Capital Flows to Emerging Markets: Disentangling Quantities from Prices[☆]

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Abstract

This paper analyzes the joint dynamics of net capital flows and sovereign spreads in Emerging Economies. We document and deconstruct three empirical facts. First, the correlation between net capital flows and sovereign spreads in EMEs is -0.14. Second, the correlation of sovereign spreads across EMEs is 0.6. Third, the correlation of net capital flows across EMEs is 0.2. We quantify the role of credit supply/demand global/idiosyncratic shocks in explaining these facts by combining dynamic factors and a two-country small open economy model with correlated productivity and interest rate shocks. While common credit supply shocks explain 39% of sovereign spread fluctuations, they account for only 9% of changes in capital flows. Correlated TFP (common credit demand) shocks account for around half of the observed comovement in capital flows but they are not a significant driver of sovereign spread comovement.

Keywords: capital flows, sovereign spread, small open economy, credit supply, credit demand, external factors.

JEL Codes: E31, E32, E43, E52, E58.

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1 Introduction

Fluctuations in international capital markets as well as changes in the access to these markets, have first order macroeconomic effects on EMEs. However, the transmission channels of shifts in international capital markets remain to be fully understood. On one hand, a large body of work has studied prices in these markets, i.e. comovement in yields, identifying a Global Financial Cycle linked to changes in the US monetary policy stance. Another strand of literature has looked at quantities, i.e. capital flows. Fewer analyses have studied the two forces jointly. Even fewer analyses have assessed the ability of current structural small open economy models to reproduce the dynamics of spreads and flows.

This paper analyzes jointly the drivers of net capital flows and country spread in EMEs. These two dimensions allow us to identify common/idiosyncratic demand/supply credit shocks. First, we characterize the relationship between capital flows and sovereign spreads at the country level. Second, we estimate a Dynamic Factor Model to identify common drivers of sovereign spreads and capital flows. We also exploit this model to quantify the role of idiosyncratic/global demand/supply credit shocks in credit markets using sign restrictions. Finally, we assess if a two-country small open economy model can replicate the empirical facts.

We document and analyze the three empirical facts. First, country spreads and net capital flows display a low and negative (-0.14) correlation at the country level. This result is robust to different measures of capital flows and country spreads. Second, country spreads are highly correlated (0.6) across countries. Third, the correlation of net capital flows across countries is significantly lower (0.2). The correlation between a common factor associated with country spreads and another one associated with capital flows is -0.53. Credit supply shocks (idiosyncratic plus global) explain 61% of fluctuations in country spreads while they account for 53% of net capital flows. While global shocks are the main driver of country spreads, idiosyncratic credit demand and supply shocks explain 85% of fluctuations in net capital flows.

A two-country small open economy model can explain the empirical facts. The model augments the canonical model of small open economy developed by Schmitt-Grohe and Uribe (2003) with estimated interest rate processes for the international and country-specific interest rates (similar to Uribe and Yue, 2006), correlated productivity shocks, and correlated shocks to the country interest rate. We calibrate the model to match business cycle characteristics of Brazil and Mexico, two representative Emerging Economies. Once we match the observed correlation between country spreads, the model reproduces the lower correlation between net capital flows and the low and negative correlation between country spreads and capital flows at the country level. While credit supply shocks explain the majority of credit spread fluctuations, credit demand shocks are key to understand capital flows fluctuations. Business cycle synchronization accounts for around half of the correlation between capital flows across countries while common shocks to the country spread display a minor role.

Global variables are key drivers of country spreads (see, for example, González-Rozada and Yeyati, 2008; Hilscher and Nosbusch, 2010; Longstaff et al., 2011; Csonto and Ivaschenko, 2013; Gilchrist et al., 2022) and also of capital flows (see, for example, Calvo et al., 1993; Fernandez-Arias, 1996; Bekaert et al., 2002; Davis et al., 2021). The literature emphasizes the role of push factors (i.e. common factor in global financial markets that affect all the countries) relative to pull factors (i.e. domestic factors that explain capital flows to some particular country). We enrich this analysis by disentangling between credit supply and credit demand. While push factors are usually associated with global credit supply, we show that common credit demand is also an important driver of credit market variables.

While country spreads are highly correlated across EMEs, the correlation between capital flows is significantly lower (see, for example, Rey, 2013; Rey, 2015; Kaminsky, 2019; Cerutti et al., 2019a). U.S monetary policy and fluctuations in global risk are important divers of the observed country spread synchronization (see, for example, Akinci, 2013; Rey, 2013; Rey, 2015; Vicondoa, 2019; Caballero et al., 2019; Miranda-Agrippino and Rey, 2020; Gilchrist et al., 2022). Financial shocks induce a large impact on asset prices contributing to explain the large comovement between sovereign spreads relative to capital flows (see, for example, Bacchetta et al. (2022) and references therein). Calvo and Mendoza (2000a) and Calvo and Mendoza (2000b) show that uninformed investors may contribute to explain the large comovement in sovereign spreads. Our findings are consistent with this explanation since correlated country spread shocks are key to explain the comovement in country spreads but they do not influence capital flows correlation across EMEs significantly.

Few works have analyzed capital flows and country spreads together (see, for example, Cerutti et al., 2019b; Scheubel et al., 2019; Miranda-Agrippino et al., 2020), which is key to disentangle credit supply and demand shocks. Even fewer works have analyzed spreads and capital flows in theoretical models (see, for example, Bai et al., 2019; Davis et al., 2021; Morelli et al., 2022). We analyze country spreads and capital flows together to determine the role of different types of shocks and characteristics in explaining credit market fluctuations. While Bai et al. (2019) focus on understanding the high correlation between sovereign spreads in EMEs, we match the correlation of sovereign spreads by calibrating the correlation between interest rate shocks. We focus on characterizing the determinants of both the correlation between net capital flows across EMEs and the negative correlation between country spreads and net capital flows at the country level.

The remaining of the paper is structured as follows. Section 2 presents a simple theoretical framework to analyze capital flows and country spread. Section 3 documents the empirical facts associated with credit markets in EMEs. Section 4 presents the two-country small open economies model to quantify the role of different characteristics in explaining the empirical facts. Section 5 concludes.

2 Drivers of Capital Flows to EMEs: A Simple Analytical Framework

This section builds the simplest theoretical model to analytically characterize the drivers of capital flows to EMEs. The goal is to fix ideas on the propagation channels through which demand and supply factors, of idiosyncratic and global nature, may determine capital flows to these economies. This will pave the road for the empirical analysis in Section 3 and the more realistic DSGE model in Section 4.[1]

Consider a textbook two-period small open economy "i" with access to a one period, non state-contingent bond in international financial markets. The economy receives an endowment each period ($\{y_1^i, y_2^i\}$) that can be either consumed or saved. Assuming that the discount factor by households (β^i) equals the gross interest rate faced by this economy in international financial markets ($1 + r^i$), and the economy starts without external debt (i.e. $d_0^i = 0$), the demand for capital flows (i.e. the change in desired net external debt in the first period, d_1) is:

$$d_1^i = \frac{y_2^i - y_1^i}{2 + r^i} \tag{1}$$

Two distinctive drivers highlighted in (1) that would raise the demand for capital flows in this economy are increases in the endowment over time and decreases of the interest rate.

In turn, this interest rate will be affected by the determinants in the supply of credit from international markets, which we assume takes the form:

$$r^i = r^* + \phi^i \left(\tilde{d}_1^i\right)^2 + \varepsilon^i, \phi^i > 0 \tag{2}$$

[1] The setup follows the textbook models in Vegh (2013) and Schmitt-Grohé and Uribe (2017). A detailed description and derivation of the model is presented in Appendix C.1.

where r^* denotes the world interest rate, ϕ^i is a parameter that captures the sensitivity of interest rate to net external debt, and ε^i is a country-specific spread shock.[2] As shown in Appendix C.1, this supply of international credit can be rationalized within an extension of the model with no-commitment to repay the debt and uncertainty on the endowment of period 2, where risk-neutral investors can choose between buying this external bond or a risk-free one.

The equilibrium level of capital flows (d_1^i) will therefore be driven by exogenous variations in the endowment process and in interest rates $\{y_1^i, y_2^i, r^i, r^*, \varepsilon^i\}$ characterized by equations (1) and (2).

In order to illustrate the role of demand and supply drivers in shaping capital flows, consider a first small open economy ("$i = 1$") under two distinct shocks. First, consider an idiosyncratic increase in future endowment $\{y_2^1\}$. As depicted in the left panel of Figure 1a, this induces an outward shift in credit demand (see equation (1)) in order to front load part of the future increase in income and smooth lifetime's consumption path. The increase in the level of equilibrium capital flows ($\Delta d_1^1 > 0$) occurs at a relatively higher country interest rate (r_1^1) associated to the increase in the total debt stock. Second, consider now a shock that affects the international interest rate (r^*). As depicted in the left panel of Figure 1b, this induces an upward shift in the supply curve of credit (see equation (2)), pushing up to a new higher level the equilibrium country interest rate (r^1) and decreases total capital inflows ($\Delta d_1^1 < 0$).

Another crucial distinction to make when identifying drivers of capital flows is their idiosyncratic or common origins. Indeed, changes in capital flows can be traced back to shocks that are specific to a country or common across countries. A textbook example of the latter is movement in world interest rates as illustrated in the previous example that considered changes in r^*. Furthermore, common shocks can propagate differently across

[2] As in Schmitt-Grohe and Uribe (2003), households consider only r^i when deciding the demand for external debt, without considering the effects of their decisions on the cross-sectional average stock of debt ($\tilde{d}_1^i$). In equilibrium, it must be the case that $\tilde{d}_1^i = d_1^i$.

countries and hence have differential impacts on capital flows.

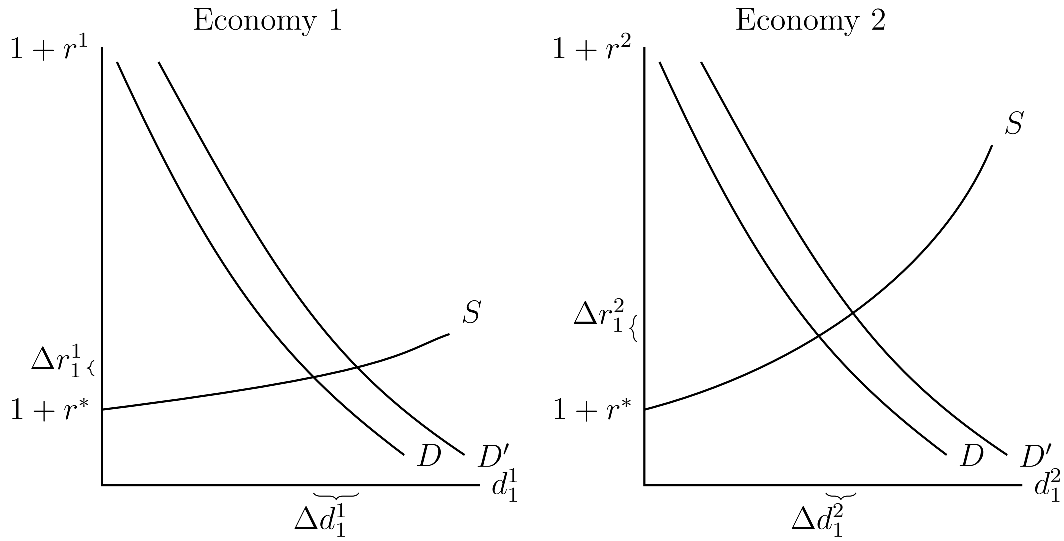
In order to illustrate these additional distinctions, consider now a second small open economy "$i = 2$" that is subject to the same two shocks than Economy 1. We assume that the two small open economies differ only in the credit supply they face: they share the same parametrization but Economy 2 faces a less elastic credit supply curve ($\phi^1 < \phi^2$).

