regarding the exogenous shocks, Figures 4.e through 4.g show the dynamics of the TFP, the interest rate and the government confiscation risk, respectively. The figures show how TFP levels are declining until the period of the crisis. The interest rate shows a large increase in the period of the crisis, and, for emerging economies, the crisis episode is also associated with an increase in government confiscation risk.

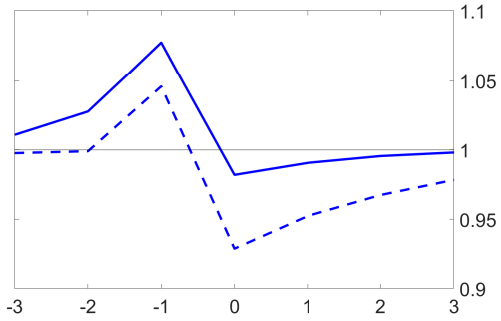
5.3 Model Validation

Finally, this section compares the results obtained from a descriptive regression using the simulated data from the model with the results obtained from the panel database in Columns (1) and (2) of Table 3. Since the confiscation risk is only present in the emerging economy model, instead of having the investment risk interact with a dummy variable for each economy group, I use the time series of the probability of confiscation, κ_f, to measure the effect of the confiscation risk.

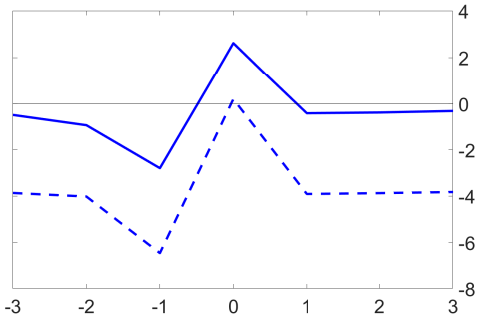
The model is successful in terms of the signs of the coefficients. With simulated data, the regression coefficients with respect to the interest rate level are negative. An interpretation of this result is that as the international interest rate increases, the opportunity cost of FDI investments increase and capital that had previously entered the economy will be reallocated and invested at the international rate. The coefficient for the lagged FDI to GDP ratio is positive, suggesting that previous higher FDI flows are associated with higher current FDI flows. Lastly, the coefficient for investment risk (κ_f in the simulated data) in the emerging economies is highly significant and negative for both real data and simulated data. This finding suggests that as investment risk increases, net FDI flows into the domestic economy decrease.

5.4 Impulse response analysis

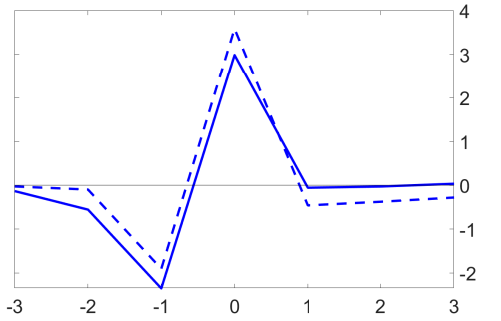
To account for the importance of providing certainty to international investors and multinationals, this section shows the results of an impulse response analysis after a shock to the government confiscation risk. Figure 5 shows the differences between the response of an economy that has five years of high confiscation risk and an economy that stays in a



