Default, Inflation Expectations, and the Currency Denomination in Sovereign Bonds*

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Abstract

The share of debt denominated in local currency issued by emerging market economies has been sharply rising over time—a progress on the road of "graduation from the original sin". Yet the evidence suggests that the graduation is partial and subject to fluctuations. In this paper, I provide novel evidence that, in a large sample of countries that have adopted inflation targeting, the share of foreign-currency denominated debt is increasing in inflation expectations and default risk. I specify a New Keynesian model with inflationary default risk, where a discretionary government manages the currency denomination of debt trading off credibility with risk sharing. Quantitatively, the model suggests that anticipations of inflationary default can explain a share of up to 30% of borrowing in foreign currency. Optimal debt management can however contain inflation, default frequency, and spreads.

Key words: Sovereign Default, Inflation, Currency Denomination, New Keynesian Theory

JEL classification: E32, E52, E63, F34, H63

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1 Introduction

Foreign currency borrowing in emerging economies is often criticized as a source of vulnerability that exposes countries to the risk of economic crises. In contrast, debt denominated in domestic currency is considered as a hedge, due to state-contingency thanks to counter-cyclical inflation typically observed in emerging economies. However, many emerging economies had difficulty placing debt denominated in local currency—a phenomenon referred to as "original sin".[1]

Starting from early 2000, many emerging economies have espoused inflation targeting as in advanced economies. This practice sparked a paradigm change in emerging economies—they reduced inflation to single digits, increased the share of local currency debt in total liabilities, and employed the currency denomination of sovereign debt as a key tool for debt management. In fact, these emerging economies tilt their borrowing towards foreign currency when inflation expectations increase. Why do inflation-targeting emerging economies borrow more in foreign currency when inflation expectations are higher? How large is the welfare gain from the optimal currency denomination in sovereign bonds?

This paper develops a New Keynesian model with sovereign default to study what determines the optimal currency denomination in sovereign bonds, shedding light on dynamic patterns observed among inflation-targeting emerging economies. In the model, the monetary authority is committed not to strategically debase local currency debt, while a discretionary fiscal government cannot commit to debt repayment and future debt choices. I argue that, given that sovereign default is inflationary, despite the central bank's commitment to refrain from strategic debt debasement, discretionary governments can still opportunistically debase local currency debt. This can be achieved by heightening default risk, elevating inflation expectations—which are anchored—and ultimately, inducing an increase in the current-period inflation that reduces the real value of local currency debt. Although debt denominated in local currency offers an insurance through state-contingency associated with default risk and the aggregate productivity, extensive local currency borrowing prompts discretionary governments to debase the value of debt by increasing default risk. To address this time-inconsistency issue, governments respond by tilting their borrowing towards foreign currency, with the aim of preventing a strategic escalation of default risk (hence inflation) ex post.

The quantitative analysis of the model highlights that the extent of foreign currency borrowing in Colombia, along with its dynamic patterns, can be primarily attributed to inflationary default. Specifically, around 30% of the share of borrowing denominated in foreign currency is directly associated with the debasement mechanism facilitated by inflationary default. Addi-

[1] It was first introduced by Eichengreen, Hausmann, and Panizza (2005). Eichengreen, Hausmann, and Panizza (2023), Onen, Shin, and Von Peter (2023) and Bertaut, Bruno, and Shin (2024) use the new dataset to revisit "original sin" of emerging economies.

tionally, the model is employed to assess the welfare gain originating from the optimal currency denomination in sovereign bonds. It reveals that default frequency, spreads and inflation are lower with the optimal debt denomination, relative to a counter-factual scenario where all borrowing is conducted solely in local currency.

I begin with three stylized facts concerning the currency denomination in sovereign bonds and inflation expectations. First, using the external debt stock data by Arslanalp and Tsuda (2014), I show a positive association between inflation expectations of inflation-targeting emerging economies and (i) the proportion of foreign currency borrowing in total external borrowing. Figure 1 displays the cross-sectional median of inflation expectations and the share of foreign currency borrowing across 15 inflation targeters, revealing a positive correlation between the share of foreign currency borrowing and inflation expectations. To further support my analysis, I establish a robust positive association between inflation expectations and (ii) the relative cost of borrowing in local currency over foreign currency and (iii) default risk. The second fact illustrates that borrowing in local currency becomes more costly when expected inflation rises. The third fact provides empirical support for default being inflationary.

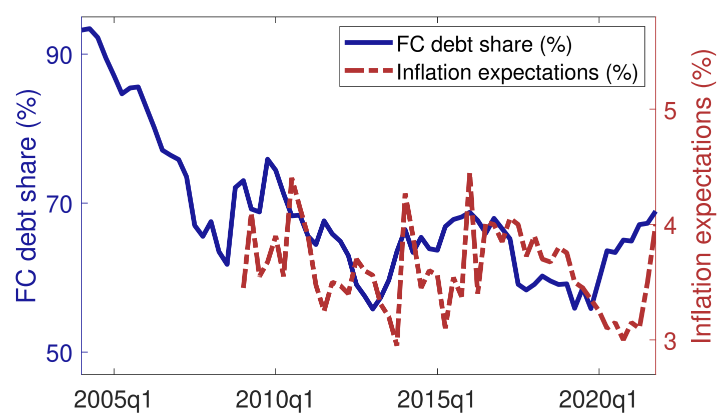

Figure 1: Comovement between FC debt share (left Y-axis) and expected inflation (right Y-axis)