Assume now that the increase in the second period endowment is common across the two economies ($\Delta y_2^1 = \Delta y_2^2$). This can be motivated from e.g. increases in commodity prices across commodity exporters EMEs (see, for example, Fernández et al., 2018). As depicted in the right panel of Figure 1a, similar to what happened to Economy 1, this shock will drive a larger capital inflows together with higher interest rates. However, the shock will not propagate uniformly across the two economies because of the higher debt elasticity in Economy 2, which materializes in a relatively milder increase in capital flows and higher levels of interest rates ($\Delta d_1^1 > \Delta d_1^2; r^1 < r^2$). Similarly, the response to an increase in the world interest rate will have an asymmetric response across economies, as depicted in the right panel in Figure 1b. For illustration purposes, we assume that, in addition to this shock, Economy 2 is impacted by an idiosyncratic shock to the spread ($\varepsilon_1^2 > 0$). The latter can be motivated with world rate increases amid episodes of risk-off in international markets, where some EMEs are viewed as relatively riskier than other. This exerts further upward pressure on domestic rates in Economy 2 and reduces capital inflows to it.

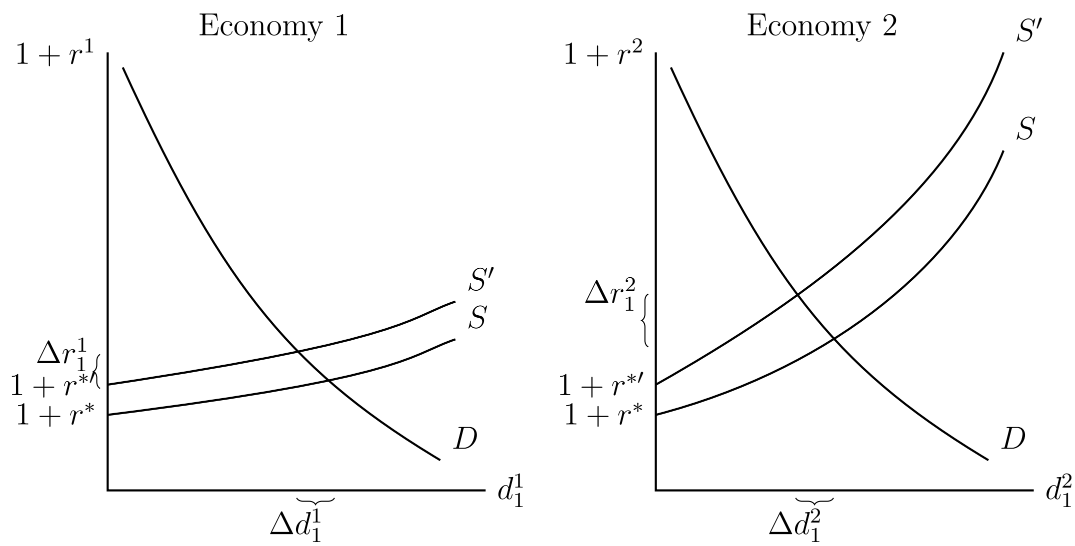
To sum up, we have described the key drivers of capital flows through the lens of the simplest version of the workhorse small open economy model. A key message is that two overlapping dimensions are crucial when studying the forces that shape capital flows to EMEs: the role of demand and supply factors, as well as their idiosyncratic or common origins. Equally relevant is the basic observation that, in order to identify these various drivers, it is crucial to *jointly* observe volumes and prices of capital flows across *various* EMEs. The next section will carry out this task more formally with an econometric framework.

Figure 1 Equilibrium in International Credit Markets

(a) Response to an increase in y_2^1 and y_2^2



(b) Response to an increase in r^* and an increase in ε^2



Note. Example on the effects of a common credit demand shock due to the increase in y_2^1 and y_2^2 (first row) and an increase in the international interest rate r^* plus a country spread shock to economy 2 ε^2 (second row) in two economies that face different credit supplies.

3 Capital Flows to Emerging Economies: Stylized Facts

This section presents the empirical results related to capital flows in EMEs. We begin by describing the measure of capital flows and country spreads we use in our empirical analysis, together with the sample of countries that we study (Subsection 3.1). Next, we take a first look at the data be means of simple correlations between spreads and capital flows both within and across countries (Subsections 3.2 and 3.3). A more formal identifications of supply-demand and common-idiosyncratic drivers behind these correlations is done next in Subsection 3.4 and contains the main results of the section. Finally, Section 3.5 presents different robustness exercises.

3.1 Data

To properly analyze the relationship between capital flows and country spreads accurately, it is paramount to use the highest frequency available, for lower frequencies may blur the identification of credit demand and supply drivers. This particularly problematic for capital flows data since balance of payments data is only available at quarterly frequency.

Considering that only the trade balance and the stock of foreign reserves are available at monthly frequency, we use the following proxy for net capital inflows computed by Calvo et al. (2008):

$$KI_t = M_t - X_t + R_t - R_{t-1} \tag{3}$$

where KI_t denote the capital inflows received by the country in period t, X_t denotes exports, M_t denote imports, and R_t is the stock of international reserves held by the country. The proxy for net capital inflows is thus computed by netting out the trade balance from changes in foreign reserves. Thus, this proxy for net capital inflows does not include net factor income and current transfers. However, these accounts represent mostly interest payments on long-term debt which should not vary so substantially as to introduce significant spurious volatility into our capital flows measure (Calvo et al., 2008). To remove seasonal movements, we use the cumulative annual flows for each month and then take the first difference of this measure (ΔKI_t) to remove seasonal movements (Calvo et al., 2008).

$$\Delta KI_t = \sum_{k=0}^{11} KI_{t-k} - \sum_{k=0}^{11} KI_{t-k-1} \qquad (4)$$

We focus on country spreads instead of country interest rates as our main variable for analysis because they reflect specific issues of Emerging Economies as opposed to interest rates which also capture characteristics of Advanced Economies like monetary policy or expected growth. We use the J.P. Morgan Emerging Market Bond Index Global (EMBI Global) for each country.[3] This measure is a good proxy to track the evolution of interest rate conditions -including those for corporates- in EMEs that has been used extensively by previous works (see, for example, Uribe and Yue, 2006; Akinci, 2013; Fernández et al., 2018; Vicondoa, 2019). We also use more disaggregated proxies for sensitivity analysis in section 3.5.

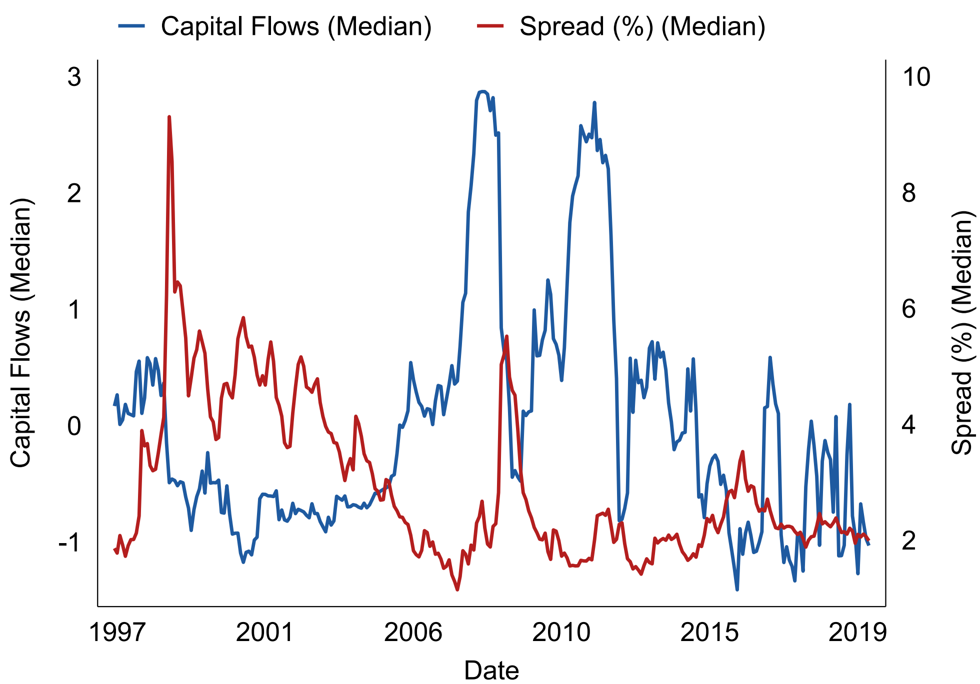
Our sample for the empirical analysis is solely based on data availability, it consists of a balanced panel of EMEs with continuous capital flows and country spreads monthly data for the period 1997:2-2019:12: Argentina, Brazil, China, Colombia, Ecuador, Malaysia, Mexico, Panama, Philippines, Poland, South Africa and Turkey.[4] Figure 2 displays the evolution of capital flows to this set of EMEs and the median of EMBI for the same set of countries. The Asian and Russian crisis induced a significant increase in country spread in EMEs and a slight capital outflows. Country spreads decline significantly after that period coupled with capital inflows to EMEs, reflecting the significant increase in commodity prices. The Global Financial Crisis induced a sharp transitory increase in country spreads and a fall in net capital flows. Finally, we see a decline a capital flows that starts in 2011, after commodity prices reach their maximum level, and that also reflects the Taper Tantrum and the expected increase in interest rates in the U.S. Figure A.1 presented in

[3]This spread is computed as an arithmetic, market-capitalization weighted average of US-dollar denominated bond spreads issued by sovereign and quasi-sovereign entities over U.S. Treasury bonds of similar duration.

[4]As robustness we also perform the empirical analysis for a subsample of EMEs for the period 1995:2-2019:12. In a series of robustness checks, we also use different measures of capital flows and spreads to assess the sensitivity of our empirical findings.

the Appendix displays the evolution of capital flows and country spread for each country. These dynamics are shared across countries. In Section 3.3 we identify the common components of both variables across EMEs.

Figure 2 Capital Flows and Country Spreads in EMEs



Note. Median net capital flows of Argentina, Brazil, China, Colombia, Ecuador, Malaysia, Mexico, Panama, Philippines, Poland, South Africa and Turkey for the period 1997:2-2019:12. Capital flows for each country is defined as the cumulative trade deficit plus the change in international reserves at monthly frequency as defined in equation (4). The aggregate series of capital flows of EMEs is computed as the monthly median of the capital flow series for all the countries. Country spread is computed as the monthly median of the EMBI for the same countries.

3.2 Correlation between Spreads and Capital Flows within EMEs

In this section we explore the relation between country spreads and capital flows at the country level. Table 1 displays the contemporaneous correlation between country spreads and capital flows at the country level.

