Banking Sector Exposure to Global Financial Cycle and Sovereign Debt Crises

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November 19, 2024

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Abstract

We investigate how exposure to the global financial cycle influences credit cycles and sovereign default risk in emerging markets. We document that emerging markets with financial sectors more reliant on foreign funding exhibit greater sensitivity to the Global Financial Cycle, proxied by the U.S. stock market volatility index (VIX). During periods of heightened global risk premium, these economies experience reduced lending and rising CDS spreads for their governments. Our model connects these phenomena, emphasizing the macro-financial linkages between global capital flows and domestic credit dynamics in emerging economies.

1. Introduction

Recent empirical evidence indicates that emerging market economies (EMEs, henceforth) experience significant output declines during deteriorations in international financial markets. For instance, Rey (2015) and Miranda-Agrippino and Rey (2020) document the existence of a global financial cycle and demonstrate that changes in the U.S. financial sector partly drive fluctuations in emerging markets. Using bank-loan-level data, Di Giovanni et al. (2022) shows that Turkish banks with higher exposure to foreign borrowing reduce their lending more significantly when the global financial cycle deteriorates, as proxied by the log level of the S&P 500 volatility index (VIX). Moreover, global banks play a critical role in systemic debt crises. For example, Morelli et al. (2022) and Gilchrist et al. (2022) find that deteriorations in global banks' balance sheets increase sovereign governments' funding costs by heightening risk aversion, making debt rollover more expensive.

This paper bridges these two strands of literature by demonstrating the heterogeneous transmission of the global financial cycle to sovereign risk, driven by banks' reliance on foreign borrowing. Using country-level data, we show that EMEs with banking sectors more dependent on foreign funding exhibit sharper declines in lending, larger output contractions, and greater increases in sovereign credit default swap (CDS) spreads during global financial cycle downturns. To explain these co-movements, we develop a model that integrates a sovereign default framework with banks' exposure to the global financial cycle. The model shows that foreign borrowing amplifies fluctuations in investment via a value-at-risk constraint on foreign lenders. This amplification mechanism links credit cycles to rising borrowing costs for risky debt, exacerbating sovereign default risk.

Using a panel of 13 EMEs, we provide empirical evidence that banks' reliance on foreign funding significantly influences the transmission of the global financial cycle to sovereign default risk. First, we document that approximately 7% of total credit to the non-financial sector in EMEs is financed through foreign bank debt. To quantify the impact of this funding structure, we interact the share of banking sector foreign debt (as a percentage of GDP) with the VIX, a measure of the global financial cycle. Our results indicate that EMEs with higher banking sector foreign funding experience steeper declines in economic activity and lending, accompanied by higher government CDS spreads.

To disentangle the drivers of sovereign risk, we propose a sovereign debt model where banks borrow from abroad to finance domestic loans and capital investments. The domestic credit cycle is influenced by shocks to capital returns and the resources provided by foreign lenders. The global financial cycle affects the domestic economy through a VaR constraint imposed on foreign lenders. In periods of heightened risk aversion, this constraint tightens, reducing foreign borrowing by banks, increasing funding costs, and curbing lending activity.

Our model replicates the empirically observed impulse response functions to VIX shocks. When risk aversion rises, tighter constraints on domestic banks lead to a 0.6% decline in lending. This contraction reduces GDP, increases the government's probability of default, and lowers government bond prices.

To highlight the importance of global financial cycle spillovers in the heterogeneous transmission of sovereign risk, we conduct a counterfactual analysis. In this scenario, we eliminate the VaR constraint, effectively severing the link between the global financial cycle and domestic credit markets. Without the collateral constraint, lending and output remain unaffected by changes in investors' risk aversion. Consequently, while bond prices still decline due to increased risk aversion, the drop is significantly smaller compared to the benchmark model. The absence of economic disruption reduces the likelihood of sovereign default, mitigating the increase in government borrowing costs.

This paper underscores the critical role of banks' foreign funding exposure in shaping sovereign debt crises. By incorporating a banking sector reliant on foreign borrowing into a sovereign debt framework, we demonstrate the heterogeneous transmission of the global financial cycle to sovereign risk. This heterogeneity arises from the credit market spillovers during periods of heightened risk aversion, which amplify the costs of issuing new debt. These findings highlight the need to account for sectoral exposures when analyzing sovereign debt crises and formulating policy responses.

1.1. Related Literature

This paper contributes to two key strands of literature: sovereign debt crises and the global financial cycle.

First, we contribute to the literature on sovereign debt crises by emphasizing the role of debt inflows to domestic banks in understanding sovereign default risk. Building on the observations by Broner et al. (2013a) and Avdjiev et al. (2022) regarding the cyclicality of net capital inflows, we argue that the global financial drivers of sovereign spreads are mediated through the domestic banking sector.

Our analysis aligns with the findings of Aguiar et al. (2016), Broner et al. (2013b), Longstaff et al. (2011), and Mitchener and Trebesch (2021), who highlight the importance of global financial cycles in explaining CDS spread movements. Moreover, we build on the insights of Wu (2020), Morelli et al. (2022), and Tourre (2017), who identify the risk premium component of the CDS spread as a critical link between global financial cycles and sovereign risk.

We also contribute to the quantitative literature on sovereign risk models, including Arellano (2008), Chatterjee and Eyigungor (2012), and Mendoza and Yue (2012). Our framework incorporates a banking sector that borrows from abroad and lends to firms within a sovereign debt model featuring long-term debt. The heterogeneous responses of government risk observed in the data are driven by the spillovers from domestic credit markets.

Second, we contribute to the literature on the global financial cycle by providing a sectoral perspective on sudden stops in capital flows. Our model captures the dual impact of sudden stops on both the banking and government sectors, building on the seminal work of Calvo (1998), Caballero and Krishnamurthy (2004), and Morelli et al. (2022). Specifically, we show that a sudden stop in banking-sector capital inflows can propagate to the government sector, exacerbating sovereign risk.

The banking sector in our model reflects the mechanisms proposed by Hahm et al. (2013) to explain the Korean credit crises. An increase in foreign risk aversion tightens value-at-risk constraints for lending to emerging market banks, leading to a contraction in domestic credit. This mechanism is consistent with the empirical findings of Di Giovanni et al. (2022), who document similar dynamics in bank lending during periods of heightened global financial stress.

The remainder of this paper is structured as follows. In Section 2, we present the data and document empirical evidence for the heterogeneous impact of the global financial cycle on government risk. Section 3 introduces our theoretical model, which links sovereign debt choices and risks to the international spillovers of domestic credit markets. In Section 4, we conduct quantitative analyses to demonstrate the critical role of the banking sector in shaping sovereign default risk.

2. Empirics

This section studies the co-movement of sovereign risk in EMs across the Global Financial Cycle (GFC), highlighting the role of the credit supply channel. Section 2.1 defines the variables required for this section and the datasets used for this purpose. Section 2.3 documents for a set of EMs the dynamics of sovereign risk and key macro variables following an increase in global risk and how domestic banks can amplify these patterns.