To accommodate these stylized facts, I propose a New Keynesian model with sovereign default and the endogenous choice of currency denomination in sovereign bonds. As in standard New Keynesian models, inflation is shaped by forward-looking pricing decisions of firms, linking current-period inflation to both marginal cost and expected future inflation. The monetary authority is committed not to strategically debase local currency debt (as it conducts inflation-targeting monetary policy in non-crisis times). However, it deviates from strict inflation targeting by pursuing expansionary policy in states of default, leading to inflationary default in equilibrium. An optimizing government, borrowing internationally from risk-neutral lenders, cannot commit to debt repayment and future debt choices. Each period, it decides whether to default on the outstanding debt stock or not; when repayment takes place, the government further determines the amount of debt issuance and the corresponding currency denomination. I show that inflationary default establishes a mechanism for governments to strategically amplify default risk, thereby raising expected inflation and, consequently, current inflation. This deliberate maneuver serves as a means to devalue debt in local currency, which ex ante raises the relative cost of borrowing in local currency over foreign currency, especially when the government manifests a strong desire for debt debasement.

Local currency borrowing provides *hedging benefits* via two channels. On one hand, local currency debt offers a hedge against productivity fluctuations. A decline in aggregate productivity results in an increase in marginal cost, resulting in a rise in contemporaneous inflation and a decrease in the real value of local currency debt. On the other hand, debt in local currency functions as a hedge against default risk, embodying another less obvious role played by local currency borrowing. Given inflationary default, a country with high default risk experiences a surge in inflation, providing a partial relief to the associated real debt burden in local currency. The second channel, however, opens the door of strategic debasement to discretionary governments. When issuing local currency debt, the government cannot commit to repayment and future debt issuance, and the return on local currency debt depends on future inflation which is contingent on these future choices. Since future borrowing raises inflation which in turn reduces lenders' expected payoff, the price of local currency debt penalizes this lack of commitment. The price of local currency debt, as a result, falls more significantly relative to that of foreign currency for larger debt issuance.

Foreign currency debt, by contrast, provides *discipline benefits*. Since the government cannot use inflation to devalue foreign currency borrowing, by tilting its borrowing towards foreign currency, a government today can enforce discipline on future governments, refraining them from pursuing strategic debasement (via raising default risk). This discipline effect is anticipated by lenders, lowering the ex-ante cost of borrowing.

The optimal currency denomination in sovereign bonds is an equilibrium outcome characterized by the relative significance between the discipline benefits of foreign currency debt and the hedging benefits of local currency debt. When the economy exhibits a low default probability and/or economic booms, governments lack strong incentives for strategic debasement—discipline benefits are thus relatively less valuable. These are good times, also periods with *low expected inflation*, in which the government issues more local currency debt to benefit from its hedging properties. When the economy experiences a high default risk and/or downturns, the desire for debt debasement by governments gets much stronger. Consequently, the discipline benefits of foreign currency borrowing become much more valuable. These are bad times, also periods with *high expected inflation*, in which the government tilts its borrowing towards foreign currency debt to curb the desire for opportunistic debasement.

In my quantitative analysis, I calibrate the model by targeting five key moments in Colombia from 2009 to 2021, a typical emerging economy in my sample with sovereign risk. Targeted moments include (1) the average domestic interest rate, (2) the average external debt to GDP ratio, (3) the average public spending to GDP ratio, (4) the average foreign currency bond spread, and (5) the average inflation. The model aligns well with these targets, and performs well in capturing other untargeted moments. For instance, the share of foreign currency borrowing in total external borrowing predicted by the model (80%) mirrors the observed data (79%). Moreover, the model closely reproduces three relevant correlations identified in my empirical studies regarding expected inflation. Specifically, inflation expectations show positive associations with (i) the share of foreign currency borrowing (.198 in the data versus .197 in the model), (ii) the relative cost of borrowing in local currency over foreign currency (.758 versus .719) and (iii) default risk (.598 versus .892).

After fitting the model to Colombian data, I proceed to the main quantitative experiment of the paper, which involves quantifying the proportion of foreign currency borrowing driven by inflationary default. To achieve this, I construct an alternative New Keynesian model specification in which inflation is orthogonal to default, i.e., default does not impact inflation at all. Under this specification, the government loses the ability to manipulate inflation via default risk, rendering the strategic debasement channel no longer available. Consequently, the government no longer requires foreign currency borrowing for disciplining purposes, causing a sharp decline in the share of foreign currency borrowing from 80% to 50%. This suggests that around 30% of the share of foreign currency borrowing in the model featuring inflationary default can be attributed specifically to inflationary default. Additionally, under orthogonality, the government counterfactually borrows more in local currency during periods of higher expected inflation—precisely when local currency borrowing provides greater hedging benefits. This indicates that the strategic debasement mechanism arising from inflationary default restrains the government from borrowing in local currency (as it elevates borrowing costs), especially during times when the government highly values the hedging benefits provided by local currency borrowing.

I finally delve into the assessment of welfare gains from the optimal currency denomination in sovereign bonds. I conduct a counterfactual exercise where the government exclusively borrows in local currency. In this setting, the government lacks the option to borrow in foreign currency, which otherwise would serve as a key mechanism to restrain opportunistic debasement. The constraint of borrowing in foreign currency leads to a rise in inflation (from 3.62% to 4.20%), the cost of borrowing in local currency (4.94% to 5.95%), and default frequency (1.35% to 2.02%). The analysis reveals that the optimal debt denomination improves the welfare by 0.13% in units of consumption equivalents, highlighting the significance of foreign currency borrowing in disciplining discretionary governments that enhances overall welfare.