The correlation between country spreads and capital flows is negative but relatively low

Table 1 Correlation between Capital Flows and Sovereign Spreads at the Country Level

	ARG	BRZ	CHN	COL	ECU	MEX	MLY	PAN	PHL	POL	SWF	TUR	Median All	Median Open
$\rho(s, f)$	0.01	-0.13^{2}	-0.19^{3}	-0.14^{2}	-0.11^{1}	-0.03	-0.08	-0.06	-0.14^{3}	-0.17^{3}	-0.19^{3}	-0.18^{3}	-0.14	-0.14

NOTE. Contemporaneous correlation between capital flows (f) and EMBI (s) of Argentina, Brazil, China, Colombia, Ecuador, Malaysia, Mexico, Panama, Philippines, Poland, South Africa and Turkey for the period 1997:2-2019:12. Capital flows is defined as the cumulative trade deficit plus the change in international reserves at monthly frequency (see equation (3)).

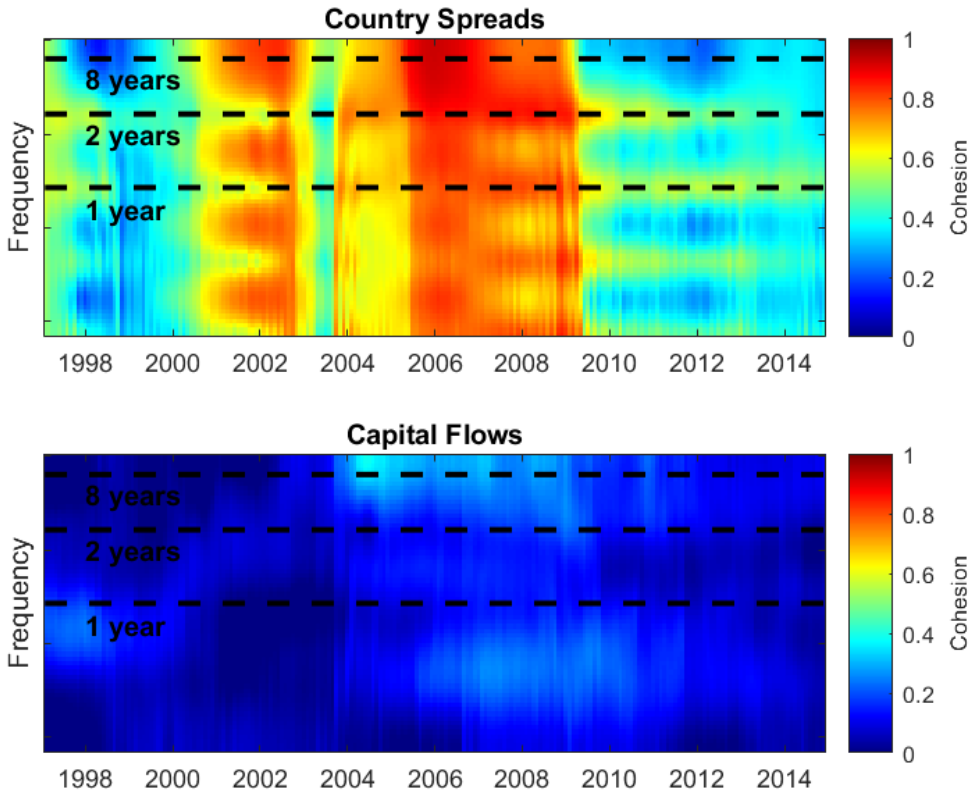
at the country level (the median is -0.14 for our baseline measure). This finding is robust if we compute the median only for economies with more open financial account.[5] Using the theoretical framework presented in Section 2, this result indicates a predominance of credit supply shocks since they explain the negative correlation between the two variables for most of the countries in the sample. This finding is robust to using different measures for capital flows.

3.3 Correlation between Spreads and Capital Flows across EMEs

Credit supply or demand shocks can be global (i.e. common to different economies) or idiosyncratic (see Section 2). In order to determine the importance of global vs idiosyncratic drivers, we focus on analyzing the comovements between country spreads and capital flows across EMEs. If the main drivers are global, country spreads and capital flows will be highly correlated across EMEs. To detemine the degree of comovement between these variables across EMEs, we follow Croux et al. (2001) and compute a Cohesion measure which is interpreted as the 5-year rolling correlation for each of the variables across countries at different frequencies. Looking at the correlation at different frequencies enables us to see if the relation between these variables shifts by frequency, extending the analysis of Rey (2013) and Cerutti et al. (2019b). Figure 3 displays the Cohesion measure for the sample of our analysis.

[5] We consider the subsample of economies with an open financial account as all the economies from the sample that coincide with the ones used by Fernández et al. (2018): Brazil, Colombia, Mexico, Malaysia, Philippines, South Africa, and Turkey.

Figure 3 Dynamic Correlation of Country Spreads and Capital Flows Across EMEs



NOTE. Cohesion measure (Croux et al., 2001) between Country Spread and Net Capital Flows of Argentina, Brazil, China, Colombia, Ecuador, Malaysia, Mexico, Panama, Philippines, Poland, South Africa and Turkey for the period 1997:2-2019:12. Net Capital flows is defined as the cumulative trade deficit plus the change in international reserves at monthly frequency as defined in Equation (4). We use EMBI as a proxy for the country spread. Each point in time denotes the cohesion measure for each frequency computed with 5-year forward window.

Country spreads are positively correlated (0.6) across EMEs. This correlation increased from 0.2 during the Asian Crisis to 0.92 during the 2000s. The correlation is stable across frequencies, confirming that this relationship is not only explained by high frequency determinants that vanish fast.

While country spreads display a high correlation across EMEs, capital flows display a positive but significantly lower correlation across EMEs. This fact is consistent with the previous findings of Rey (2013) and Cerutti et al. (2019b). The correlation also increases slightly during the 2000s up to 0.39 and decreases after the Global Financial Crisis. As it is the case with country spreads, the pattern of lower correlation is stable across frequencies.

These two empirical facts can be explained by the contribution of idiosyncratic or global and demand or supply credit supply shocks. While credit supply shocks are predominant to explain the negative correlation between country spreads and capital flows within EMEs, it is not clear the role of global or idiosyncratic components since spreads are highly correlated and the correlation of capital flows is low. In the next section we will identify the role of the four type of shocks in explaining the dynamics of capital flows and country spreads.

3.4 Disentangling the Contribution of Idiosyncratic-Common Credit Demand-Supply

We identify the contribution of global/idiosyncratic demand/supply shocks in explaining the dynamics of capital flows and country spreads by estimating a Dynamic Factor Model (DFM). First, we recover a common factor capital flows and one for country spreads with the following model:

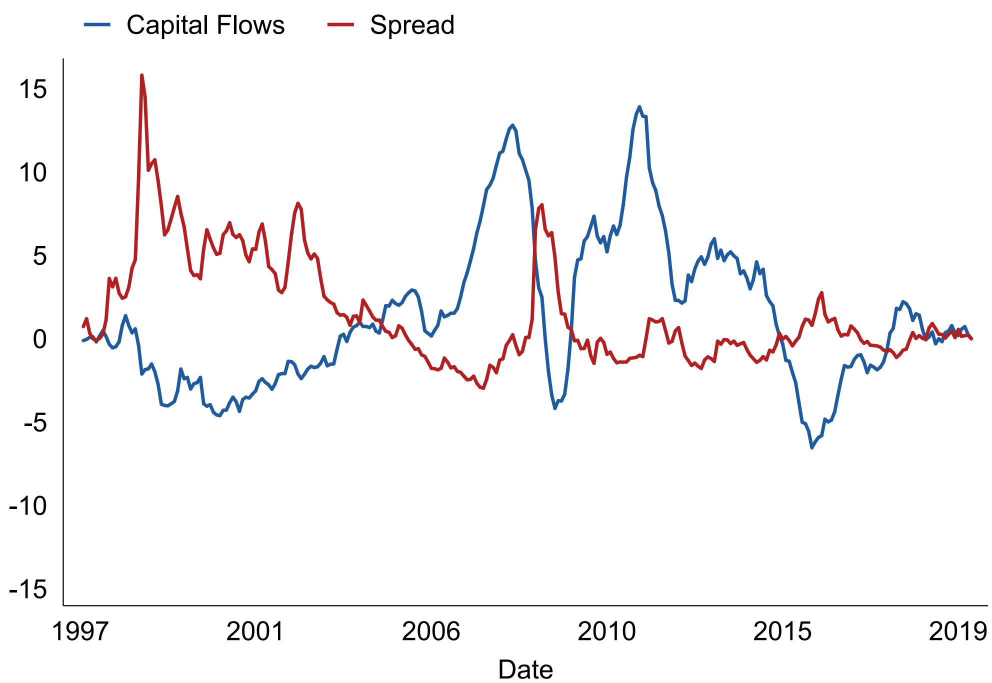
$$
\begin{aligned}
X_t &= \beta F_t + \epsilon_t \\
F_t &= \gamma F_{t-1} + \eta_t
\end{aligned}
\tag{5}
$$

where X_t is the $2N \times T$ series of capital flows and country spreads for the N countries for T periods, β is the $2N \times 2$ matrix with factor loadings, F_t is a $2 \times T$ matrix with 2 common factors (one for capital flows F_t^k and another one for country spreads F_t^s) which follow an AR(1) process, ϵ_t is $2N \times T$ matrix of idiosyncratic shocks to capital flows and country spreads, and γ is a 1×2 vector denotes the persistence of each factor.[6] Figure 4 displays the common factors of capital flows and country spreads.

The factor that captures the common movement of country spreads accounts for 58% of

[6] We identify a common factor of capital flows (country spreads) imposing that the loading of country spreads (capital flows) is 0. In particular, all the series of capital flows are included first in X_t (i.e. from rows 1 to N) and all the spread series are included next (i.e from rows $N+1$ to $2\times N$). Then, we impose the restriction that then we impose $\beta_{N+1:2\times,1} = 0$ and that $\beta_{1:N,2} = 0$), which implies that the first (second) factor is only identified using only series of capital flows (country spreads).

Figure 4 Common Factor for Country Spreads and Capital Flows



Note. Cumulative dynamic factors between capital flows and EMBI of Argentina, Brazil, China, Colombia, Ecuador, Malaysia, Mexico, Panama, Philippines, Poland, South Africa and Turkey for the period 1997:2-2019:12. Capital flows is defined as the cumulative trade deficit plus the change in international reserves at monthly frequency.

the variability in credit spread. This factor increases significantly during the Russian Crisis and remains high until 2002, when the commodity super-cycle started. The factor then spikes with the Global Financial Crisis, with a subsequent decline, and increases around 2015 when the FED increased the Fed Funds rate from the Zero Lower Bound.

The factor that captures the common movement of capital flows accounts for only 20% of the variation of capital flows. This factor, which is positively correlated with commodity prices, displays a different pattern from the credit spread factor. Capital inflows to the region increased during the 2000s, associated with the commodity super-cycle, and then declines significantly during the Global Financial Cycle. Unlike the dynamics of country spread factor, capital inflows increase significantly until 2011 and then declined, reflecting the Taper Tantrum in 2013 and the lift-off of the FED.

Overall, capital flows and country spread factors are negatively correlated (-0.53). This means that common drivers in country spreads comove with common drivers in capital flows but they do not convey the same information.