2.1. Data

We construct country-level information at quarterly frequency starting from the first quarter of 2002 until the last quarter of 2019, depending on data availability. We avoid the period after the COVID-19 pandemic due to different behavior and excess liquidity in international markets.

To capture the fluctuations of the GFC, we use the volatility index of the S&P500, VIX. This choice is driven by the empirical literature on the GFC as a way to capture changes in global risk due to its high correlation with asset prices (Miranda-Agrippino and Rey, 2020).

To measure the foreign exposure by sector we rely on the dataset constructed by Avdjiev et al. (2022). This dataset is constructed using the IMF's Balance of Payment (BOP), filling the data gaps with the Bank of International Settlements (BIS)' locational banking and debt securities and World Bank datasets. The data is available on the BIS website. [1] The data is divided into four sectors: General Government, Banks, Corporate, and Central Bank. We focus on the first three sectors.

From the BIS, we collect information on short-term or maturing government debt liabilities, domestic credit to the non-financial sector, and real exchange rates. From the World Bank, we collect real and nominal GDP, with the latter being used to normalize foreign positions.

[1] Available at: https://www.bis.org/publ/work760.htm

The World Bank also provides trade data, imports and exports, which we use to control the balance of payment flows. Lastly, we use consumer price indexes constructed by the IMF.

From Bloomberg, we collect data for credit default swap (CDS) prices at the end of each quarter. Due to the fact that it is the most liquid contract, we selected the five-year CDS. Although the literature has shown that the CDS premia accounts for much more than the default probability of the sovereign debt, we will not decompose the CDS into risk-neutral default probability and the risk premium. [2] Our variable of interest is the exposure of the financial sector to foreign borrowing. To construct the exposure of the financial sector, we take the total foreign debt of banks and divide it by the country's GDP, with similar measurements computed for the other sectors like government and corporate.

Our list of countries contains 13 emerging economies: Brazil, Chile, Colombia, Hungary, Indonesia, Korea, Malaysia, Mexico, Poland, Russia, Thailand, Turkey, and South Africa.

2.2. Summary Statistics

First, we describe the unconditional moments of our panel to document some empirical correlations between emerging markets' exposure to foreign borrowing and output. Our total sample contains 1,039 observations across 13 countries, with a balanced panel after 2005.

Table 1 describes the main unconditional moments of the critical variables in our empirical analysis. In our sample, it is clear that, on average, corporate exposure is higher than bank exposure; however, the correlation of both with respect to the dispersion of real GDP growth is the same. Additionally, we observe a negligible correlation between banks' exposure and average CDS. This points to a possible explanation of why these emerging economies have, on average, higher volatility in the GDP. These facts provide evidence supporting the credit supply channel we will argue in the following subsections: banks' exposure has an effect on sovereign risk through its impact on the real economy, which is not ex-ante correlated with government default risk.

[2] See Wu (2020) for a more precise explanation

	Mean	Std. Dev.
CDS (basis points)	154	68
Real GDP Growth	3.4	1.2
Banks Exposure (% GDP)	34.9	21.6
Banks Exposure (% Loans)	7.0	3.5
Corp. Exposure (% GDP)	51.1	19.7
Gov. Exposure (% GDP)	47.7	38.5
Correlation with σ(GDP Growth)		
Bank Exposure	0.34	
Corp Exposure	0.34	
Correlation with Average CDS		
Bank Exposure	0.03	
Corp Exposure	-0.25	

Table 1: Summary Statistics

2.3. Effects of the Global Financial Cycle in Sovereign Risk

We document how sovereign risk, domestic loans, and real GDP respond to the GFC. Based on Rey (2015), we use the VIX index to capture movements in the GFC, defined as changes in a global risk premium. [3]

It is already well documented by Di Giovanni et al. (2022) that whenever the VIX increases, there are outflows of money from emerging market banks, triggering increases in loan rates and decreases in loans (i.e. a credit supply shock in EMs). In this subsection, we document that this indeed holds at the aggregate level for these economies, and it has some implications for aggregate output.

Our exercise is based on the local projections method à-la-Jordà (2005). Let $\Delta_h \ln y_{c,t+h}$ denote country c log cumulative change for its variable y at period t and horizon h. We estimate these dynamic responses using the Panel Local Projection (LP):

$$\Delta_h \ln y_{c,t+h} = \underbrace{\alpha_{c,h}}_{\substack{\text{Country}\\ \text{FE}}} + \underbrace{\gamma_{c,q}}_{\substack{\text{Quarter}\\ \text{FE}}} + \beta_h \text{VIX}_t + \Gamma \underbrace{X_{c,t-1}}_{\substack{\text{Country}\\ \text{Controls}}} + \varepsilon_{c,t+h}, \tag{1}$$

[3] Using asset prices for firms in EMs, Hegarty et al. (2024) estimated a global risk premium that correlates with measures of global risk as the VIX and the U.S. excess bond premium.

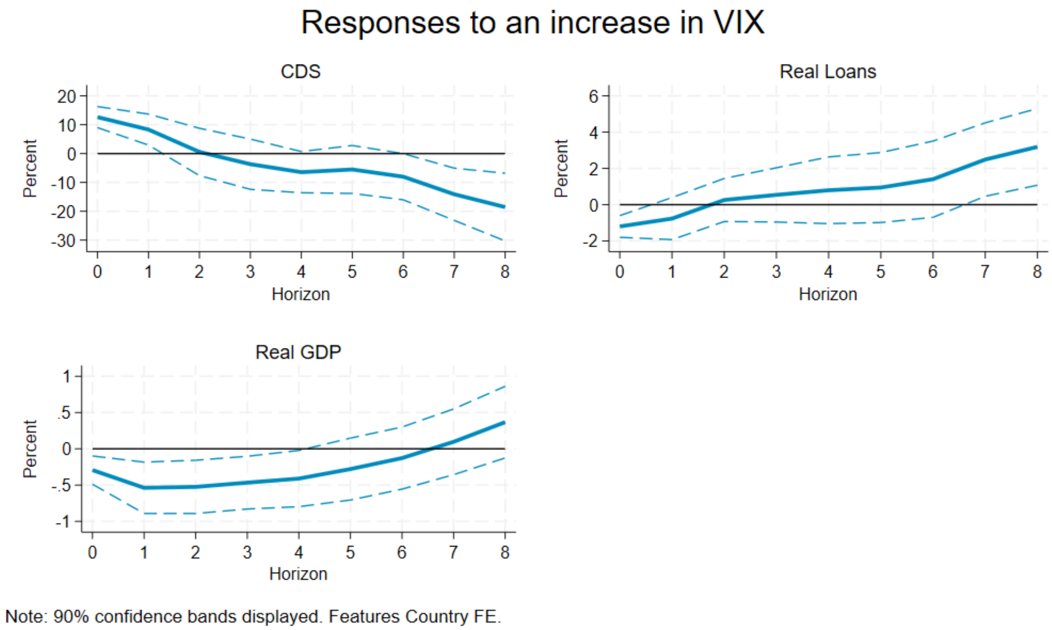


Figure 1: Effects of higher global risk

where $y \in \{\text{CDS}, \text{Loans}, \text{real GDP}\}$, $\alpha_{c,h}$ are country-level fixed effects, and $\gamma_{c,q}$ is the country-specific quarter fixed effect to remove seasonality. We also control for four lags of GDP growth, four lags of inflation, four lags of log changes in the real exchange rate, four lags of growth of $\Delta_h \ln y_{c,t+h}$, exposure of the banking sector, foreign short-term government debt over total GDP, foreign corporate debt over total GDP, and total trade over total GDP.