From a policy perspective, this paper sheds light on the importance of establishing fiscal discipline to facilitate local currency borrowing from abroad—the presence of fiscal discretion would trigger an upsurge in foreign currency borrowing. While, as theorized in Du, Pflueger, and Schreger (2020), a commitment by the monetary authority to refrain from strategic debasement enables countries to predominantly borrow in local currency given that fiscal governments do not feature any limited commitment, this paper highlights that a deficiency of fiscal solvency can still create opportunities for strategic debasement which, in equilibrium, heightens the share of foreign currency borrowing for displining purposes.

The literature. This paper builds on the literature on sovereign debt and the New Keynesian monetary policy. The government's problem in the model follows the standard sovereign default framework developed by Eaton and Gersovitz (1981), as in Aguiar and Gopinath (2006) and Arellano (2008). Various studies have expanded upon this framework to explore different aspects of debt management.[2] Closely related to this paper, Arellano and Ramanarayanan (2012) study the optimal debt maturity choice by the sovereign, addressing tradeoffs between discipline and hedging properties. Whereas short-term debt proves valuable for providing incentives, long-term debt offers a hedge for consumption smoothing. The optimal currency denomination in this paper also involves analogous tradeoffs—debt in local currency functions as a hedge, while debt in foreign currency prevents perverse incentive problems.[3]

This paper is also linked to sovereign default literature with nominal rigidities. Many studies have explored the interplay between defaultable sovereign debt and the downward rigidity of nominal wages. Na, Schmitt-Grohé, Uribe, and Yue (2018) assert that exchange rate depreciation associated with sovereign default is optimal, as it adjusts real wages to their efficient level. Bianchi, Ottonello, and Presno (2023) highlight a tradeoff in fiscal policy between boosting aggregate demand but potentially elevating default risk, accommodating pro-cyclical fiscal policy observed in countries with high default risk.[4] These papers, however, abstract from

[2]For instance, Cole and Kehoe (2000) investigate self-fulfilling rollover crises, recently revisited by Aguiar, Chatterjee, Cole, and Stangebye (2022) and Corsetti and Maeng (2023). Bocola and Dovis (2019) employ a quantitative model to analyze European sovereign debt crises. Chatterjee and Eyigungor (2012) and Hatchondo, Martinez, and Sosa-Padilla (2016) study the sovereign default model with long-term bonds. Ayres, Navarro, Nicolini, and Teles (2018) examine the role of expectations in sovereign default models.

[3]Similarly, Bianchi, Hatchondo, and Martinez (2018) study the optimal choice of international reserves, navigating the trade-off between insurance benefits and a rise in borrowing costs. Broner, Lorenzoni, and Schmukler (2013) and Aguiar, Amador, Hopenhayn, and Werning (2019) explore other tradeoffs associated with issuing debt with long maturity relative to the short-term one.

[4]Bianchi and Mondragon (2018) show that self-fulfilling debt crises are more likely to take place in countries lacking monetary independence. Bianchi and Sosa-Padilla (2023) emphasize a macroeconomic-stabilization hedging role for reserves in the presence of sovereign risk and downward rigidity of nominal wages.

the role of inflation expectations in affecting equilibrium allocation, as they directly impose downward rigidity on nominal wages.

To address this issue, this paper integrates sovereign default into the New Keynesian framework, where nominal rigidities stem from forward-looking price-setting by firms, thereby generating a standard New Keynesian Philips Curve that bridges contemporaneous inflation and expected inflation. I contribute to the literature by developing a framework that mirrors the salient features of many emerging economies, where central banks commit to refrain from debt debasement (via conducting inflation-targeting policy during non-crisis times) but fiscal governments carry sovereign default risk. In this regard, the goal of this paper is very similar to the goal pursued by Arellano, Bai, and Mihalache (2023), who also acknowledge the need to develop a framework reflecting the practices in many emerging economies. My work is complementary to theirs, as the primary mechanism generating inflationary default differs. I elaborate on the distinction from their work in Section 3.3.

This paper is also related to the literature following Calvo (1988) that investigates the incentives of governments to default on debt in local currency.[5] Aguiar and Amador (2013) explore the role of discretionary inflation in preventing self-fulfilling rollover crises. Galli (2020) shows that default is inflationary, as seigniorage becomes a crucial source of the government's revenue. Related, Sunder-Plassmann (2020) studies how debt ownership affects inflation with local currency borrowing.[6]

The existing literature on the optimal choice between foreign currency and local currency bonds is limited.[7] Du et al. (2020) address the time-inconsistency issue associated with monetary discretion, illustrating that countries with discretionary monetary policy tilts their borrowing towards foreign currency to avoid costly inflation ex post. Engel and Park (2022) emphasize a defaultable monetary rule as the main factor shaping the currency composition of sovereign debt. Ottonello and Perez (2019) focus on the real exchange manipulation channel that drives time-inconsistency problem of the government.[8] These studies, including mine, highlight that foreign currency borrowing serves as a mechanism to discipline the government against opportunistic

[5] Another strand of self-fulfilling debt crises literature, following Calvo (1988), is explored in Corsetti and Dedola (2016), Ayres, Navarro, Nicolini, and Teles (2019) and Lorenzoni and Werning (2019). See Corsetti and Maeng (2024) for a reappraisal.