The previous empirical facts (i.e. the low and negative correlation between capital flows and country spreads within countries and the high (low) correlation of spreads (capital flows) across countries) are explained by idiosyncratic or global credit supply or demand shocks. We use the estimated DFM to identify four structural shocks from the four series of innovations for each country with the following assumptions using sign restrictions:

- Global Supply ($\varepsilon_t^{S,G}$): moves the factor of spreads F_t^s and the one of capital flows F_t^k in opposite directions.

- Global Demand ($\varepsilon_t^{D,G}$): moves the factor of spreads F_t^s and the one of capital flows F_t^k in the same directions.

- Idiosyncratic Supply ($\varepsilon_t^{S,I}$): moves the country-specific spreads and country-specific capital flows in opposite directions, without affecting F_t^s and F_t^k.

- Idiosyncratic Demand ($\varepsilon_t^{D,I}$): moves the country-specific spreads and country-specific capital flows in the same directions, without affecting F_t^s and F_t^k.

In particular, the matrix of idiosyncratic disturbances ε_t and the one of global disturbances η_t can be rotated to identify the role of demand/supply and global/idiosyncratic credit shocks in explaining the previous findings. The definition of structural shocks implies the following relation between the innovations of system (5) and the underlying four structural shocks:

$$\begin{bmatrix} \eta_t^S \\ \eta_t^K \\ \epsilon_t^S \\ \epsilon_t^K \end{bmatrix} = \begin{bmatrix} + & + & 0 & 0 \\ - & + & 0 & 0 \\ . & . & + & + \\ . & . & - & + \end{bmatrix} \begin{bmatrix} \varepsilon_t^{S,G} \\ \varepsilon_t^{D,G} \\ \varepsilon_t^{S,I} \\ \varepsilon_t^{D,I} \end{bmatrix}$$

where . denotes that we are leaving the coefficient unrestricted. We compute the Variance Decomposition on impact to measure the importance of each shock to explain the variance of country spreads and capital flows. Tables 2 and 3 display the fraction of the variance of country spreads and capital flows that is explained by each structural shock, respectively.

Table 2 Share of Variance of Country Spreads explained by each Shock

	F_t^s	ARG	BRZ	CHN	COL	ECU	MEX	MSY	PAN	PHL	POL	SWF	TUR	Median
$\varepsilon_t^{S,G}$	64	3	38	24	49	14	58	42	49	51	39	39	33	39
$\varepsilon_t^{D,G}$	36	2	21	14	27	8	33	24	28	29	22	22	19	22
$\varepsilon_t^{S,G}+\varepsilon_t^{D,G}$	100	5	59	38	76	22	91	66	77	80	61	61	52	61
$\varepsilon_t^{S,I}$	0	52	27	31	15	38	6	18	12	11	22	22	30	22
$\varepsilon_t^{D,I}$	0	43	14	31	9	40	3	16	11	9	17	17	18	17
$\varepsilon_t^{S,I}+\varepsilon_t^{D,I}$	0	95	41	62	24	78	9	34	23	20	39	39	48	39

NOTE. Variance decomposition of country-specific and common (Factor) spreads due explained by global supply shocks $\varepsilon_t^{S,G}$, global demand shocks $\varepsilon_t^{D,G}$, country-specific supply shocks $\varepsilon_t^{S,I}$, and country-specific demand shocks $\varepsilon_t^{D,I}$.

Table 3 Share of Variance of Net Capital Flows explained by each Shock

	F_t^k	ARG	BRZ	CHN	COL	ECU	MEX	MSY	PAN	PHL	POL	SWF	TUR	Median
$\varepsilon_t^{S,G}$	64	1	26	27	1	1	9	33	1	7	23	10	13	9
$\varepsilon_t^{D,G}$	36	0	15	15	1	1	5	18	0	4	13	5	8	5
$\varepsilon_t^{S,G}+\varepsilon_t^{D,G}$	100	1	41	42	2	2	14	51	1	11	36	15	21	14
$\varepsilon_t^{S,I}$	0	55	22	30	54	52	44	25	51	45	38	45	41	44
$\varepsilon_t^{D,I}$	0	44	37	28	44	46	42	24	48	44	26	40	38	41
$\varepsilon_t^{S,I}+\varepsilon_t^{D,I}$	0	99	59	58	98	98	86	49	99	89	64	85	79	85

NOTE. Variance decomposition of country-specific and common (Factor) capital flows due explained by global supply shocks $\varepsilon_t^{S,G}$, global demand shocks $\varepsilon_t^{D,G}$, country-specific supply shocks $\varepsilon_t^{S,I}$, and country-specific demand shocks $\varepsilon_t^{D,I}$.

The predominant role of supply shocks in explaining both variables is key to understand the negative correlation between country spreads and capital flows at the country level. While global credit supply shocks are the main drivers of country spreads, country-specific supply and demand shocks are the main drivers of net capital flows. Global shocks account for only 14% of the fluctuations in capital flows. This fact helps to explain why capital flows are not so correlated across countries why sovereign spreads are. Calvo and Mendoza (2000a) and Calvo and Mendoza (2000b) show, in a context of financial globalization with informational frictions, that uninformed investors may mimic the behavior of informed investors. This setting may contribute to explain the importance of global shocks for country spreads. The predominance of idiosyncratic shocks in explaining capital flows in this context may be rationalized by the demand due to domestic macroeconomic conditions. In the theoretical model developed in Section 4 we will assume an estimated process for the country spread that matches the empirical one and analyze why capital flows are significantly less correlated.

3.5 Robustness

In this section we assess the robustness of the previous empirical facts. First, we redo the previous analysis with alternative measures of capital flows and country spreads. Second, we extend the DFM model to consider regional factors (i.e. factors that are common only for the countries that belong to that region).

Alternative Measures of Capital Flows and Country Spreads

In our baseline analysis, we consider a measure of sovereign spread based on public bonds while our proxy for capital flows includes both public and private flows. Sovereign spreads are highly correlated with corporate spreads in the same economy but they do not coincide (see, for example, Caballero et al., 2019). However, using a more disaggregated proxy for capital flows and country spreads, where both of them are computed based on the same assets, implies loosing country coverage or working with lower frequency data (quarterly), which may blur identification of demand and supply shocks. In this subsection, we show that the previous empirical facts are robust to alternative measures of capital flows and country spreads at monthly and quarterly frequencies. Tables are included in Appendix B.2.

First, we consider disaggregated balance of payments monthly data for Brazil.[7] Brazil is one of the few countries with balance of payments data available at monthly frequency. We compute a proxy for capital flows using two disaggregated accounts of the balance of payments and sovereign spread (EMBI) as a proxy for country spread. The correlation between capital flows and country spread is comparable with the one computed our baseline sample (see Table A.1).

Second, we exploit the quarterly database used by Caballero et al. (2019). We define net corporate debt flows as the difference in the stock of corporate debt for some EMEs together with the External Financial Index computed by Caballero et al. (2019). The advantage of this analysis is that the measure of country spread is computed using the same set of bonds used to compute capital flows. Another advantage is that this database covers a representative set of EMEs. The main drawback is that this database is only available at quarterly frequency. Table A.2 in the Appendix presents the results from this analysis. The correlation between capital flows and country spread is also similar to the one presented in Table 1, with a median correlation between capital flows and country spreads of -0.14.

Third, we use issuance of corporate debt and their corresponding yields for Brazil, Colombia, Mexico and Turkey available at quarterly frequency from Thomson Reuters for the period 1994:1-2019:1. In this case, we compute a yield as a weighted average of all the individual bond yields of that country and compute the sum of bond issued for every quarter.[8] The key advantage of this exercise is that we can track the yields associated to each bond, private and public. The main drawback is that the data only covers total issuance in primary markets and we cannot distinguish between domestic and international

[7] This data is available at https://www.bcb.gov.br/content/statistics/specialseriestables/BalPayM.xlsx.

[8] The weights are defined as the share of every bond on the total bond issued by that country in that quarter.

bond issuance, which is key for computing capital flows. To partially address this issue, we consider only bond issued in international currency. The results using this database are presented in Table A.3. The main conclusions remain unchanged, with a median correlation between capital flows and country spreads of -0.25.

Fourth, we compute capital flows using balance of payments data published by the IMF. In particular, we define capital flows as the sum of net direct investment, net portfolio investment, and net other investment.[9] The country spread is the quarterly EMBI average. The key advantage of this database is that is available and comparable for a wide range of countries. The drawback is that it is only available at quarterly frequency and that we do not have a country spread measure based on these capital flows. The results using this database are presented in Table A.4. The main conclusions remain unchanged, with a median correlation between capital flows and country spreads of -0.28.

Finally, we use the series of capital flows at monthly frequency computed by Koepke and Schneider (2020) together with the EMBI as a proxy for capital flows. The advantage of this database is that it contains a comparable measure of capital flows for a wide range of EMEs. The results using this database are presented Table A.5. The main conclusions remain unchanged, with a median correlation between capital flows and country spreads of -0.27.

Regional Factors

The relatively low correlation between capital flows across EMEs may be due to the fact that net capital flows are more correlated at regional level, due for example to the higher synchronization of business cycles. To analyze if this is the case, we have extended the DFM presented in 5 to extract two region-specific factor: Asian and Latin American. These factors affect only by construction the countries that belong to that region and have no effect on the remaining ones. Figure A.3 included in the Appendix displays the two regional

[9] Other investment comprises loans, trade credit, bank deposits, and cash.

factors for capital flows and country spreads. These additional regional factors explain 29 (11) of the observed variability of capital flow (country spreads). The predominant role of regional factors relative to the global factor in explaining capital flows is consistent with Kaminsky et al. (2020). All in all, the fact that capital flows are less correlated across countries that country spreads is not fully explained by the existence of a common component at regional level.

4 Capital Flows and Country Spread Dynamics in a Two-Country Small Open Economy Model

In this section, we extend the two-period model presented in Section 2 to an infinite-horizon general equilibrium model to assess if the model can replicate the empirical findings described in the previous section, something that has not been analyzed by previous works. In particular, we focus our analysis on understanding three empirical facts. First, the high observed comovement between country spreads across EMEs. Second, the relatively low comovement of net capital flows across EMEs. Third, the observed correlation of -0.14 between capital flows and country spreads at the country level. Bai et al. (2019) show that the presence of long-run risk is key to explain why sovereign spreads are significantly more correlated than business cycles in EMEs. They show that 2/3 of the fluctuations in spreads are explained by long-run risk. In this section we do not focus on explaining this high correlation of sovereign spreads. We calibrate the model to match the observed correlation of country spreads and assess if the model can match the other two empirical findings. We also use this model to quantify the role of different country-specific characteristics and frictions in explaining these empirical facts.

The model is a two-country version of the small open economy model developed by Mendoza (1991) and extended by Schmitt-Grohe and Uribe (2003). We choose to use a two-country model instead of modelling the twelve EMEs together to keep the model tractable and also to simplify the calibration exercise.[10][11] Based on the empirical facts, we depart from the baseline model used by Schmitt-Grohe and Uribe (2003) in two important dimensions. First, each economy faces three shocks to: the international risk-free interest rate, the country spread, and to productivity. Considering the previous empirical findings, we allow productivity and country spread shocks to be correlated across two countries. Correlated TFP shocks contribute to match the observed business cycle syncronization between the two economies, capturing common credit demand shocks. Correlated country spread shocks account for the comovement of spreads that are not explained by business cycle comovement. Second, to better understand the behavior of capital flows, we estimate the country-specific country spread as a function of macroeconomic fundamentals and plug in these estimated equations in the model, following the strategy and specification proposed by Uribe and Yue (2006). While in the simplified model presented in Section 2 the country spread depends on the stock of net external debt, in this version we model the interest rate process as a function of the determinants of changes in the stock of debt to capture more accurately the dynamics between country interest rate and business cycle conditions. Stationarity of the net external position is induced by assuming Portfolio Adjustment Costs (PAC) as defined by Schmitt-Grohe and Uribe (2003).