Figure 1 illustrates the mean responses to an increase in 1 SD in the VIX. As expected, the sovereign risk, measured by changes in CDS prices, hikes are driven by heightened risk aversion among foreign investors. Additionally, we observe a decline in these EMs' output while their lending appears to be relatively unaffected; it decreases only on impact.

Although these average estimations tell us the direction in which the global financial cycle affects these emerging economies, they do not highlight the underlying mechanisms driving these effects. To address the role of the credit supply channel, we exploit the cross-sectional variance across countries to understand how the global financial cycle and bank exposure might explain the increased sovereign risk.

2.4. The Role of Domestic Banks' Foreign Exposure

To examine the role of domestic banks in amplifying the transmission of the global financial cycle, we re-estimate our previous regression, incorporating an interaction term between banking sector exposure to foreign borrowing and the VIX.

Let $w_{c,t-1}$ be the normalized banking sector foreign exposure described in Subsection 2.1. Our benchmark regression, based on Jordà (2005), is specified as follows:

$$\Delta_h \ln y_{c,t+h} = \underbrace{\alpha_{c,h}}_{\text{Country FE}} + \underbrace{\gamma_{c,q}}_{\text{Quarter FE}} + \underbrace{\delta_{t+h}}_{\text{Time FE}} + \beta_h(\text{VIX} \times w_{c,t-1}) + \Gamma \underbrace{X_{c,t-1}}_{\text{Country Controls}} + \varepsilon_{c,t+h}. \quad (2)$$

The primary innovation in this specification is the interaction term between exposure of the banking sector to foreign borrowing and the VIX. The coefficient of this term, β_h, captures the marginal effect of a one-standard-deviation increase in the VIX on the outcome variable, conditional on the banking sector of a given country being one standard deviation more exposed to foreign borrowing.

Figure 2 illustrates the heterogeneous responses across EMs based on the extent of banking sector exposure to foreign borrowing. The results indicate that countries with banking sectors more heavily indebted to foreign investors experience greater increases in sovereign risk following a rise in global risk. Furthermore, the responses of real loans and real GDP highlight the amplifying role of domestic banks in transmitting the global financial cycle.

This amplification operates through the credit supply channel, whereby heightened global risk raises the borrowing costs of domestic banks. This, in turn, triggers a contractionary credit supply shock. The resulting credit contraction has real effects in the economy, which in turn amplifies the rise in sovereign risk previously identified.

These results are robust to additional sources of heterogeneities. Appendix XX shows the Impulse Response Functions (IRF) for the outcome variables when we also control other interaction terms with VIX: corporate exposure, short-term government debt, and trade.

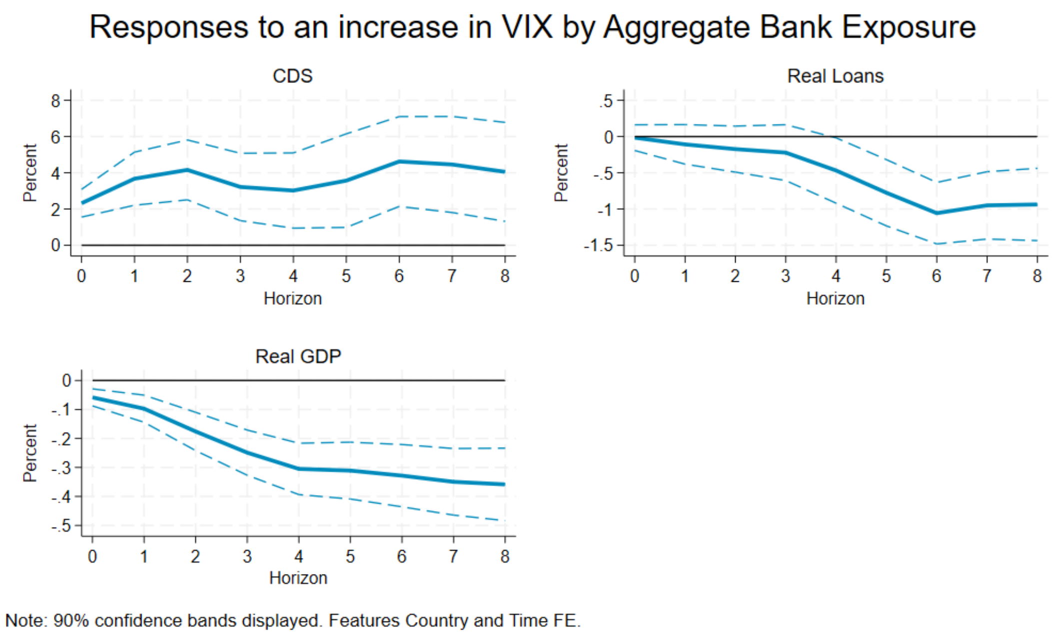


Figure 2: Heterogeneous response due to Banks' Foreign Exposure

The evidence presented in this section underscores the role of domestic banks in transmitting the global financial cycle to sovereign risk. However, quantifying the relevance of the amplifying mechanism described requires a model capable of replicating the observed patterns. Accordingly, the next section introduces the model employed to evaluate the importance of the credit supply channel.

3. Model

Having documented this relationship between banks' exposure to the global financial cycle and sovereign risk, we now interpret these patterns through a sovereign debt model lens. The key friction in the model will be the limited availability of external debt to banks. Sudden decreases in the available foreign credit to banks trigger a drop in domestic lending, causing the output to fall. The lower output will be associated with higher sovereign risk. The new feature of the literature will be the addition of international financial inflows to banks to capture the relationship between the global financial cycle and sovereign debt crises.

Time is discrete and indexed by $t = 0, 1, 2, \ldots$. The economy comprises a household, firms, financial intermediaries, a benevolent government, and foreign lenders.

3.1. Household

The economy has a representative household composed of a continuum of workers and bankers, both with mass one. Each period, workers provide labor l_t to firms at wages w_t. Also, at every period t, $1-\sigma$ of workers turn into bankers, who run the financial intermediaries (banks). To start their operations, each new banker receives an initial net worth $\bar{n}$.

Each member individually makes deposits d_t and labor supply l_t choices.