[6] Other related work that focuses on the relationship between local currency debt and inflation includes Hurtado, Nuño, and Thomas (2023) and Hur, Kondo, and Perri (2018), who study the interaction between discretionary inflation and defaultable local currency debt. Du and Schreger (2016) show that inflation can negatively affect the balance sheets of firms.

[7] Devereux and Wu (2022) study how reserve accumulation leads to a rise in the share of local currency borrowing. Hofmann, Patel, and Wu (2022) investigate how the balance sheet mismatch of international lenders resulting from local currency lending contributes to the fragility of emerging economies' external borrowing. Lee (2022) explores the role of exogenous exchange rates and risk-averse lenders on debt denomination. Schmid, Valaitis, and Villa (2023) compare the real and nominal debt denomination under committed and discretionary taxation.

[8] Ottonello and Perez (2019) also study the role of discretionary inflation in debt denomination.

behaviours. My work, however, in contrast to theirs, focuses on how the interaction between monetary and fiscal policies affects currency denomination. I defer a full discussion of the differences between my work and theirs in Section 3.5.

The paper is organized as follows. Section 2 presents stylized facts that motivate the analysis. Section 3 describes the model and characterizes the main trade-offs involved in the choice of currency denomination in sovereign bonds. Section 4 presents quantitative results of the model and compares them to data counterparts. Section 5 concludes.

2 Empirical Findings

In this section, I document three novel empirical regularities linking inflation expectations and the sovereign's external borrowing among inflation-targeting emerging economies. I present the robust association between inflation expectations and (i) the currency denomination in external borrowing of the sovereign, (ii) the cost of borrowing in domestic local currency (LC) over that in foreign currency (FC), and (iii) default risk.

I begin by showing that, in response to an increase in inflation expectations, inflation-targeting emerging economies borrow more in foreign currency. Subsequently, I provide a rationale for the empirical relationship between the relative cost of borrowing in local currency over foreign currency and inflation expectations. Foreign lenders demand a higher compensation when lending in the local currency of emerging markets due to the heightened exposure to a significant inflation (debasement) risk associated with local currency borrowing. Lastly, I establish that default is inflationary; with higher default risk, inflation expectations are also higher. All empirical analyses are conducted at a quarterly frequency, due to data availability.

2.1 Data Description

The main variable of interest is the share of foreign currency debt in total external sovereign debt. The data for this variable are sourced from the dataset constructed by Arslanalp and Tsuda (2014), which provides information on foreign holdings of government debt issued for the period spanning from 2004Q1 to 2021Q4.[9] The dataset encompasses all major and extensively studied emerging countries. The debt stock is recorded at book value, implying that it is immune to the changes in the market prices of bonds. The sample under consideration consists of 15 inflation-targeting emerging countries, a subset of the 24 countries in Arslanalp and Tsuda (2014). Among

[9] Arslanalp and Tsuda (2014) have constructed and upheld a panel dataset documenting the currency denomination in sovereign bonds across emerging economies. This dataset, compiled from diverse data sources, has been employed in previous studies, including the work of Ottonello and Perez (2019), Du et al. (2020), Sunder-Plassmann (2020), Engel and Park (2022), Devereux and Wu (2022), and Lee (2022).

these 24 countries, I exclude all six non-targeters, namely Argentina, Bulgaria, China, Egypt, Latvia, and Lithuania. Romania, Ukraine, and Uruguay are excluded due to the unavailability of data on local currency sovereign debt spreads. To summarize, the 15 countries included in my analysis are: Brazil, Chile, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand, and Turkey.[10]

Data on inflation expectations for each emerging economy come from Bloomberg. The median values of survey data (institutional forecasts) are used to measure the expected inflation one year ahead, from 2009Q1 to 2021Q4.[11]

To assess default risk, I collect data on five-year sovereign US dollar-denominated Credit Default Swap (CDS) from Bloomberg. These Over-the-Counter derivatives quote the premium, commonly referred to as the spread, that holders of sovereign debt can pay to fully insure themselves against credit events such as sovereign default. This measure has been extensively adopted in other studies as an indicator of sovereign default risk.[12]

To measure the cost of borrowing in local currency, I employ the five-year local currency bond spread ($spread_{DS,it}$) from Du and Schreger (2016) and add the US five-year treasury rates back to the spreads to recover five-year zero-coupon local currency bond yields y_{it}^{LC}, in accordance with the approach outlined in Lee (2022). For the cost of borrowing in foreign currency, following Du et al. (2020), I use five-year sovereign US dollar-denominated CDS spreads ($CDS_{\$,it}$) along with the US five-year treasury rates to formulate five-year zero-coupon foreign currency bond yields y_{it}^{FC}. Therefore, the costs of borrowing in foreign and local currency, respectively, are measured as follows:

$$
\begin{aligned}
y_{it}^{FC} &= CDS_{\$,it} + y_{it}^{US} \\
y_{it}^{LC} &= spread_{DS,it} + y_{it}^{US}
\end{aligned}
$$

I incorporate macro controls in my regressions: year-over-year real exchange rate depreciation, year-over-year inflation, year-over-year real GDP growth, external sovereign debt to GDP ratio, capital openness index, and private credit to GDP ratio. The data are collected from FRED, CEIC, the IMF IFS dataset, World Bank WDI dataset, and Chinn and Ito (2006). I argue that the

[10]It is noteworthy that both India and Russia started to adopt inflation targeting in 2015. In my empirical analysis, I exclude periods in these two countries when inflation targeting was not adopted. The complete exclusion of India and Russia from the analysis does not qualitatively alter any of the obtained results. The details of the years of inflation targeting in my sample, along with a comprehensive graphical depiction of the data, are provided in Appendix A.