In the next subsections we present the model for each small open economy. To simplify notation, we omit the country index and we only use it when common and idiosyncratic variables interact. The full set of equilibrium conditions are presented in Appendix C.

[10]The model could be extended to include the twelve economies considered in our baseline sample. However, we would have to calibrate the model for each economy separately. We prefer to keep the model tractable and focus on understanding the determinants of capital flows and country spreads and on the role of different frictions in explaining the results.

[11]We abstract from trade linkages across the EMEs in the model for tractability. We conjecture that, should trade linkages be added to our framework, we would need a lower correlation between country spread shocks to match the observed correlation between country spreads.

4.1 The Model

Each small open economy is populated by a larger number of identical households with GHH preferences described by the following utility function:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{\left[c_t - \omega^{-1} h_t^{\omega}\right]^{1-\gamma} - 1}{1-\gamma} \tag{6}$$

where β is the discount factor, c_t denotes consumption, h_t denotes hours worked, γ is the constant relative risk aversion coefficient, and ω is the inverse of the Frisch labor supply elasticity. These preferences, which have been widely used in international macroeconomic models, do not display an income effect that affects the labor supply decision. The budget constraint is given by:

$$c_t + i_t + \frac{\phi}{2}\left(k_{t+1} - k_t\right)^2 + (1 + r_{t-1})d_{t-1} = y_t + d_t + \frac{\psi}{2}(d_t - \overline{d})^2 \tag{7}$$

where i_t denotes investment, ϕ is a parameter that determines the strength of capital adjustment costs, d_t is the net external debt position, and ψ is a parameter that determines the strength of the Portfolio Adjustment Costs (PAC). PAC are necessary to induce determinacy in the model (see, for example, Schmitt-Grohe and Uribe, 2003). The representative household is subject to the following no-Ponzi constraint:

$$\lim_{j\to\infty} \mathbb{E}_t \frac{d_{t+j}}{\prod_{s=0}^{j}(1 + r_s)} \leq 0 \tag{8}$$

Output is produced by using capital k_t and labor services h_t as inputs according to the following production function:

$$y_t = A_t k_t^{\alpha} h_t^{1-\alpha}; \quad \alpha \in (0, 1) \tag{9}$$

where A_t represents the productivity of the economy. The capital shocks evolves according to:

$$k_{t+1} = (1-\delta)k_t + i_t \tag{10}$$

where $\delta \in [0,1]$ denotes the rate of capital depreciation.

Households choose a process for $\{c_t, h_t, y_t, i_t, k_{t+1}, d_t\}$ to maximize the utility function (6) subject to constraints ((7) to (10)).

4.2 Driving Forces

Each economy is affected by shocks to the following variables: international interest rate (R_t^*), domestic interest rate (R_t), and productivity (A_t). In our empirical model, we extracted a common factor of capital flows and another one of country spreads using a baseline sample of 12 economies. To keep the model in line with the countries used for the calibration (Brazil and Mexico), we introduce the comovement between these variables as correlated shocks instead of modelling a factor that includes all the countries considered in our baseline sample.[12]

The law of motion of the productivity process is described by:

$$\ln A_t = \rho_A \ln A_{t-1} + \varepsilon_t^A$$

where ρ_A captures the persistence of the productivity process and ε_t^A is the shock to productivity. We assume that productivity shocks for each country are drawn jointly from a Normal distribution with the following variance-covariance matrix:

$$\Sigma^A = \begin{bmatrix} {\sigma_{11}^A}^2 & \sigma_{12}^A \\ \sigma_{21}^A & {\sigma_{22}^A}^2 \end{bmatrix}$$

[12]Another alternative could be to estimate a common factor for the two economies. However, estimated of TFP for these countries are not available at quarterly frequency. Modelling the observed correlation as correlated shocks is more direct and helps to keep the model tractable.

where ${\sigma_{i,i}^{A}}^2$ is the variance of country $i = \{1, 2\}$ productivity shock and $\sigma_{i,j}^{A}$ is the covariance between the productivity shocks where $\sigma_{12}^{A} = \sigma_{21}^{A} \neq 0$. This assumption of correlated TFP shocks is a reduced form way of modelling the business cycle synchronization between these economies, which can explain common demand for credit. Business cycle synchronization may be explained by common shocks to TFP, commodity prices, among others. The correlated TFP shocks capture these potential explanations.

Following Uribe and Yue (2006), the interest rate faced by each economy in international financial markets evolves according to:

$$\begin{aligned}
\hat{R}_t &= \rho_R \hat{R}_{t-1} + \rho_{R^*} \hat{R}_t^* + \rho_{R1^*} \hat{R}_{t-1}^* + \rho_y \hat{y}_t \\
&+ \rho_{y1} \hat{y}_{t-1} + \rho_i \hat{\imath}_t + \rho_{i1} \hat{\imath}_{t-1} + \rho_{tby} tby_t \\
&+ \rho_{tby1} tby_{t-1} + \gamma_{i,i} \epsilon_t^r
\end{aligned}$$

where variables with $\hat{x}$ denote log-deviations with respect to the steady state, $tby_{i,t}$ is the trade balance-to-output ratio, and ϵ_t^r denotes the shock to the country interest rate. We assume that country interest rate shocks are drawn jointly from a Normal distribution with the following variance-covariance matrix:

$$\Sigma^R = \begin{bmatrix} \sigma_{11}^2 & \sigma_{12} \\ \sigma_{21} & \sigma_{22}^2 \end{bmatrix}$$

where $\sigma_{i,i}^2$ is the variance of country $i = \{1, 2\}$ interest rate shock and $\sigma_{i,j}$ is the covariance between the country interest rate shocks where $\sigma_{12} = \sigma_{21} \neq 0$. This is a direct way of modelling the correlation between sovereign spreads that is not driven by business cycle synchronization.

Finally, the international interest rate R_t^* dynamics is characterized by the following process:

$$\hat{R}_t^* = \zeta \hat{R}_{t-1}^* + \epsilon_t^*$$

where $\hat{R}^*_t$ denotes the log-deviation of the international interest rate with respect to the steady state, ζ denotes the persistence of the process, and ϵ^*_t is a shock to the international interest rate drawn from a Normal distribution with variance γ^{*2}_t.

4.3 Calibration

The model is calibrated using quarterly data for Brazil and Mexico from 1997:Q1-2019:4, which coincides with the sample period of the empirical analysis. We pick two representative EMEs, from the sample of twelve countries used in the empirical analysis, that are open to capital flows and that have experienced significant shifts during the sample under analysis.

A subset of the parameters in the model is calibrated following Schmitt-Grohe and Uribe (2003), adjusted to quarterly frequency. We assume that households in both economies share the same risk aversion coefficient, which equals 2, and the same inverse Frisch elasticity, which equals 1.455. We assume an annual capital depreciation rate of 10% and we calibrate the share of capital in the production function to be equal to 32%.

Another subset of parameters is calibrated to match some long-run ratios in the data. β is calibrated to match the mean international interest rate faced by both economies of 4% annual, considering that $\beta R^* = 1$. $\overline{d}$ is calibrated to match the trade balance-to-output ratio in steady state. Capital and portfolio adjustment costs are calibrated to match the observed investment and trade balance-to- output ratio volatility in each country, respectively.

The standard deviation of the TFP shock is calibrated to match the observed output volatility in each country. The persistence of the TFP process (p_A) is set to match the persistence of output in each country. The covariance between TFP shocks ($\sigma^A_{i,j}$) is set to match the observed output correlation between Brazil and Mexico.

Finally, the international and country interest rate processes for each country are estimated using quarterly data for the U.S., Brazil and Mexico from 1997:Q1-2019:Q4. Following Uribe and Yue (2006), the real interest rate for the U.S. is proxied by the Real TBILL which is computed as the 3-month gross Treasury bill rate divided by the average gross inflation based on the GDP Deflator over the past four quarters, as a proxy for expected inflation. Table 4 displays the value of the estimated parameters for the international interest rate process. The country interest rate for Brazil and Mexico is defined as the gross real interest rate for the U.S. times the gross country spread, proxied with the EMBI Global. Table 5 displays the values of the estimated coefficients for each country. The first column of the table reports the estimated values from Uribe and Yue (2006) as a reference.

Table 4 Calibrated Parameters

Parameter	Description	Target	Brazil	Mexico
γ	CRRA parameter	Schmitt-Grohe and Uribe (2003)	2	
ω	Inverse Frisch elasticity	Schmitt-Grohe and Uribe (2003)	1.455	
δ	Depreciation rate	Schmitt-Grohe and Uribe (2003)	0.025	
α	Capital share	Schmitt-Grohe and Uribe (2003)	0.32	
β	Discount factor	$\beta R^* = 1$	0.99	
ζ	Persistence R_t^*	Estimated	0.97	
σ_{R^*}	Std. Dev. of R^* shock	Estimated	0.00183	
$\overline{d}$	Debt in steady state	Average TBY	0.38	3.9
ϕ	Capital adjustment cost	Investment volatility	0.00398	0.00781
ψ	Portfolio adjustment costs	TBY volatility	0.00000001	0.00000001
ρ_A	Persistence TFP	Output persistence	0.6355	0.765
σ_{ii}^A	Std. Dev. TFP Shock	Output volatility	0.00641	0.00505
σ_{ij}^A	Covariance TFP Shocks	Output correlation	0.3	0.3
σ_{ii}^R	Std. Dev. Spread Shocks	Spread Volatility	0.00485	0.0014
σ_{ij}^R	Covariance Spread Shocks	Spread Correlation	0.707	0.707

The estimated coefficients are consistent with the original estimations of Uribe and Yue (2006) but less precise since our sample uses only one country instead of a panel. While the coefficients associated with output are lower and less statistically significant, the ones associated with trade balance-to-output ratio are larger for Brazil.

4.4 Model Evaluation

Table 6 reports the unconditional theoretical moments for each economy together with their empirical counterpart. Values in bold denote moments which are particularly important

Table 5 Estimated Interest Rate Processes

	UY (2006)	Brazil	Mexico
r_{t-1}	0.63***	0.75***	0.77***
	[0.146]	[0.067]	[0.077]
y_t	−0.79***	−0.22	−0.28***
	[0.212]	[0.153]	[0.097]
y_{t-1}	0.62***	−0.14	0.26***
	[0.213]	[0.163]	[0.089]
i_t	0.11*	0.11*	0.09***
	[0.065]	[0.058]	[0.029]
i_{t-1}	−0.12*	0.03	−0.08**
	[0.071]	[0.060]	[0.031]
tby_t	0.29*	0.80***	0.10
	[0.155]	[0.236]	[0.072]
tby_{t-1}	-0.19	−0.72***	0.01
	[0.148]	[0.230]	[0.075]
R_t^*	0.50	0.71*	0.73***
	[0.323]	[0.409]	[0.171]
R_{t-1}^*	0.36	-0.21	−0.41**
	[0.487]	[0.416]	[0.194]
Obs	160	90	90
R^2	0.62	0.92	0.97

Note. Estimated interest rate processes. The first column presents the original estimates from Uribe and Yue (2006) using a panel of EMEs. Second and third columns present the estimated interest rate processes for Brazil and Mexico, respectively, using data from 1997:1-2019:4. The processes were estimated using instrumental variables, where r_{t-1} was instrumented with r_{t-2}. Standard errors are presented in brackets. ***, **, and * denote 1%, 5% and 10% confidence level.

for credit markets. The objective of this exercise is to assess if the model can reproduce the empirical facts related with capital flows and country spreads within and across countries. In particular, considering that the model matches the correlation of country spreads across countries and output comovement, we assess whether it can match the negative and low correlation between capital flows and country spreads and the low correlation of capital flows across countries. These moments, which have not been analyzed by previous works, are key to determine if the model can capture the observed dynamics in credit markets.