Their utility function over consumption of production good $u(\cdot)$ is linear, and their discount rate is β. The household has disutility from working. Their lifetime expected utility will be

$$\mathbb{E}_0 \sum_{t\geq 0} \beta^t [C_t] \tag{3}$$

where c_t is the consumption at time t. Household supply a unit of labor, i.e., $L_t = 1$.

Household receives previous deposit D_t, plus the dividends from exiting bankers F_t. They also lend capital and provide labor to firms. Capital is rented via household entrepreneurs. Consequently, we have that the household budget constraint is given by

$$C_t + D_{t+1} + n_t = w_t l_t + R_{D,t} d_t + F_t. \tag{4}$$

The optimality condition of deposits yields that its price will be given by $R_t = \beta^{-1}$.

3.2. Foreign Lenders

Foreign lenders provide domestic banks and governments with a perfectly elastic international credit supply. To study fluctuations in the risk premium of global investors, we parametrize their stochastic discount factor as

$$\Lambda_{t,t+1} = \beta^{\star} \exp\left(-\kappa_t \varepsilon_{t+1} - \frac{1}{2}\kappa_t^2 \sigma_\varepsilon^2\right), \tag{5}$$

where $\beta^\star$ is the foreign lenders' discount factor; κ_t is a stochastic exogenous variable that captures the market price of risk; and ε_{t+1} are the innovations of domestic credit risk shock. A similar formulation of foreign investors' stochastic discount factor has been used in the sovereign debt literature (Arellano and Ramanarayanan, 2012; Bianchi et al., 2018) to provide a tractable representation that captures changes in global risk premium. As explained later, we build on this formulation to capture the risk-taking channel of Correa et al. (2021). Investors value bonds more in states where the government is more likely to default and require larger yields, even if default is not expected. Consider a cash flow h in the next period to see this. The value of this cash flow for foreign investors is then

$$q^\star(\kappa_t, h) = \beta^\star \mathbb{E}[h] - \beta^\star \kappa \mathrm{Cov}(\varepsilon_{t+1}, h) \tag{6}$$

where the result is based on a first-order Taylor approximation.

With Equation 6, we can derive the foreign lenders' risk-free rate by

$$R_t^\star = \frac{1}{\beta^\star}, \tag{7}$$

which implies that the risk-free rate of foreign lending does not increase with uncertainty.

Assumption 1. $\beta < \beta^\star$.

Assumption 1 impose that the domestic agent is more impatient than the international lender for any realization of κ. Moreover, as demonstrated later, due to these assumptions, domestic bankers always prefer to raise their funds in the international market.

3.3. Firm

A representative firm rents capital from banks at rate $R_{k,t}$ and hires labor at wages w_t to operate a constant return-to-scale production technology.

$$Y_t = \omega_t^D L_t^{1-\alpha} K_t^\alpha \tag{8}$$

where ω_t^D is a shock affecting the capital return, similar to Morelli et al. (2022) but for domestic banks, and α is the capital share. We assume that ω_t^D depends on the default decision of the government. This assumption is to capture the connection between default risk and deterioration of banks' balance sheets, as observed by Moretti (2020); Arellano et al. (2020).

Firms are taxed at τ of their revenues. The static firm problem is to solve their operational profit:

$$(1-\tau)\omega_t^D L_t^{1-\alpha} K_t^{\alpha} - W_t L_t - R_{K,t} K_t + \omega_t^D (1-\delta) K_t. \tag{9}$$

Solving for the labor and capital choices, we have the following first-order conditions:

$$W_t = (1-\tau)\omega_t^D (1-\alpha)\left(\frac{K_t}{L_t}\right)^{\alpha} \tag{10}$$

$$R_{K,t} = (1-\tau)\omega_t^D \alpha \left(\frac{L_t}{K_t}\right)^{1-\alpha} + \omega_t(1-\delta) \tag{11}$$

Given that $L_t = 1$, in equilibrium, firm maximization implies that wages and the capital rent are $W_t = (1-\tau)\omega_t^D(1-\alpha){K_t}^{\alpha}$ and $R_{K,t} = (1-\tau)\omega_t^D \alpha {K_t}^{\alpha-1} + \omega_t^D(1-\delta)$, more on the capital return later.

We assume that the log of ω_t follows an AR(1) processs

$$\log \omega_{t+1} = (1-\rho_\omega)\mu_\omega + \rho_\omega \log \omega_{t+1} + \varepsilon_{t+1}^{\omega} \quad \varepsilon_{t+1}^{\omega} \sim N(0, \sigma_\omega) \tag{12}$$

$\varepsilon_{t+1}^{\omega}$ is the shock to the log of exogenous productivity with persistence ρ_ω and standard deviation σ_ω. ω_{t+1} can be interpreted as a capital quality shock at the aggregate level.

Whenever the government default there occurs a drop in ω_t such that

$$\omega_t^D = (1 - \mu * (1-D))\omega_t$$

where $\mu \in (0,1)$ captures the drop in asset quality. The drop lasts until the economy regains access to foreign markets.

3.4. Bankers

At the beginning of the period, the probability of idiosyncratic risk is realized. Then, each banker receives a shock with probability $1-\sigma$ such that they turn back into workers. In this case, their net worth is transferred back to the household. Bankers use foreign bonds b_{t+1}

and deposits d_{t+1} to finance the acquisition of assets a_{t+1}, i.e., claims on the capital return. These loans to entrepreneurs are risky as they depend on the aggregate capital return ω_t. Bankers are competitive and take all prices as given. The net worth of a surviving banker is $n_t = R_{K,t}a_t - R_t d_t - R_t^{\star} b_t$.

The budget constraint (BC) for a banker is

$$a_{t+1} \leq n_t + d_{t+1} + b_{t+1}. \tag{13}$$

Similar to Gertler and Karadi (2011), we introduce an agency problem between bankers and lenders that limits the ability to raise assets, yielding the following asset constraint (AC)

$$\vartheta a_{t+1} \leq n_t. \tag{14}$$

This constraint can be interpreted as a capital constraint for banks, similar to the one imposed by Basel regulation.

In addition, the banker will face a distinct collateral constraint (CC) for foreign borrowing, given by [4]

$$b_{t+1} \leq \theta(\mathcal{S})a_{t+1} \tag{15}$$

where $\theta(\mathcal{S}_t)$ captures collateral constraints on foreign borrowings in a concise matter. The collateral constraint depends on how much the foreign lenders value the bank's assets under a value-at-risk approach

$$\theta(\mathcal{S}_t) = \theta(\mathcal{S}_t) = \theta^D \left[1 - \kappa \frac{\sigma_\omega}{\mathbb{E}_t\, \omega_{t+1}}\right] \tag{16}$$

$\bar{\theta}^D$ is the constant collateral constraint, which depends on the government default decision D. This assumption models that cross-border borrowings are unsecured and subject to bank defaults. The parameter θ^D captures how open the economy is to foreign borrowing by banks, σ_ω is the standard deviation of the capital shock, and $\mathbb{E}_t\, \omega_{t+1}$ is the expected shock. This constraint boils down to a value-at-risk of foreign lenders.