[11]The inflation expectations data in a quarterly frequency is limited to a maximum horizon of one year. In Appendix B, a robustness check is conducted using expected inflation with shorter time horizons. Note that inflation swaps, commonly used to gauge inflation expectations, are not traded in all 15 emerging countries of my sample. The survey data are the only available source for inflation expectations.

[12]See, for instance, Galli (2020).

positive correlations between expected inflation and (i) the currency denomination in external borrowing of the sovereign, (ii) the cost of borrowing in domestic local currency (LC) over that in foreign currency (FC), and (iii) default risk, are not driven by a spurious correlation between macro controls and inflation expectations.

2.2 Currency Denomination

I first examine the correlation between the share of external sovereign borrowing in foreign currency and inflation expectations. The foreign currency debt share of country i at time t is denoted as $FCshare_{it}$:

$$FCshare_{it} = \frac{\text{Foreign held foreign currency sovereign debt}_{it}}{\text{Foreign held total sovereign debt}_{it}}$$

I run the country and time fixed effect panel regression in quarterly frequency, which takes the following form:

$$FCshare_{it} = \alpha_i + T_t + \beta \mathbb{E}_t[\pi_{i,t+4}] + \Gamma' X_{it} + \epsilon_{it}$$

where $\mathbb{E}_t[\pi_{i,t+4}]$ denotes inflation expectations one year ahead. The country-specific macro controls X_{it} include year-over-year inflation, year-over-year real exchange rate depreciation, year-over-year real GDP growth, external sovereign debt to GDP ratio, capital openness index, and private credit to GDP ratio.

The regression estimates are reported in column (1) and (2) of Table 1. Column (1) displays the estimate of the regression that only includes inflation as a macro control. These estimates reveal a positive association between the share of FC debt and inflation expectations—an increase in expected inflation by one percentage point is associated with 1.7-2.0 percentage points higher foreign currency share of external debt.[13]

As the data on debt stocks are measured at their book values, any changes in valuation arise only from movements in nominal exchange rates. Specifically, when the local currency depreciates, the book value of local currency debt falls relative to that of foreign currency debt, resulting in a mechanical increase in the share of foreign currency borrowing. To address the nominal exchange rate valuation effect, I adopt the approach proposed by Lee (2022), using the exchange rate against the US dollar in 2010Q1 throughout the sample periods.[14] The corresponding

[13]By contrast, inflation itself has no explanatory power on FC debt share, which aligns with the existing literature that finds a zero correlation between inflation and the share of foreign currency borrowing, referred to as 'the mystery of original sin'. See, for instance, Hausmann and Panizza (2003), Eichengreen et al. (2005) and Engel and Park (2022) for details.

[14]This approach implicitly posits that all foreign currency borrowing is denominated in the US dollar.

Table 1: FC Debt Share and Inflation Expectations

	FC debt share $FCshare$ (%)		Adjusted FC debt share $FCshare^{ADJ}$ (%)	
	(1)	(2)	(3)	(4)
$\mathbb{E}_t[\pi_{i,t+4}]$ (%)	2.003***	1.739***	1.316***	1.262***
	(0.371)	(0.365)	(0.324)	(0.320)
Inflation (%)	0.168	0.270	0.00388	0.0439
	(0.188)	(0.184)	(0.169)	(0.163)
Real Exchange Rate Depreciation (%)		-0.0907**		-0.0617*
		(0.0386)		(0.0351)
Real Exchange Rate Depreciation (%)		-0.0907**		-0.0554
		(0.0386)		(0.0351)
External Sovereign Debt to GDP (%)		-0.299***		-0.439***
		(0.0675)		(0.0677)
Capital Openness		-1.007		2.218***
		(0.711)		(0.627)
Private Credit to GDP (%)		-0.0976**		-0.0276
		(0.0411)		(0.0399)
Observations	639	639	639	639
R-squared	0.942	0.947	0.948	0.956

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are reported in parentheses. All specifications include country and quarterly date fixed effects. In column (1) and (2), the dependent variable is the share of FC debt in total public external debt; in column (3) and (4), the dependent variable is the share of nominal exchange rate adjusted FC debt in total public external debt.

exchange-rate-adjusted share of foreign currency borrowing is denoted as $FCshare_{it}^{ADJ}$:

$$FCshare_{it}^{ADJ} = \frac{\text{Foreign held foreign currency sovereign debt, using 2010Q1 exchange rate}_{it}}{\text{Foreign held total sovereign debt, using 2010Q1 exchange rate}_{it}}$$

Column (3) and (4) of Table 1 report the estimates using $FCshare^{ADJ}$ as a dependent variable. The coefficient estimates, while quantitatively smaller after accounting for mechanical fluctuations, remain substantial, ranging from 1.26 to 1.32.[15]

The positive correlation between the share of foreign currency debt and inflation expectations remains robust across various specifications. Table B1 provides a summary of regression results, taking the first difference of each variable to investigate how the net stock of debt changes in response to changes in inflation expectations. The estimates indicate that the sovereign issues more debt denominated in foreign currency relative to the local currency when inflation

[15]The positive correlation between the exchange-rate-adjusted FC debt share and inflation expectations remains robust regardless of the specific quarterly date chosen as the base date for the nominal exchange rate.

expectations increase. Table B2 reports results dropping time fixed effects and introducing global control variables. I find the estimates in Table B2 quantitatively similar to the benchmark regression (1) and (2) in Table 1, due to the fact that time fixed effects have already accounted for any common, time-varying component (e.g., global factors) for each emerging market sovereign over the periods. Table B3 compares the results using inflation expectations for different time horizons, spanning one quarter, six months, and one year.[16] Inflation expectations for the longest time horizon (one-year expectations in my sample) show the greatest explanatory power regarding the share of foreign currency debt.