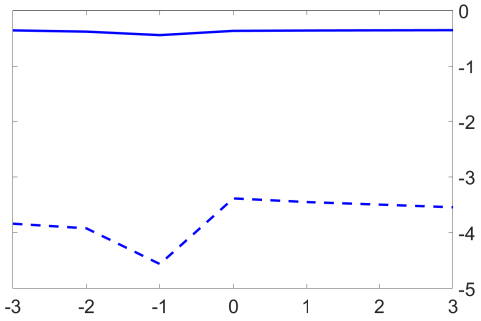
(a) Tobin's Q in levels



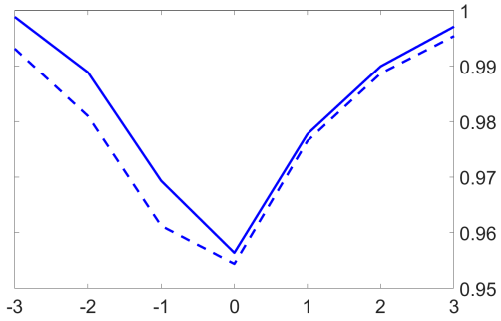
(b) FA as a percentage of GDP



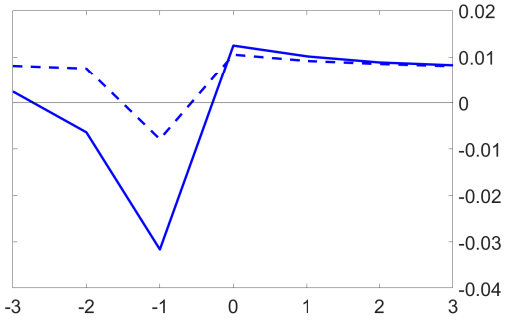
(c) PI as a percentage of GDP



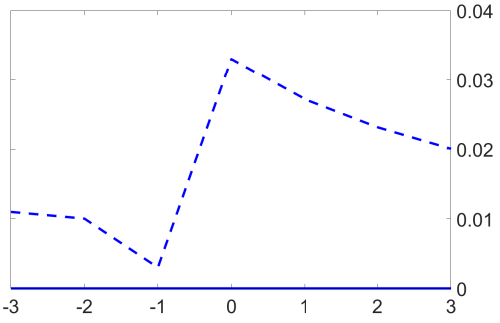
(d) Net FDI as a percentage of GDP



(e) TFP in levels



(f) Interest rate in levels



(g) Confiscation risk in levels

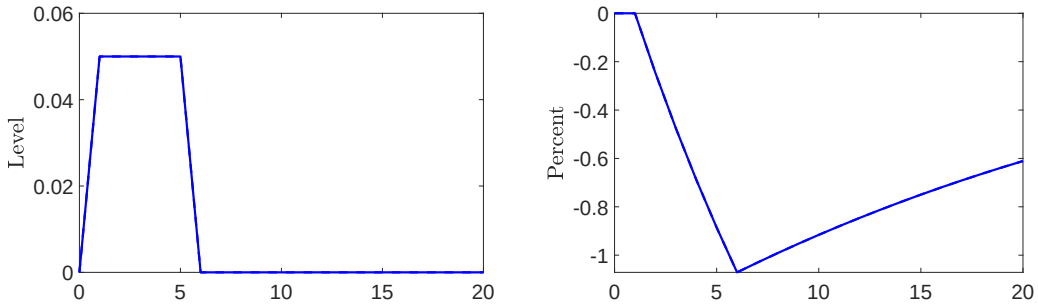
Figure 4: Simulated Event Study of a Sudden Stop. Solid (dashed) lines correspond to advanced (emerging) economy model.

Table 3: Descriptive Panel Regression

	Dependent variable: -FDI / $GDP_{i,t}$ (%)	
	Real Data (1)	Simulated Data (2)
$r_{US,t}$	-0.253	-0.093^{***}
	(0.154)	(0.0003)
(-FDI / GDP)$_{i,t-1}$	0.343^{***}	0.497^{***}
	(0.022)	(0.001)
-inv$_{i,t}$ * Dummy Adv$_{i,t}$	0.260	–
	(0.239)	
-inv$_{i,t}$ * Dummy Eme$_{i,t}$	-0.398^{*}	–
	(0.225)	
$\kappa_{f_{i,t}}$	–	-17.798^{***}
		(0.040)
Country FE	*YES*	*YES*
Observations	1,922	379,994
R^2	0.293	0.988

Note: Standard errors in parentheses. *p<0.1; **p<0.05; ***p<0.01

null confiscation risk state. For the analysis, the economies start at the long-run average levels of bonds and foreign capital and stay in a low interest rate environment with average TFP. Figure 5.a shows the dynamics of the government confiscation risk. Regarding the production, Figure 5.b shows how total GDP starts declining and reaches its lowest point at around -1 percent in the first period after the confiscation risk becomes zero. Figures 5.c and 5.d show the responses in the financial account and the FDI as a percentage of GDP. In both series, we see a transitory contraction of about 2.5 percentage points for as long as the confiscation risk is high.