The model matches quite accurately not only the business cycle dynamics but also the correlation between net capital flows and country spread for both countries and the comovement of capital flows across countries. Moreover, the model also captures the auto-coerralation of capital flows and country spreads. The implied Portfolio Adjustment Costs

Table 6 Model Evaluation

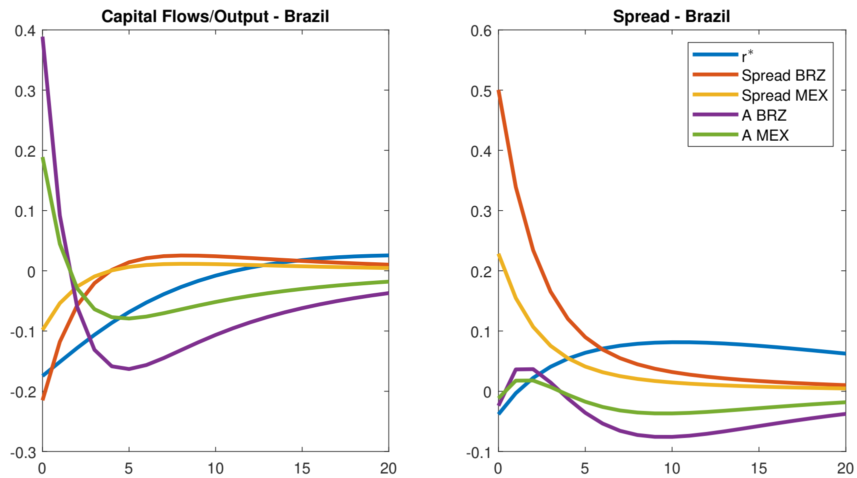
	Brazil		Mexico	
	Data	Model	Data	Model
std(y)	1.73	1.73	1.68	1.68
std(i)	5.49	5.50	4.4	4.40
std(tby)	2.5	1.26	1.63	1.25
std(kflows/y)	3.16	0.74	1.14	0.6
std(r*)	0.45	0.45	0.45	0.45
std(spread)	0.83	0.83	0.32	0.32
corr(spread,kflows/y)	**-0.21**	**-0.10**	**-0.03**	**-0.11**
corr(spread,y)	-0.18	-0.12	-0.11	-0.08
corr(kflows/y,kflows/y(-1))	-0.16	0.67	0.25	0.85
corr(spread,spread(-1))	0.9	0.78	0.9	0.87
corr(y,y(-1))	0.72	0.72	0.83	0.83
corr(y_{BR},y_{MEX})	0.3	0.3	0.3	0.3
corr(spread$_{BR}$,spread$_{MEX}$)	**0.65**	**0.65**	**0.65**	**0.65**
corr((kflows/y)$_{BR}$,(kflows/y)$_{MEX}$)	**0.35**	**0.39**	**0.35**	**0.39**

are very low, the minimum to induce stationarity. Thus, the model does a good job in replicating the Global Financial Cycle in EMEs, replicating the high (low) comovement between country spreads (net capital flows). However, the model does not match the observed volatility of net capital flows. This fact could be explained by portfolio decisions which are not captured by the standard small open economy (see, for example, Devereux and Sutherland, 2011). Extending the standard model to include portfolio decisions is important to characterize capital flows and asset prices (see, for example, Bacchetta et al., 2022). All in all, we conclude that the model matches the empirical facts once we assume a process for country spreads that resembles the empirical counterpart. In the next subsections we assess the role of different features in explaining the empirical facts.

4.5 Impulse Responses and Variance Decomposition

Figure 5 displays the response of capital flows and country spreads in Brazil to all the shocks considered in the model. The IRFs of both variables for Mexico to all the shocks are presented in Appendix C.2.

Figure 5 IRFs of Capital Flows and Country Spread in Brazil



NOTE. Response of capital flows-to-output ratio and country spreads in Brazil to a one standard deviation shock in the model. Spread BRZ (Spread MEX) denotes the IRFs to a shock to the interest rate in Brazil (Mexico). A BRZ (A MEX) denotes the IRFs to a TFP shock in Brazil (Mexico). r^* denotes the IRFs to a shock to the international interest rate.

An exogenous increase in productivity induces an immediate increase followed by a lagged decrease in capital flows to the economy that can be explained the transitory nature of the shock. Thus, this shock induces a shift in the demand for credit. The dynamics of capital flows can be explained by the increase in investment due to the observed increase in the marginal productivity of capital and by the increase in savings to smooth consumption due to the transitory nature of the shock. The sovereign spread initially decreases and increases following business cycle dynamics.

An exogenous increase in the sovereign spread increases the country interest rate inducing an improvement in the current account associated with capital outflows from the economy. Thus, this shock induces a tightening in the slope of international credit supply to this economy. The improvement in the current account can be explained both the fall in investment, due to the increase in the marginal cost of capital, and also to the increase in savings, due to the increase in returns. An increase in the international interest rate induces a shift upwards in the international credit supply, keeping the slope unchanged. In this case, the country spread increases due to the negative effect of the international interest rate on business cycle conditions which then feed into the estimated country spread process. The shock also induces capital outflows from the economy due to the increase in the country interest rate which reduce investment and increases savings.

Table 7 displays the 2-year ahead variance decomposition of capital flows-to-output ratio and country spreads in each country.

Table 7 2-Year Ahead Variance Decomposition

	Credit Supply Shocks			Credit Demand Shocks	
	R*	Spread BRZ	Spread MEX	A BRZ	A MEX
Capital Flows/Output BR	19	12	3	53	13
Spread BR	4	78	16	2	0
Capital Flows/Output MX	15	3	1	22	59
Spread MX	7	66	26	0	0

NOTE. Percentage of the 2-Year ahead variance of capital flows-to-output ratio and country spreads in Brazil and Mexico explained by international interest rate shocks (R^*), shocks to the spread in Brazil (Spread BRZ) and Mexico (Spread MEX), and shocks to productivity shock in Brazil (A BRZ) and in Mexico (A MEX). The results are based on simulations from the theoretical model presented in this Section.

Common credit supply shocks are an important driver of country spread dynamics, explaining 20% in Brazil and 73% in Mexico. In both cases, common shocks to the country spread (i.e. shocks to the country spread in one country that affect country spread in the other country) are the predominant over shocks to the international interest rate, which do not affect country spreads significantly. The importance of common shocks to the country spread may be key to explain the high observed comovement between country spreads.

Credit demand shocks are key to understand capital flow dynamics, explaining up to 66% in Brazil and 81% in Mexico. The predominant credit demand shock is the idiosyncratic productivity shock, which explains 53% of capital flows fluctuations in Brazil and 59% of capital flows fluctuations in Mexico.

While country spread dynamics are explained mostly by credit supply shocks, credit demand shocks are key to explain capital flow dynamics. This difference in the source of fluctuations may help to explain the high comovement of country spreads coupled with a low comovement of capital flows. In the next subsection we assess the contribution of each feature in explaining these dynamics.

4.6 Assessing the Determinants of Synchronization

In this section we quantify the importance of different features of the model to explain previous findings. In particular, we simulate the model for two different scenarios and compute the moments associated with the main empirical facts for each case. First, we assume that there is no correlation of TFP shocks across countries (Exp. 1). This assumption eliminates the output correlation between both economies and is useful to gauge the importance of common credit demand in explaining the main results. Second, we assume that there is no correlation of credit spread shocks across both economies (Exp. 2). In this case, we eliminate the main source of common credit shocks and allow spreads to be correlated only due to business cycle synchronization. In all the experiments we only adjust the corresponding parameter, keeping the remaining ones unchanged. Table 8 displays the main theoretical moments related with credit markets in each of these cases together with their value in the baseline model.

Table 8 Unconditional Moments - Baseline and Counterfactual Experiments

	Baseline		Exp. 1		Exp. 2	
	Brazil	Mexico	Brazil	Mexico	Brazil	Mexico
std(kflows/y)	0.74	0.60	0.74	0.60	0.74	0.60
std(spread)	0.83	0.32	0.83	0.32	0.83	0.32
corr(spread,kflows/y)	-0.1	-0.11	-0.10	-0.11	-0.10	-0.11
corr(y_{BR},y_{Mex})	0.3		**0**		0.3	
corr($spread_{BR}$,$spread_{MEX}$)	0.65		0.65		**0.24**	
corr($kflowsy_{BR}$,$kflowsy_{MEX}$)	0.39		**0.18**		0.37	

NOTE. Unconditional moments computed using simulated data from the theoretical two-country small open economy model presented in this section. Baseline denote the moments computed the baseline calibration described in Section 4.3. Exp. 1 denotes the moments computed using the baseline calibration but assuming that $\sigma^{A}_{i,j} = 0$ (i.e. no correlation between productivity shocks). Exp. 2 denotes the moments computed using the baseline calibration but assuming that $\sigma^{R}_{i,j} = 0$ (i.e. no correlation between credit spread shocks.

Two important findings emerge from the analysis. First, business cycle synchronization is key for explaining capital flows comovement but has no effect on country spread comovement. This fact is consistent with the importance of common productivity shocks to explain capital flows dynamics presented in Table 7. Second, common shocks to the country spread, which captures the Global Financial Cycle in the model, does not affect the correlation between capital flows significantly. Thus, capital flows seem to be determined by demand shocks more than shifts in international credit supply, in line with the findings presented in Table 7. Thus, the high correlation between country spreads and the relatively low correlation between capital flows can be explained by the different shocks that determine both variables. While common credit supply shocks are an important source of country spread fluctuations, common TFP shocks are key to understand the synchronization of net capital flows to EMEs. While in the current model we take the dynamics of sovereign spread as given, the high correlation between credit spreads may be rationalized by the existence of uniformed investors that follow informed ones, exacerbating fluctuations in asset prices (see, for example, Calvo and Mendoza, 2000b). The high comovement of country spreads may be also explained by the importance of long-run risk shocks faced by EMEs, as shown by Bai et al. (2019).

5 Conclusions

This paper documents three empirical facts about credit markets in EMEs. First, the correlation between country spreads and net capital flows is -0.14. Second, country spreads are highly correlated across EMEs. Third, the correlation between capital flows is positive but significantly lower than country spreads. We show that credit supply shocks (both global and idiosyncratic) explain 61% of the observed variation in sovereign spreads. While common credit supply shocks explain 39% of the sovereign spread fluctuations, they account for only 9% of fluctuations in net capital flows. Net capital flows are mostly explained (85%) by idiosyncratic credit shocks, being supply and demand equally important. Finally, we show that a calibrated two-country small open economy model augmented with an estimated process for the interest rate and correlated productivity and interest rate shocks matches the observed dynamics. The correlation between productivity shocks explains around half of capital flows correlation while it does not affect the correlation of sovereign spreads. The correlation between interest rate shocks explains around two thirds of sovereign spread fluctuations while they do not affect significantly the observed correlation of net capital flows.