To summarize, inflation-targeting emerging economies tend to borrow more in foreign currency when inflation expectations rise. That is to say, these countries borrow more in foreign currency when local currency borrowing offers more hedges (i.e., higher inflation expectations).

2.3 Relative Costs of Borrowing and Default Risk

In this subsection, I investigate how the relative cost of borrowing in local currency over foreign currency and default risk vary with inflation expectations. I initiate the analysis with the following panel fixed effect regression, regarding the relative cost of borrowing in LC over FC:

$$y_{it}^{LC} - y_{it}^{FC} = \alpha_i + T_t + \beta \mathbb{E}_t[\pi_{i,t+4}] + \Gamma' X_{it} + \epsilon_{it}$$

where y_{it}^{LC} and y_{it}^{FC}, respectively, are the five-year zero-coupon local and foreign currency bond yield.

Columns (1) and (2) of Table 2 present the results of the regression outlined above. A one percentage point increase in inflation expectations is positively associated with a 0.498-0.545 percentage point increase in the excess cost of borrowing in local currency over foreign currency. In other words, when inflation expectations are higher, foreign lenders require more compensation when lending in the local currency relative to the foreign currency. In Table B4, I also report the elasticity of five-year local and foreign currency bond yields to inflation expectations, indicating that the estimated elasticity is 4 times larger for the local currency bond yield compared to the foreign currency bond yield—the cost of borrowing in local currency is more sensitive to changes in inflation expectations relative to that in foreign currency.

Now I shift the focus to the relationship between default risk and inflation expectations. I set five-year sovereign US dollar-denomiated CDS spread ($CDS_{\$,it}$) as a dependent variable. The corresponding estimates are reported in Column (3) and (4) of Table 2. A one percentage point increase in inflation expectations is associated with a 0.165-0.169 percentage point increase in

[16] Expected inflation longer than one year is not available in a quarterly frequency.

Table 2: Relative Cost of Borrowing in LC over FC, Default Risk, and Inflation Expectations

	LC Yield over FC Yield $y_{it}^{LC} - y_{it}^{FC}$ (%)		CDS Spread $CDS_{\$,it}$ (%)	
	(1)	(2)	(3)	(4)
$\mathbb{E}_t[\pi_{i,t+4}]$ (%)	0.498***	0.545***	0.169***	0.165***
	(0.0800)	(0.0798)	(0.0299)	(0.0306)
Inflation (%)	0.130***	0.0975***	0.0947***	0.0772***
	(0.0307)	(0.0310)	(0.0157)	(0.0146)
Real Exchange Rate Depreciation (%)		0.0140*		-0.0107***
		(0.00724)		(0.00258)
Real GDP Growth Rates (%)		-0.0167		0.00540
		(0.0247)		(0.00899)
External Sovereign Debt to GDP (%)		0.0286***		0.0473***
		(0.0110)		(0.00604)
Capital Openness		0.506***		-0.339***
		(0.164)		(0.0635)
Private Credit to GDP (%)		0.0284***		0.00435
		(0.00999)		(0.00478)
Observations	511	511	559	559
R-squared	0.858	0.870	0.774	0.821

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are reported in parentheses. All specifications include country and quarterly date fixed effects. In column (1) and (2), the dependent variable is the relative cost of borrowing in LC over FC; in column (3) and (4), the dependent variable is five-year US dollar-denominated CDS spread.

CDS spread. This result suggests that default risk is positively associated with high expected inflation, implying that default is inflationary.

Replacing time fixed effects with global factors does not qualitatively alter the results, as shown in Tables B5 and B6. Remarkably, in all these specifications, the significance of expected inflation persists in explaining the relative cost of borrowing in local currency over foreign currency and default risk.

2.4 Summary

The key takeaway from this section is that, when expected inflation rises, (i) inflation-targeting emerging economies tend to borrow more in foreign currency relative to the local currency, (ii) the excess cost of borrowing in local currency relative to the foreign currency increases, and (iii) default risk escalates. As expected inflation increases, borrowing in local currency becomes more costly, leading the government to shift borrowing towards foreign currency. In the subsequent section, I construct a New Keynesian model with sovereign default to illustrate that inflationary default plays a pivotal role in determining the relative cost of borrowing in local currency over foreign currency, thus shaping the currency denomination of sovereign debt.

3 Model

In this section, I develop a small open economy New Keynesian model incorporating sovereign default and an endogenous choice of currency denomination in sovereign bonds. In this environment, the monetary authority is committed to abstaining from strategically debasing local currency debt, and yet borrowing in local currency can still be debased by a discretionary fiscal government. Given inflationary default, the government may strategically raise the default risk and thereby inflation expectations, which ultimately drives up the current-period inflation. Foreign currency borrowing then serves to discipline this opportunistic debasement (via raising default risk ex post), reducing the overall borrowing costs and enhancing the welfare.