(a) Confiscation risk (κ_f)

(b) GDP

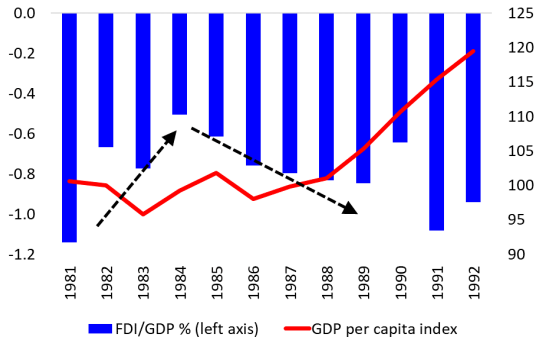
(c) FA as a percentage of GDP

(d) FDI as a percentage of GDP

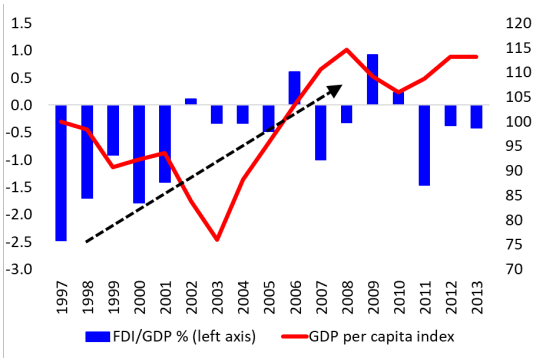
Figure 5: Impulse response analysis after a five-year increase in government confiscation risk.

5.5 Anecdotal Evidence: Episodes of Government Confiscations

To give the previous results some historical context, in this section I present anecdotal evidence of two episodes of increases in government confiscation risk and actual nationalizations. In 1982, three months before leaving office, Mexico's President Jose Lopez Portillo nationalized the banks. After two years under the control of the government, in 1984 almost all assets were re-privatized and by 1990 only 18 out of the 58 originally nationalized banks remained under the government's control (Haber (2005) and Gruben and McComb (1997)). Figure 6.a shows how, after the nationalization, the FDI to GDP ratio dropped 0.8 percentage points and GDP decreased 4 percent in 1983. The drop in FDI is about a third of the drop obtained by the model, as Figure 5.d shows. With respect to a more lasting shock, in 1998, after Hugo Chavez was elected Venezuela's president, the risk of government confiscation increased until 2003, when the oil industry was re-nationalized (Weisbrot, Ray, Sandoval, et al. (2009)). Figure 6.b shows how, from 1997 to 1999, the FDI to GDP ratio decreased 1.5 percentage points and GDP decreased 5 percent. Comparing these episodes to the results obtained in the previous section, we can see that the model is able to replicate the dynamics of the FDI flows after an increase in government confiscation risk. Regarding GDP, the model underestimates the decline; however, it is important to note that the episodes presented in this section correspond to actual nationalizations of foreign capital and not only to increases in the risk of government confiscation.



(a) Mexico, FDI/GDP (%) and GDP per capita (Index 1982=100)



(b) Venezuela, FDI/GDP (%) and GDP per capita (Index 1997=100)

Figure 6: Episodes of expropriations. Source: World Bank WDI.

6 Conclusion

Balance of payments crises, characterized by Sudden Stops, are not a phenomenon exclusive to emerging economies. However, decomposing the financial account uncovers important differences between advanced and emerging economies in their FDI flows. First, advanced economies have, on average, zero net FDI flows, and, second, advanced economies have sufficient outflow FDI to act as buffer savings during Sudden Stops. These differences motivate the study of the components of capital flows in both types of economies to better understand why the probability of a Sudden Stop is larger in emerging economies than in advanced economies.

To quantify the effect of the FDI channel on the probability of a Sudden Stop, I propose a DSGE small open economy model that has a loan-to-value collateral constraint, a fixed domestic stock of capital and foreign investment subject to government confiscation risk and that generates Sudden Stop crises endogenously. I calibrate the model using data for a large sample of advanced and emerging economies and find that the FDI channel has a meaningful impact on the probability of a Sudden Stop. In particular, the model suggests that if an emerging economy increases its capital-to-GDP ratio and eliminates government confiscation risk, it would reduce the probability of a Sudden Stop from 2.9 to 2.7 percent and would increase its debt-to-income ratio from 47 to 65 percent.