Similar to the story of Caballero and Krishnamurthy (2004), these banks, due to their exposure to foreign borrowing, suffer sudden decreases in capital flows. This shifts their

[4] A similar idea can be found in Caballero and Krishnamurthy (2004).

funding towards domestic deposits, which are more expensive, in turn increasing their lending rates.

Banker maximizes their terminal wealth, i.e.,

$$V(n_t) = \max_{\{a_{s+1}, d_{s+1}, b_{s+1}\}_{s\geq t}} \mathbb{E}_t \sum_{s\geq t} \beta^{s-t+1}\sigma^{s-t}(1-\sigma)n_{s+1} \tag{17}$$

subject to the budget constraint 13, asset constraint 14, collateral constraint 15, and the law of motion (LOM) for net worth,

$$n_{s+1} = R_{K,s+1}a_{s+1} - R_{s+1}d_{s+1} - R^{\star}_{s+1}b_{s+1}. \tag{18}$$

Let $\mathcal{S} = \{\omega, \kappa, K\}$ denote the aggregate private sector states in this economy. Here, $\{\omega, \kappa\}$ are the aggregate exogenous variables, while K is the aggregate stock of capital.

The dynamic banking problem can be written as

$$V^B(\mathcal{S}, n) = \max_{a', d' b' \geq 0} (1-\sigma)n + \sigma\beta\,\mathbb{E}\big[V^B(\mathcal{S}', n')\big] \tag{19}$$

$$\text{s.t.}\ \ a' \leq n + d' + b' \tag{BC}$$

$$a' \leq (1/\vartheta)n \tag{AC}$$

$$b' \leq \theta(\mathcal{S})a' \tag{CC}$$

$$n' = R'_K a' - Rd' - R^{\star}b' \tag{LOM}$$

Lemma 1. *The value function of the banker is linear in net worth n.*

Proof. Suppose $V(\mathcal{S}', n')$ is linear in n', and we can denote it by $V(\mathcal{S}', n') = v(\mathcal{S}')n'$.

Taking the first-order conditions with regard to a', d', b'

$$\begin{aligned}
a' :&\quad \beta\,\mathbb{E}_{\mathcal{S}',\mathcal{S}}[v(\mathcal{S}')R'_K] = \mu^{BC}(\mathcal{S}) + \mu^{AC}(\mathcal{S}) - \theta\mu^{CC}(\mathcal{S}) \\
d' :&\quad \beta\,\mathbb{E}_{\mathcal{S}',\mathcal{S}}[v(\mathcal{S}')]R = \mu^{BC}(\mathcal{S}) \\
b' :&\quad \beta\,\mathbb{E}_{\mathcal{S}',\mathcal{S}}[v(\mathcal{S}')]R^{\star} = \mu^{BC}(\mathcal{S}) - \mu^{CC}(\mathcal{S})
\end{aligned}$$

First, notice that the budget constraint will always be binding, as $\beta\,\mathbb{E}[v(\mathcal{S}')] > 0$. Then, by combining the second and third Euler equations, we have that

$$\mu^{CC}(\mathcal{S}) = \mu^{BC}(\mathcal{S})\left[1 - \frac{R^\star}{R}\right] > 0, \tag{20}$$

i.e., the constraint for foreign borrowing also binds under Assumption 1. All these arguments are conditional on positive deposits ($d' > 0$).

Inputting the optimality conditions on the value function and using the law of motion for the net worth, we have

$$V^B(\mathcal{S}, n) = [\mu^{BC}(\mathcal{S}) + \mu^{AC}(\mathcal{S}) - \theta\mu^{CC}(\mathcal{S})]a' - \mu^{BC}(\mathcal{S})d' - [\mu^{BC}(\mathcal{S}) - \mu^{CC}(\mathcal{S})]b'$$

Since the collateral constraint is always binding, let $b' = \vartheta a'$. With this, we have

$$V^B(\mathcal{S}, n) = [\mu^{BC}(\mathcal{S}) + \mu^{AC}(\mathcal{S})]a' - \mu^{BC}(\mathcal{S})d' - \mu^{BC}(\mathcal{S})b'.$$

Then, using the budget constraint, we can simplify the value function to

$$V^B(\mathcal{S}, n) = \mu^{BC}(\mathcal{S})n + \mu^{AC}(\mathcal{S})a'.$$

Finally, by using the complementary slackness of the asset constraint, we get that the value function for the banker will be given by

$$V^B(\mathcal{S}, n) = \mu^{BC}(\mathcal{S})n + \mu^{AC}(\mathcal{S})(1/\vartheta)n, \tag{21}$$

as we desired. □

Since we are interested in foreign exposure and not domestic constraints, we will make the following assumption in the future.

Assumption 2. $\vartheta = 0$.

The assumption says that banks can freely raise deposits domestically, as a consequence, we can simplify the banks value function to $v(\mathcal{S}) = 1$ for all $\mathcal{S}$.

3.5. Government

The government decides the level of public goods G_t to provide to the household. It finances these expenditures by imposing a constant tax rate τ on the firm production and by issuing one-period debt in international markets. At every t, after observing the aggregate productivity and the foreign investor stochastic discount factor, the government decides to default or repay its outstanding debt B_t. If it decides to default, the economy will enter autarky for both government and private sectors. The economy regains access to financial markets with probability ζ when in autarky. At each period, only a fraction λ of the debt matures, while the rest remains outstanding. Government also realized coupon payment, c, towards their debt stock. New bond issues is B_{t+1} at prices Q_t. The government is benevolent and maximizes the lifetime utility of public goods to the household in Equation 3. The time t budget constraint of the government that did not default

$$G_t + (\lambda + c)B_t = Q_t(B_{t+1} - (1 - \lambda)B_t) + \tau Y_t(H).$$

While under exclusion, the government budget constraint is

$$G_t = \tau Y_t(H).$$

The objective of the government is maximizing the present discounted value of the utility derived from the provision of public goods in the economy:

$$\mathbb{E}_0 \sum_{t \geq 0} \beta^t \left[\frac{G_t^{1-\chi} - 1}{1 - \chi} \right]. \tag{22}$$

3.6. Market Clearing Conditions

We now describe the market clearing conditions for this economy. Recall that under the exogenous banker exit rate, the effective aggregate net worth (N^e) today is

$$N^e = \sigma N + (1 - \sigma)\bar{n}.$$

From the banker's problem, we established that their net worth limits the supply of assets. Then, we can define an upper-bound for the amount of assets each banker can supply each period as

$$a' \leq \frac{1}{\vartheta} n.$$

Aggregating these results yields

$$A' \leq \frac{1}{\vartheta} N^e.$$

As banks supply loans to fund the purchase of capital by entrepreneurs, the market clearing condition for domestic credit is subjected to the following constraint:

$$K' = A' \leq \frac{1}{\vartheta} N^e. \tag{23}$$

The last step is determining the loan interest rate based on the bankers' problem. Using the first-order condition and the fact that the rates are known, we have that the lending rate R_A is a convex combination of domestic and foreign rates and given by

$$\mathbb{E}_{\mathcal{S}'|\mathcal{S}}[R'_K] = \theta(\mathcal{S}) R^\star + (1 - \theta(\mathcal{S})) R_D \tag{24}$$

Intuitively, if banks can raise an extra deposit unit, the lending rate will be such that there will be no arbitrage for them.