3.1 Environment

The model includes households, final goods firms, intermediate goods firms, the central bank, a benevolent government conducting fiscal policy, and a continuum of risk-neutral competitive foreign lenders with measure one. Time is discrete and indexed by $t = 0, 1, 2, \cdots$. The government has the discretion to decide whether to default or repay. When choosing repayment, it issues non-state-contingent defaultable debt in two currencies: local currency (LC) and foreign currency (FC).

Notably, the model includes only one type of final goods, which is either produced using all varieties of intermediate goods or imported from abroad. This design eliminates the possibility of the government manipulating the real exchange rate to reduce the local currency debt burden. Throughout the paper, the primary distinction between FC and LC debt lies in their susceptibility to debasement risk.

3.1.1 Households

Households get utility from the consumption of private goods C_t and public spending G_t, while incurring disutility by supplying labor N_t to intermediate good firms. Their preferences are given by:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(C_t, G_t, N_t)$$

where the utility function exhibits strong separability and is given by

$$u(C_t, G_t, N_t) = \frac{C_t^{1-\gamma} - 1}{1-\gamma} + \alpha_G \frac{G_t^{1-\gamma} - 1}{1-\gamma} - \frac{N^{1+1/\zeta}}{1+1/\zeta} \tag{1}$$

Households take prices and policies as given and choose the private consumption, labor supply, and holdings of domestic bonds B_t^d. Domestic bonds are risk-free and denominated in local currency and can only be traded among domestic households.

Households are hired and earn labor income $W_t N_t$. In addition, they accrue profits from several other sources, and these profits are independent of and unaffected by the individual decisions of atomistic households. Hence, I summarize their total profits with the variable Ψ_t. The government levies taxes on households in a lump-sum manner, deducting a fraction τ from their total revenue. Their budget constraint is given by

$$P_t C_t + Q_t^d B_{t+1}^d = (1-\tau)(W_t N_t + \Psi_t) + B_t^d$$

where Q_t^d is the price of domestic bonds. Combining the first-order conditions for the private consumption, labor supply and domestic bonds, households' problem is characterized by the intratemporal labor-consumption margin and the Euler equation:

$$-\frac{u_{N,t}}{u_{C,t}} = w_t \tag{2}$$

$$u_{C,t} = i_t \beta \mathbb{E}_t \left[\frac{u_{C,t+1}}{\pi_{t+1}} \right] \tag{3}$$

$u_{x,t}$ denotes marginal utility with respect to variable x in period t; the real wage is $w_t \equiv W_t/P_t$; inflation is $\pi_t \equiv P_t/P_{t-1}$; the nominal domestic interest rate is the yield of domestic bonds $i_t \equiv 1/Q_t^d$.

3.1.2 Final Goods Firms

The representative final goods firm produces with technology

$$Y_t = \left[\int_0^1 y_{jt}^{\frac{\eta-1}{\eta}} dj \right]^{\frac{\eta}{\eta-1}}$$

where y_{jt} is the use of differentiated intermediate goods of type $j \in [0,1]$, and η captures the degree of substitutability of intermediate goods in the production of final goods. The optimization problem of final goods firms yields the demand function for intermediate goods j:

$$y_{jt} = \left(\frac{p_{jt}}{P_t}\right)^{-\eta} \Upsilon_t \tag{4}$$

where p_{jt} is the price of intermediate good j at time t. The price of final goods P_t is the price index $P_t = \left(\int_0^1 p_{jt}^{1-\eta} dj\right)^{1/(1-\eta)}$.

3.1.3 Intermediate Goods Firms

Each intermediate goods firm j produces using the labor as an input, taking aggregate productivity as given. Following Arellano (2008) and Chatterjee and Eyigungor (2012), aggregate productivity depends on the credit standing of the sovereign Ξ_t. Aggregate productivity in a good credit standing z_t is higher than that in a bad credit standing z_t^D. In Section 3.1.4, I elaborate on how the credit standing Ξ_t is contingent upon the repayment and default choices made by the sovereign. The production function of intermediate good j is then characterized by:

$$y_{jt} = \begin{cases} z_t n_{jt} & \text{Good Credit Standing } \Xi_t = 1 \\ z_t^D n_{jt} & \text{Bad Credit Standing } \Xi_t = 0 \end{cases} \tag{5}$$

where n_{jt} is the amount of labor used by the firm j.

Intermediate goods firms encounter the price-setting friction, involving a convex quadratic adjustment cost if they do not raise their prices to meet the inflation target $\bar{\pi}$ set by the central bank, as in Rotemberg (1982). A firm j's profit in period t is given by:

$$\widetilde{\Psi}_{jt} = p_{jt} y_{jt} - (1-\tau^N) W_t n_{jt} - \frac{\varphi}{2}\left(\frac{p_{jt}}{p_{jt-1}} - \bar{\pi}\right)^2 P_t \Upsilon_t \tag{6}$$

Firms receive a constant labor subsidies $1-\tau^N = (\eta-1)/\eta$, which is designed to correct the markup in intermediate goods markets.[17] Additionally, I assume that the aggregate resources dedicated to price changes—the last term in equation (6)—are rebated back to the households.[18]

[17] In line with the standard practice in the New Keynesian literature, I introduce a labor subsidy aimed to eliminate average inefficiencies induced by monopolistic competition.