On the policy side, in addition to encouraging a stronger rule of law that would bring certainty to foreign investors (i.e., reduce the risk of government confiscation), emerging economies should promote policies that encourage outflow FDI to diversify international capital flows and become more resilient to financial distress. This action would reduce the probability and severity of a financial crisis while increasing the debt capacity of the economy and reducing consumption volatility.

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Online Appendix to "FDI Flows and Sudden Stops in Small Open Economies"

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The following table shows the list of economies classified as advanced and emerging:

Table A-1: List of countries

Albania [Emerging]	Fiji [Emerging]	Netherlands [Advanced]
Algeria [Emerging]	Finland [Advanced]	New Zealand [Advanced]
Angola [Emerging]	France [Advanced]	Norway [Advanced]
Antigua and Barbuda [Emerging]	French Territories: French Polynesia [Advanced]	Oman [Emerging]
Argentina [Emerging]	French Territories: New Caledonia [Advanced]	Palau [Emerging]
Aruba [Advanced]	Gabon [Emerging]	Panama [Emerging]
Australia [Advanced]	Georgia [Emerging]	Paraguay [Emerging]
Austria [Advanced]	Germany [Advanced]	Peru [Emerging]
Azerbaijan, Republic of [Emerging]	Greece [Emerging]	Poland [Emerging]
Bahamas, The [Advanced]	Grenada [Emerging]	Portugal [Advanced]
Bahrain, Kingdom of [Emerging]	Guyana [Emerging]	Qatar [Advanced]
Barbados [Emerging]	Hungary [Emerging]	Romania [Emerging]
Belarus [Emerging]	Iceland [Advanced]	Russian Federation [Emerging]
Belgium [Advanced]	Iran, Islamic Republic of [Emerging]	Saudi Arabia [Emerging]
Belize [Emerging]	Iraq [Emerging]	Serbia, Republic of [Emerging]
Bermuda [Advanced]	Ireland [Advanced]	Seychelles [Emerging]
Bosnia and Herzegovina [Emerging]	Israel [Advanced]	Singapore [Advanced]
Botswana [Emerging]	Italy [Advanced]	Sint Maarten [Advanced]
Brazil [Emerging]	Jamaica [Emerging]	Slovak Republic [Emerging]
Brunei Darussalam [Advanced]	Japan [Advanced]	Slovenia [Emerging]
Bulgaria [Emerging]	Jordan [Emerging]	South Africa [Emerging]
Canada [Advanced]	Kazakhstan [Emerging]	Spain [Advanced]
Chile [Emerging]	Korea, Republic of [Emerging]	St. Kitts and Nevis [Emerging]
China, P.R.: Hong Kong [Advanced]	Kuwait [Advanced]	St. Lucia [Emerging]
China, P.R.: Macao [Advanced]	Latvia [Emerging]	St. Vincent and the Grenadines [Emerging]
China, P.R.: Mainland [Emerging]	Lebanon [Emerging]	Suriname [Emerging]
Colombia [Emerging]	Libya [Emerging]	Sweden [Advanced]
Costa Rica [Emerging]	Lithuania [Emerging]	Switzerland [Advanced]
Croatia [Emerging]	Luxembourg [Advanced]	Thailand [Emerging]
Curacao [Advanced]	Macedonia, FYR [Emerging]	Trinidad and Tobago [Emerging]
Cyprus [Advanced]	Malaysia [Emerging]	Turkey [Emerging]
Czech Republic [Emerging]	Maldives [Emerging]	Tuvalu [Emerging]
Denmark [Advanced]	Malta [Emerging]	United Kingdom [Advanced]
Dominica [Emerging]	Marshall Islands, Republic of [Emerging]	United States [Advanced]
Dominican Republic [Emerging]	Mauritius [Emerging]	Uruguay [Emerging]
Ecuador [Emerging]	Mexico [Emerging]	Venezuela, Republica Bolivariana de [Emerging]
Equatorial Guinea [Emerging]	Montenegro [Emerging]	
Estonia [Emerging]	Namibia [Emerging]	