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A Data Appendix

Capital flows series are computed using equation (3). The variables are obtained from:

- X: exports in current USD FOB at monthly frequency. Source: International Financial Statistics, IMF.
- M: imports in current USD CIF at monthly frequency. Source: International Financial Statistics, IMF.
- R: stock of foreign reserves in current usd at monthly frequency: Source: International Financial Statistics, IMF.

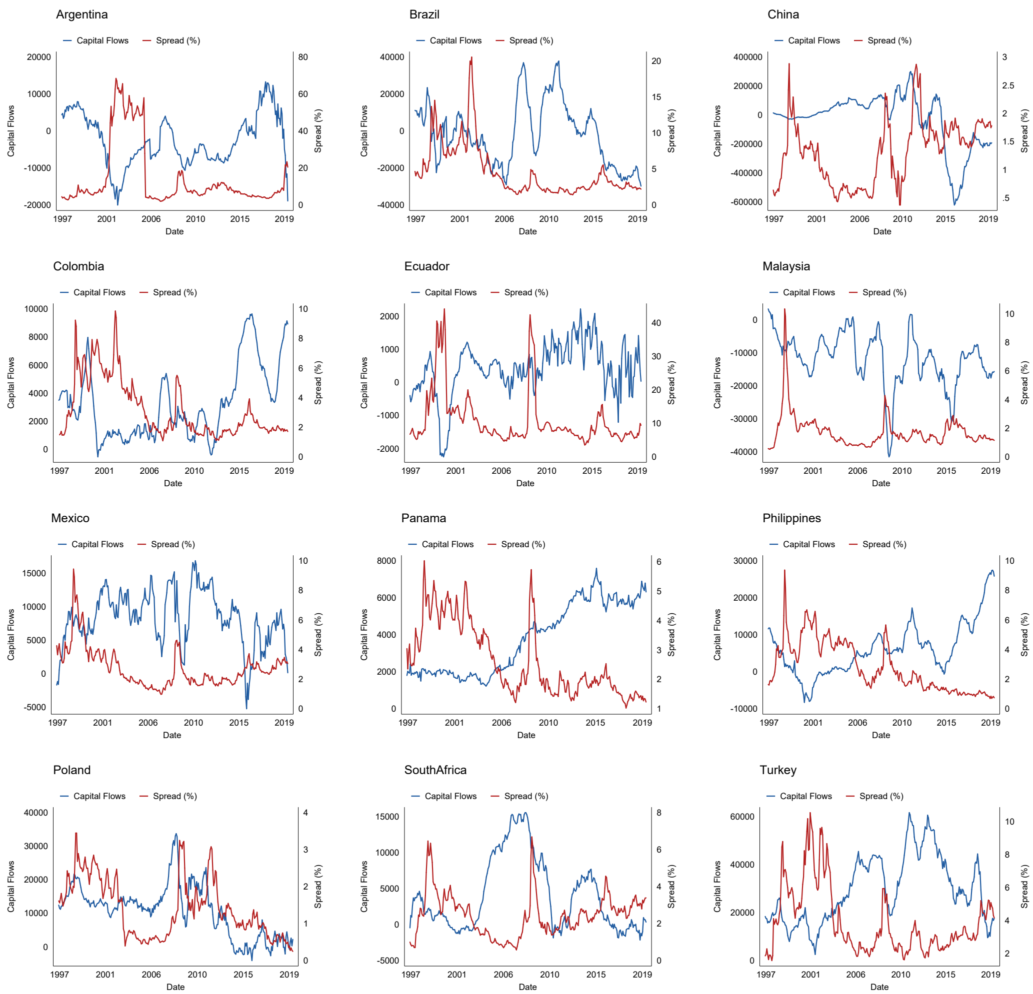
The series of capital flows is expressed in real terms using the series of U.S. Producer Price Index by Commodity: All Commodities (PPIACO) available at FRED.

Country spreads are proxied by the monthly average of the JP Morgan Emerging Market Bond Index Global (Stripped Spread).

Figure A.1 displays the evolution of capital flows and sovereign spread by country.

We compute moments for Brazil and Mexico to calibrate the two-country small open economy model and to estimate the interest rate equation. The data comes from the International Financial Statistics database compiled by the IMF. Output and investment were downloaded in domestic currency and nominal terms, and the trade balance was downloaded in domestic currency real terms. We deflate output and investment using the GDP deflator. We compute the trade balance-to-output ratio as the trade balance expressed in real terms divided by output expressed in real terms. In order to extract the cyclical components, we apply the Hodrick-Prescott filter with $\lambda = 1600$ to the series of real output, real investment, and trade balance-to-output expressed in logs. To estimate the interest rate processes, we follow Uribe and Yue (2006) and extract a log cuadratic trend from the series of real output and real investment before estimating the process.

Figure A.1 Capital flows and country spreads



Note. Series of capital flows and country spreads used in the Empirical Analysis.

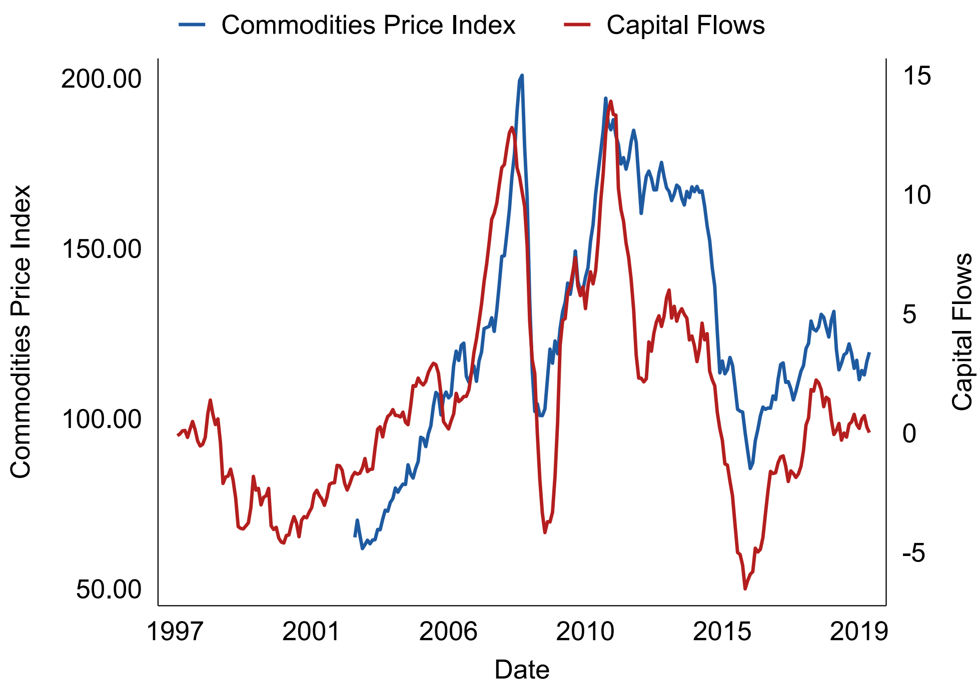
B Additional Empirical Results

B.1 Factor in Capital Flows and Commodity Prices

Figure A.2 displays the factor of capital flows together with the evolution of commodity prices, as computed by the International Monetary Fund.[13] The correlation between the 2 series is 0.73, reflecting the high comovement between these series.

[13]Source: https://www.imf.org/en/Research/commodity-prices.

Figure A.2 Common Factor for and Capital Flows and Commodity Prices



NOTE. Cumulative dynamic factors between capital flows of Argentina, Brazil, China, Colombia, Ecuador, Malaysia, Mexico, Panama, Philippines, Poland, South Africa and commodity prices for the period 1997:2-2019:12. Capital flows is defined as the cumulative trade deficit plus the change in international reserves at monthly frequency. Commodity price index as computed by the IMF.

B.2 Alternative Datasets

In this section we present results described in Section 3.5.

Disaggregated BoP Monthly Data for Brazil. Table A.1 displays the correlation between country spread (EMBI) and two accounts from Brazilian Balance of Payments: Portfolio Investment (net incurrance of liabilities) and Loans (net incurrance of liabilities). The correlation at monthly or quarterly frequency is comparable with the one computed our baseline proxy for capital flows.

Table A.1 Correlation between capital flows and EMBI for Brazil

	Portfolio Inv.	Loans
$\rho(s,f)M$	-0.25^{3}	-0.12^{2}
$\rho(s,f)Q$	-0.35^{3}	-0.22^{2}

Note.[1],[2],[3] *denote* $p < 0.01, p < 0.05, p < 0.1$, *respectively.*

Caballero et al. (2019) dataset. Table A.2 displays the correlation between the change in the stock of corporate debt and the External Financial Index (EFI) for each country, both using the data set of Caballero et al. (2019).

Table A.2 Correlation between EFI and capital flows computed from Caballero et al. (2019)

	BRZ	CHI	COL	MEX	MLY	PER	PHL	SWF	TUR	Median
$\rho(s,f)$	-0.60^1	0.32^1	-0.23^3	-0.26^2	0.15	-0.14	-0.10	0.04	-0.2	-0.14

Issuance of Debt. Table A.3 displays the contemporaneous correlation between issuance of debt in foreign currency and the corresponding yields. Unlike the other data sets, in this case we are looking at gross capital inflows.

Table A.3 Correlation between issuance of debt and yields

	BRZ	COL	MEX	TUR	Median
$\rho(s,f)$	-0.13	-0.54^1	-0.05	-0.37^1	-0.25

Quarterly BoP Data. Table A.4 displays the correlation between country spreads, proxied by EMBI, and capital flows computed from quarterly Balance of Payments data. Capital flows are defined as the sum of direct investment, portfolio investment and other investment.

Table A.4 Correlation between capital flows and country spread at quarterly frequency

ARG	BRZ	CHN	COL	ECU	MEX	MLY	PAN	PHL	POL	SWF	TUR	Median
-0.3	-0.26			-0.35	-0.11			-0.08	0.21	-0.44	-0.5	-0.28

Koepke and Schneider (2020) dataset. Table A.5 displays the correlation between spread and capital flows, using the series of capital flows computed by Koepke and Schneider (2020). Country spread is proxied with the EMBI as in our baseline sample.