3.7. Equilibrium

We now focus on describing the equilibrium of this economy. For this, we follow the definition of Arellano et al. (2020). First, we define the equilibrium conditions for the private sector, taking the government policies as given. Then, we describe the government's recursive problem.

The aggregate state of the economy includes the aggregate shock for productivity, international lenders stochastic discount factor shock, the capital stock $\mathcal{S} = \{\omega, \kappa, K\}$, and the initial level of government debt B. Given the aggregate state, the government makes choices of default and borrowing with decision rules given by $B' = Z_B(\mathcal{S}, B)$, and $D = Z_D(\mathcal{S}, B)$.

These public sector states and choices for default D are relevant to bankers' loans, foreign borrowing, and deposit choices, as the financial autarky is imposed on the whole economy. It also affects the entrepreneurs as their investment return depends on the default decision of the government.

I now formally define the private sector equilibrium.

Definition 1. *Given an aggregate state $\mathcal{S}, B\}$; and government policies for default D; the the private equilibrium consists of*

- *bankers' policies for assets $a'(\mathcal{S}, \mathcal{B})$,foreign borrowing $x'(\mathcal{S}, B)$, and deposits $d'(\mathcal{S}, B)$;*
- *household policies for labor $L(\mathcal{S}, B)$, deposits $d'(\mathcal{S}, B)$, and consumption $C(\mathcal{S}, B)$;*
- *representative firm policies for labor $L(\mathcal{S}, B)$, and capital $K(\mathcal{S}, B)$;*
- *price functions for wages $W(\mathcal{S}, B)$, capital rental rate $R_K(\mathcal{S}, B)$ and constant deposit rates R_D;*
- *the government bond price function $Q(\mathcal{S}, B')$;*

such that (i) the policy functions of the firms satisfy their optimization problem; (ii) policy for families satisfies their optimality conditions; (iii) the bankers' policy satisfies their maximization problem under their constraints; (iv) Capital good market clear; (v) the government price schedule satisfies

$$Q(\mathcal{S}, B') = \mathbb{E}_{\mathcal{S}'|\mathcal{S}}[\Lambda[1 - Z_D(\mathcal{S}', B')]];$$

(vi) Foreign lenders break even.

Having defined the private sector equilibrium,we now describe the recursive equilibrium. I follow the standard quantitative sovereign default literature and define the value function $W(\mathcal{S}, B)$ associated with the default decision

$$W(\mathcal{S}, B) = \max_{D\in\{0,1\}} (1 - D)V(\mathcal{S}, B) + DV(\mathcal{S}^D, 0)$$

where $\mathcal{S}^H$ captures that $A^H = \theta A$, and $V(\mathcal{S}, B)$ is the value of repaying debt B and is given by

$$V(\mathcal{S}, B) = \max_{B'} \frac{G^{1-\chi} - 1}{1 - \chi} + \beta\,\mathbb{E}_{\mathcal{S}'|\mathcal{S}}\,W(\mathcal{S}', B')$$

subject to the budget constraint

$$G = \tau Y(\mathcal{S}) - (c+\lambda)B + Q(\mathcal{S}, B')(B' - (1-\lambda)B) \geq 0,$$

and the evolution of aggregate shocks.

Definition 2. *The Markov recursive equilibrium consists of government policy functions for default $D(\mathcal{S}, B)$, borrowing $B'(\mathcal{S}, B)$, and value functions $V(\mathcal{S}, B)$ and $W(\mathcal{S}, B)$ such that (i) the policy and value functions for the government satisfy its optimization problem; (ii) private equilibrium is satisfied; and (iii) the functions Z_D and Z_B are consistent.*

We now conduct a quantitative analysis of the model to test if it can replicate the data correlations.

4. Quantitative Analysis

This section builds a quantitative model, consistent with the empirical evidence in Section , to study the transmission of global risk premiums through banks' balance sheets and the real economy. Section 4.2 describes the parametrization of the model and compares the model prediction with its empirical counterparts.

4.1. Computation

The computation of our model follows the definitions for the equilibrium set in the model section. First, we guess investment policies for the bankers, and then, taking them as given, solve the government problem. With government policies, we solve the entrepreneur's problem again. We do this procedure until the policies on entrepreneurs converge.

4.2. Parametrization

We calibrate the model to represent a typical emerging market economy, ensuring consistency with our dataset. Our approach involves targeting average macroeconomic moments while leveraging cross-country heterogeneity for further decomposition. The calibration is conducted at a quarterly frequency

We calibrate the model in two steps. First, we fix a set of parameters to standard values commonly used in the literature, as reported in Table 2. Panel A lists the parameters governing the domestic economy. The capital share, α, is set to 0.30, with a quarterly depreciation rate, δ, of 0.025. The probability of reentry to the financial sector, ζ, is calibrated based on Gelos et al. (2011) and set to 0.06. The elasticity of government consumption, χ, is assigned a value of 2, which is standard in the sovereign default literature. Lastly, the parameter τ is set to target a corporate tax rate of 30%. Lastly, we set the parameter λ at 0.05 to match an average maturity of 5 years.

For foreign lenders, we follow standard practices in the literature to parameterize their stochastic discount factor. The parameter $\beta^{\star}$ is calibrated to target an annual risk-free interest rate of 3%. Additionally, the foreign lenders' Markov transition matrix, Π_{κ}, is set to reflect a quarterly probability of high-risk premia of 5% and a duration of five quarters. The persistence of the aggregate capital shock ρ_{ω} is set to 0.95, the standard of the literature.

Parameter	Description	Value
Panel A. Domestic Economy		
α	Capital share	0.3
χ	CRRA Parameter	2
ρ_{ω}	Persistence of Capital Shock	0.95
δ	Depreciation rate	0.025
τ	Corporate tax rate	0.3
ζ	Probability of re-entry	0.06
λ	Inverse of bond maturity	0.05
Panel B. Rest of the World		
$\beta^{\star}$	Lenders' discount factor	0.992
$\Pi_{\kappa}(\kappa_L, \kappa_H)$	Probability of High Risk-Premium	0.05
$\Pi_{\kappa}(\kappa_H, \kappa_L)$	Duration of High Risk-Premium	0.2

Table 2: Fixed Parameters

Note: This table presents the parameters fixed in our calibration. Panel A lists parameters relevant to the domestic economy, while Panel B focuses on those relevant to foreign lenders.

In the second step, we calibrate the model parameters to match key moments related to government default, output fluctuations, and bank exposure. Given that none of the countries in our sample defaulted on their debt during the observed period, we target an annual default probability of approximately 0.5%. To measure sovereign spreads, we rely on credit default swap (CDS) prices, which inherently include the risk premium, ensuring consistency with the model's structure. The set of calibrated parameters is presented in Table 3.