B.3 Regional Factors

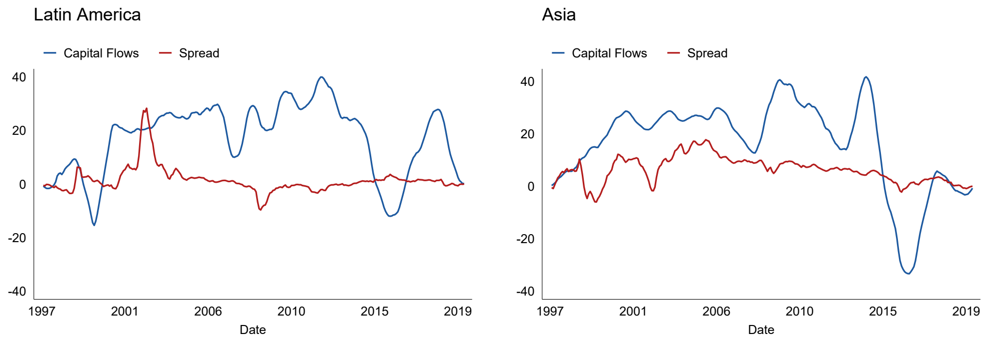
Figure A.3 displays the estimated regional factors of capital flows and country spreads for Asian and Latin American countries. Both factors are identified using a Dynamic Factor

Table A.5 Correlation between country spread and capital flows computed by Koepke and Schneider (2020)

	BRZ	CHN	MLY	MEX	PHL	POL	SWF	TUR	Median
$\rho(s, fTotal)M$	-0.27^3	0.11	.	-0.39^2	0.01	0.17^2	-0.32	-0.31^3	-0.27
$\rho(s, fDebt)M$	-0.22^3	0.00	-0.14	-0.26^3	0.01	0.16^2	-0.17^3	-0.29^3	-0.16

Model that considers a global factor, which affects all the economies, and regional factors, which affects only the countries of that region.

Figure A.3 Regional factors of country spreads and capital flows



Note. Series of regional factors of capital flows and country spreads estimated with a DFM that includes a global and regional factors for spreads and capital flows.

Table A.6 Importance of Global and Regional Factors by Country

	ARG	BRZ	CHN	COL	ECU	MLY	MEX	PAN	PHL	POL	SWF	TUR	Median
Capital Flows - Global	0.01	0.40	0.34	0.06	0.12	0.11	0.23	0.03	0.09	0.21	0.21	0.54	0.16
Capital Flows - Global y Regional	0.25	0.44	0.87	0.71	0.14	0.12	0.46	0.06	0.51	–	–	0.55	0.45
Spread - Global	0.06	0.70	0.06	0.81	0.45	0.66	0.79	0.85	0.63	0.55	0.55	0.68	0.64
Spread - Global y Regional	0.43	0.99	0.29	0.88	0.48	0.66	0.82	0.85	0.97	–	–	0.68	0.75

Note. Share of the country-specific capital flows and country spreads variance explained by the global and regional factors. We report the Adjusted R^2.

C Theoretical Model

C.1 Simple 2-Period Analytical Model

In this section we present the model presented in Section 2, which follows closely the model presented by Vegh (2013) (see Chapter 2).

Demand for Credit without Uncertainty

The representative household receives an endowment every period $\{y_1, y_2\}$ which can be either consumed or traded internationally. The economy has access to international financial markets. The representative household solves the following problem:

$$Max_{C_1,C_2} U(C_1) + \beta U(C_2)$$

$$\text{subject to}$$

$$C_1 + \frac{C_2}{1+r_1} = (1+r_0)B_0 + Y_1 + \frac{Y_2}{1+r_1}$$

where C_t denotes the consumption every period, B_0 is the net international asset position of the economy, and r_t is the interest rate that the country faces in international financial markets. The Euler equation is:

$$U'(C_1) = \beta\,(1+r)\,U'(C_2)$$

Let's assume that $B_0 = 0$, $r_0 = r_1 = r$ and that $\beta\,(1+r) = 1$. In this case, $C_1 = C_2$. Thus, using the budget constraint, the consumption every period equals:

$$\overline{C} = \left[Y_1 + \frac{Y_2}{1+r}\right]\frac{1+r}{2+r}$$

The associated demand for net international debt is:

$$D_1 = -B_1^f = C_1 - Y_1 = \frac{Y_2 - Y_1}{2 + r}$$

Equilibrium in Credit Markets with Uncertainty

Let's assume that output is distributed following a Uniform distribution between 0 and $\overline{Y_2}$ ($Y_2 \sim U[0, \overline{Y_2}]$). If the country defaults in period 2, it does not pay its debt but it suffers an output loss of ϕY_2. Thus, the country decides to default in the second period if C_2^D, the consumption level with default, is larger than C_2^N, the consumption value without default, since these levels determine directly the level of utility. Thus, if the country pays its debt, consumption equals: $C_2^N = Y_2 + (1 + r) B_1^f$. If the country does not pay its debt, consumption equals: $C_2^D = (1 - \phi) Y_2$. The country decides to default if: $d_1 > \frac{\phi Y_2}{1+r}$. This condition can be expressed as a function of Y_2 as follows: $Y_2 < \frac{d_1(1+r)}{\phi}$. Then, the probability of default (π) is given by:

$$P(Y_2 < \frac{D_1^f (1 + r)}{\phi}) \tag{11}$$

$$\pi = \frac{D_1^f (1 + r)}{\phi} \frac{1}{\overline{Y_2}} \tag{12}$$

We assume that the international creditors are risk neutral and can either invest in a safe bond with a return r^* or in the domestic bond. Thus, the expected value of both investment have to equalize in equilibrium:

$$\begin{aligned} (1 - \pi)(1 + r) &= (1 + r^*) \\ (1 + r) &= \frac{1 + r^*}{1 - \pi} \end{aligned}$$

Replacing π with the value obtained in equation 11 yields:

$$1+r=\frac{1+r^*}{1-\frac{D_1^f(1+r)}{\phi\overline{Y_2}}}$$

Thus, the equilibrium value of $1+r$ is given by:

$$\begin{aligned} 1+r &= \frac{(1+r^*)\,\phi\overline{Y_2}}{\phi\overline{Y_2}-D_1^f\,(1+r)} \\ 0 &= D_1^f\,(1+r)^2-\phi\overline{Y_2}\,(1+r)+(1+r^*)\,\phi\overline{Y_2} \end{aligned}$$

The solution to the last equation is given by:

$$r=\begin{cases} r^* & si\, D_1\leq 0 \\ \frac{2(1+r^*)D_1^{max}}{D_1}\left(1-\sqrt{1-\frac{D_1}{D_1^{max}}}\right)-1 & si\, 0<D_1\leq D_1^{max} \end{cases}$$

where $D_1^{max}=\frac{\phi Y_2^H}{4(1+r^*)}$. The supply of credit has a positive slope given by:

$$\frac{dr}{dD_1}=\frac{(1+r^*)D_1^{max}}{D_1^2\sqrt{1-\frac{D_1}{D_1^{max}}}}\left(2-\frac{D_1}{D_1^{max}}-2\sqrt{1-\frac{D_1}{D_1^{max}}}\right)>0 \qquad 0<D_1<D_1^{max}$$

The credit supply also has the property that if $D_1=0$, then $r=r^*$ since there is no default risk in this case. Thus, this credit supply for a country i can be approximated by the following expression that we use in section 2:

$$r^i=r^*+\phi^i\left(\tilde{d_1^i}\right)^2+\varepsilon^i,\phi^i>0$$

where ε^i is a random variable that captures credit supply shocks.

C.2 2-Country Small Open Economy Model

Equilibrium Conditions

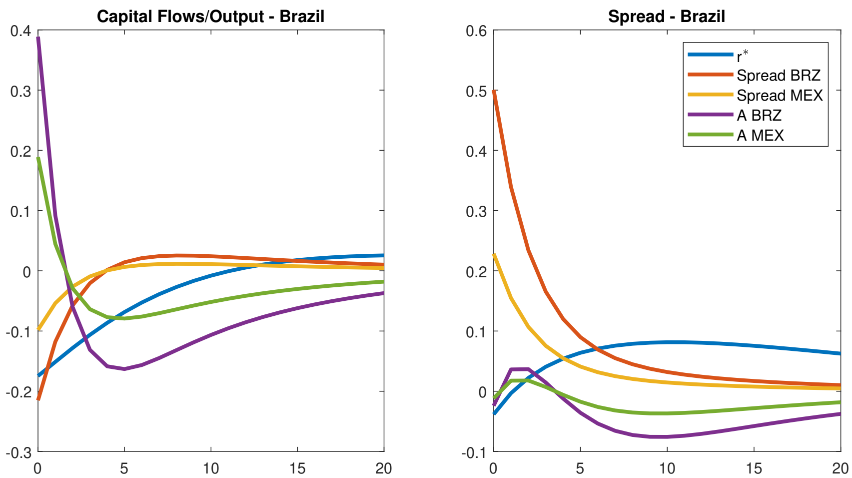
A competitive equilibrium of the model presented in Section 4 is a set of processes $\{d_t, c_t, h_t, y_t, i_t, k_{t+1}, r_t, \lambda_t\}_{t=0}^{\infty}$ that satisfies:

$$
\begin{aligned}
y_t &= A_t k_t^{\alpha} h_t^{1-\alpha} \\
k_{t+1} &= i_t + (1-\delta) k_t \\
\lim_{j\to\infty} E_t \frac{d_{t+j}}{\prod_{s=1}^{j}(1+r_s)} &\leq 0 \\
d_t &= (1+r_{t-1}) d_{t-1} - y_t + c_t + i_t + \frac{\Phi}{2}(k_{t+1}-k_t)^2 + \frac{\psi_3}{2}\left(d_t - \bar{d}\right)^2 \\
\lambda_t &= \beta (1+r_t) \mathbb{E}_t \lambda_{t+1} \\
\left[c_t - \omega^{-1} h_t^{\omega}\right]^{-\gamma} &= \lambda_t \\
\left[c_t - \omega^{-1} h_t^{\omega}\right]^{-\gamma} h_t^{\omega-1} &= \lambda_t A_t (1-\alpha) \left(\frac{k_t}{h_t}\right)^{\alpha} \\
\lambda_t \left[1 + \Phi (k_{t+1} - k_t)\right] &= \beta \mathbb{E}_t \lambda_{t+1} \left[A_{t+1}\alpha \left(\frac{h_{t+1}}{k_{t+1}}\right)^{1-\alpha} + 1 - \delta + \Phi (k_{t+2} - k_{t+1})\right] \\
\lambda_t \left[1 - \psi_3 \left(d_t - \bar{d}\right)\right] &= \beta (1+r_t) \mathbb{E}_t \lambda_{t+1} \\
\hat{R}_{i,t} &= \rho_R \hat{R}_{i,t-1} + \rho_{R^*} \hat{R}_t^* + \rho_{R1^*} \hat{R}_{t-1}^* + \rho_y \hat{y}_{i,t} + \rho_{y1} \hat{y}_{i,t-1} + \rho_i \hat{\imath}_{i,t} + \rho_{i1} \hat{\imath}_{i,t-1} + \rho_{tby} tby_{i,t} \\
&+ \rho_{tby1} tby_{i,t-1} + \gamma_{i,i} \epsilon_{i,t}^r + \gamma_{i,j} \epsilon_{j,t}^r \\
\hat{R}_t^* &= \zeta \hat{R}_{t-1}^* + \gamma_t^* \epsilon_t^* \\
\ln A_t &= \rho_A A_t + \eta \varepsilon_t^A
\end{aligned}
$$

Additional Results

Figure A.4 displays the IRFs of capital flows and country spreads in Mexico to all the shocks considered in the model.

Figure A.4 IRFs of Capital Flows and Country Spread in Brazil



NOTE. Response of capital flows-to-output ratio and country spreads in Brazil to a one standard deviation shock in the model. Spread BRZ (Spread MEX) denotes the IRFs to a shock to the interest rate in Brazil (Mexico). A BRZ (A MEX) denotes the IRFs to a TFP shock in Brazil (Mexico). r^* denotes the IRFs to a shock to the international interest rate.