For the capital returns, we set its standard deviation η_ω to 0.0005. These parameters are chosen to match the volatility of a typical emerging country's GDP as observed in Neumeyer and Perri (2005). The parameter for the increased risk aversion κ_h is set to 1000; this and the bank's collateral constraint give that in periods of higher risk aversion, the share of foreign borrowing decreases by 50%. The parameters for the collateral constraint are set to 0.08 to match the banks' foreign exposure, as a share of total GDP. μ is chosen to match the default probability of the government. The coupon rate is set such that in the absence of default, the bond price should be equal to $\beta^\star$.

Parameter	**Description**	**Value**
η_ω	Std dev. of Capital Shock	0.0005
μ	Loss on Default	0.025
β	Domestic Discount Rate	0.987
θ	Collateral Constraint	0.08
κ_h	Lenders' risk aversion	1000

Table 3: Calibrated Parameters

Note: This table presents the parameters fixed in our calibration. Panel A lists parameters relevant to the domestic economy, while Panel B focuses on those relevant to foreign lenders.

Table 4 compares the targeted moments with the model generated moments. The model does a good job of matching the standard deviation of these emerging economies' GDP. It can also match the targeted default probability of 0.5%, and roughly matches the bank's foreign exposure. However, it does overestimates the government debt to GDP ratio and CDS standard deviations, and underestimate the CDS prices.

Now, we turn our attention to the impulse response functions generated by the model.

4.3. Impulse Responses

We now describe the time-series dynamics of our model by presenting impulse response functions of the aggregate to a positive risk aversion shock on κ. We construct the in our non-linear model following Koop et al. (1996). We simulate 10,000 paths for the model for

Table 4: Targeted Moments

Moment	**Data/Target**	**Model**
GDP (std)	3.0%	3.5%
Debt to GDP Gov.	47.70%	95.35%
Banks Foreign Debt (%GDP)	34.9	39.99
CDS basis point (mean)	154	32
CDS basis point(std)	68	136
Default Probability (annual %)	0.5	0.4

Note: This table presents the parameters fixed in our calibration. Panel A lists parameters relevant to the domestic economy, while Panel B focuses on those relevant to foreign lenders.

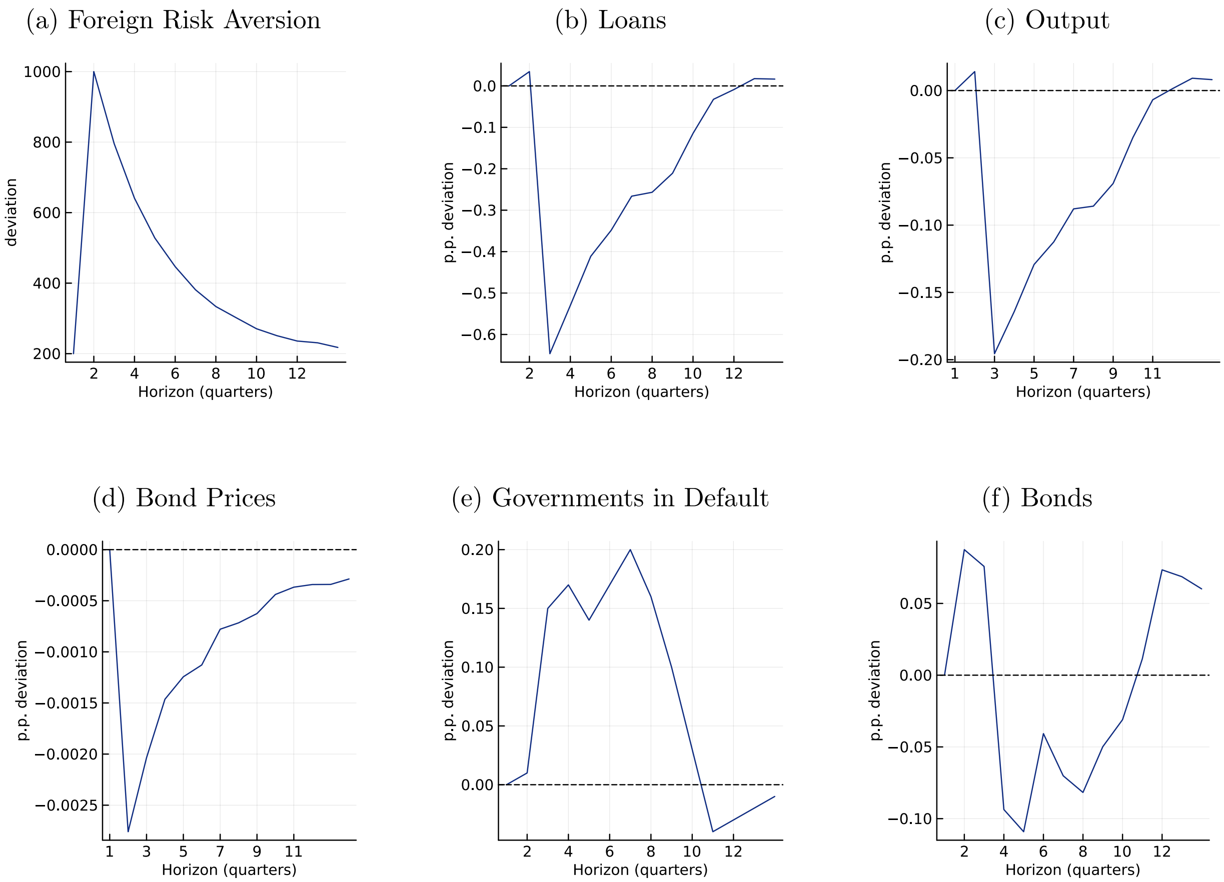
512 periods. From periods 1 to 500, the aggregate shocks follow their underlying Markov chains so that the level of government debt, capital, and default converges to their limiting distribution of endogenous states. In period 501, the *impact* period, normalized to zero in the plots, we increase all histories' κ to match the high state. From the period 501 onward the risk aversion shock follows the conditional Markov. The impulse response plot the average, across the 10,000 paths, of the variables from period 500 to 512.

In Figure 3, we plot the impulse responses to risk aversion increase for κ, loans/capital, GDP, bond prices, governments in default, and government bonds. Panel (a) shows that the average κ goes to 1000 at period 1, or the shock period. After impact the shock follows their conditional Markov transition going back to their limiting distribution in 11 periods, this is why the impulse response function is done for only 12 periods.

In Panel (b), we plot the aggregate effect of this shock on bank loans. Since the shock, limits the amount of debt banks can take from foreign lenders, they pass the increased funding costs to their investments, triggering an aggregate decrease in loans. This is in line with the empirical evidence from Di Giovanni et al. (2022). The drop in lending, at the impact, is around 0.6% at the quarter. This matches the empirical interacted Jorda-projection up to the first year. In Panel (c), we see that this drop in loans/capital causes a drop in output of around 0.2%, which roughly matches the mean response of our economies.

In Panel (d), we plot the bond prices. Similar to the empirical setting the κ shock decreases bond prices, and thus, increase the debt premium by roughly 25 basis points. This occurs

Figure 3: Response to an Increase in Foreign Risk Aversion



Notes: Impulse responses to a high-risk aversion of foreign investors.

as more banks are in default in subsequent periods, as observed in Panel (e). Since both the bond prices and amount of foreign debt of banks depend on the κ is impossible to disentangle what is the impact of banks foreign borrowing in this analysis. Thus, in the next section, we construct a counterfactual analysis where the amount of foreign borrowing by banks do not respond to κ.

4.4. Counterfactual

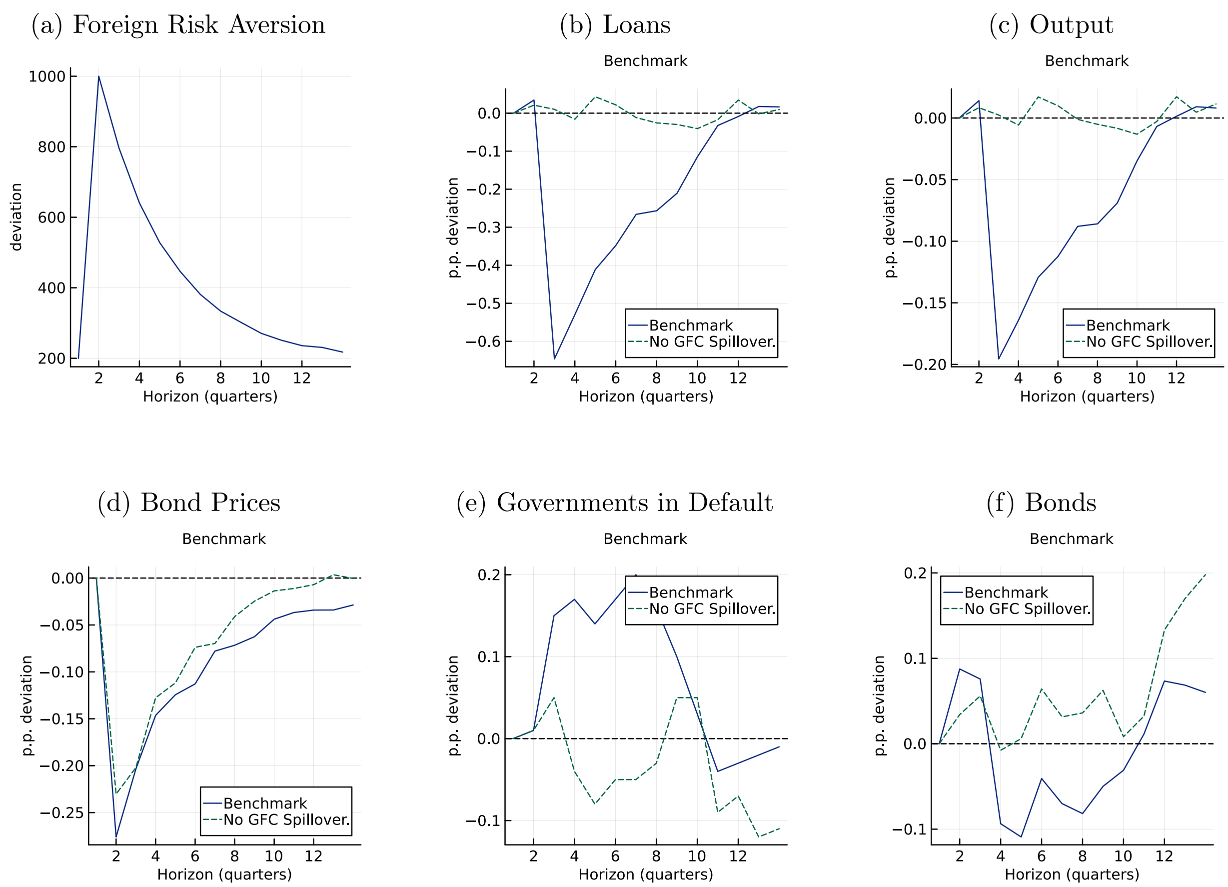
We now asses the endogenous amplification of our model coming from the banking sector. To breakdown the role of the banking credit channel and the spillover of the global financial cycle, in the counterfactual, we set θ to be constant. Thus, we fully eliminate any direct impact that the global financial might have in lending.

Figure 4 plots the benchmark impulse response functions with the counterfactual exercise. Panel (b) shows the main mechanism for the amplification of the global financial cycle. When κ increases, banks can no longer tap as much in foreign markets, thus, triggering a decrease in lending. In the counterfactual, where this does not occurs, we see that lending, and, thus, capital is quite stable. This translates to the aggregate output, as we can see from Panel (c).

To see how this credit cycle affect government default risk, we turn to Panel (d). There it is evidence the amplification that this credit channel has on sovereign risk. Although in both cases the bond prices drop due to the increased risk aversion, this drop is roughly 30% larger in the case where the credit cycles occurs. This point is even clearer when we look at Panel (e), in which, it is evident that the number of governments in default only increases in the benchmark case, and not in the counterfactual.

The counterfactual experiment highlights a possible source of heterogeneity in sovereign default risk, the exposure of the banking sector to the global financial cycle. Since as there occurs a drop in bond prices simultaneously to a decrease in economic activity, this generates more pressure on governments to repay their debt. Consequently, we observe that these economies face a higher spread on their bonds, relative to countries less exposed to it.

Figure 4: Counterfactual Response to an Increase in Foreign Risk Aversion



Notes: Impulse responses to a high-risk aversion of foreign investors.

5. Conclusion

This paper examines the critical role of the banking sector's foreign funding exposure in shaping the transmission of global financial cycles to sovereign risk. By integrating a sovereign debt model with a banking sector reliant on foreign borrowing, we provide a novel perspective on how sudden stops and global risk aversion propagate through domestic credit markets to amplify sovereign default risk.

Our findings highlight several key insights. First, we empirically document the heterogeneous impact of the global financial cycle on government risk, showing that EMEs with higher banking sector foreign borrowing experience steeper declines in lending, sharper output contractions, and more significant increases in sovereign CDS spreads during periods of heightened global risk aversion. Second, our model demonstrates that these dynamics are driven by the value-at-risk constraints imposed on foreign lenders, which tighten during global financial stress and curtail banks' access to international credit markets. This contraction reduces domestic lending, depresses economic activity, and increases sovereign default probabilities.

Furthermore, our counterfactual analysis underscores the importance of this mechanism. When the spillover of the global financial cycle to credit markets is eliminated, sovereign default risk rises significantly less as the economic transmission channel is severed. This finding emphasizes the interconnected nature of the banking sector and government risk in the context of global financial cycles.

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