[18] Alternatively, if one posits that inflation incurs a real resource cost (negligible at the first-order but not for higher orders), this would significantly impact the equilibrium allocation due to the pronounced non-linearity of sovereign default models. For instance, elevated inflation during default periods would impose a substantial resource-draining quadratic cost, mechanically reducing the attractiveness of default. With reasonable parameter values, I find that the resource-draining cost either renders default always suboptimal for the government, or leads to a larger degree of output loss in a recession (as inflation is higher) than in booms—default then occurs during booms rather than busts. Since the primary focus of the paper does not revolve around how the resource-draining cost shapes the government's decision to default, I abstract from delving into this aspect by rebating back price-adjustment costs to

In other words, the households are presumed to own the "price-adjusting agency". The total profit rebated back to households each period, the owner of both intermediate goods firms and "pricing-adjusting agency", can then be represented as follows:

$$\Psi_t = \int_0^1 \widetilde{\Psi}_{jt} dj + \int_0^1 \frac{\varphi}{2}\Big(\frac{p_{jt}}{p_{jt-1}} - \bar{\pi}\Big)^2 P_t \Upsilon_t dj$$

Now I characterize the intermediate good firm's optimization problem. Each period, a firm j, taking the nominal wage W_t and the final good price P_t as given, chooses n_{jt} and p_{jt} dynamically to maximize expected discounted profits subject to the demand schedule (4), the technology (5) and the profit (6):

$$\max_{n_{jt}, p_{jt}} \mathbb{E}_0 \sum_{t=0}^{\infty} M_{0,t} \widetilde{\Psi}_{jt} \text{ where } M_{0,t} \equiv \beta^t \frac{u_{C,t} P_0}{u_{C,0} P_t}$$

Note that, the profits are discounted using the stochastic discount factor of households, denoted as $M_{0,t}$, the owners of the firms.

Upon a good credit standing (i.e., aggregate productivity is equal to z_t), the optimality condition for each intermediate goods firm, after imposing symmetry across all firms ($p_{jt} = P_t$) and a labor subsidy $1 - \tau^N = (\eta - 1)/\eta$, is:

$$\big(\pi_t - \bar{\pi}\big)\pi_t = \frac{\eta - 1}{\varphi}\Big(\frac{w_t}{z_t} - 1\Big) + \beta \mathbb{E}_t \Bigg[\frac{u_{C,t+1}}{u_{C,t}}\big(\pi_{t+1} - \bar{\pi}\big)\pi_{t+1}\frac{\Upsilon_{t+1}}{\Upsilon_t}\Bigg] \tag{7}$$

This equation features a New Keynesian Phillips Curve (NKPC) that links inflation to contemporaneous marginal cost (w_t/z_t), and inflation expectations. Note that, under a bad credit standing in period t, z_t is replaced with z_t^D in (7).

3.1.4 Government

A benevolent government makes default/repayment (and currency denomination) decisions trying to maximize the expected utility of households. However, it has a discount factor β_G that is different from that of households. The objective function of the government is:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta_G^t u(C_t, G_t, N_t)$$

At the beginning of each period, under a good credit standing in the prior period ($\Xi_{t-1} = 1$), the government can choose whether to default ($D_t = 1$) or to repay maturing debt ($D_t = 0$).

households. The role of resource-draining inflation in models with high non-linearity is explored in Freund, Lee, and Rendahl (2023).

If the decision is to repay, the government maintains a good credit standing ($\Xi_t = 1$), issues external debt to foreign lenders, and determines the currency denomination of these bonds. The government's real budget constraint, given full debt repayment, is

$$G_t + B_{FC,t} + \frac{B_{LC,t}}{\pi_t} = Q_{FC,t}B_{FC,t+1} + Q_{LC,t}B_{LC,t+1} + \tau(w_t N_t + \psi_t) - \tau_N w_t N_t$$

where $B_{x,t}$ and $Q_{x,t}$ ($x \in \{FC, LC\}$) denote, respectively, the maturing debt obligations and the bond price denominated in currency x at time t. $\tau(w_t N_t + \psi_t)$ corresponds to the real revenue tax raised from households, encompassing both the real labor income $w_t N_t$ and total profit ψ_t. Labor subsidies $\tau_N w_t N_t$ are imposed to reduce the average markup to zero among intermediate goods firms. After incorporating labor subsidies, the equilibrium budget constraint becomes:

$$G_t + B_{FC,t} + \frac{B_{LC,t}}{\pi_t} = Q_{FC,t}B_{FC,t+1} + Q_{LC,t}B_{LC,t+1} + \tau z_t N_t \tag{8}$$

The term $z_t N_t$ represents the country's output. The fiscal government collects tax revenue in a lump-sum manner, equivalent to τ of the economy's output, borrows from foreign lenders, and repays the outstanding stock of debt. Note that, the only difference between FC and LC debt in this environment is whether debt repayment is subject to debasement risk or not.

When the government has a bad credit standing ($\Xi_t = 0$), the aggregate productivity declines to z_t^D, and the government loses access to borrowing from foreign lenders. The credit standing turns bad if the government decides to default in the current period ($\Xi_{t-1} = 1$ and $D_t = 1$).[19] Additionally, I posit that, if the credit standing in the previous period was bad ($\Xi_{t-1} = 0$), the government may regain access to the international financial market with zero outstanding debt for an exogenous probability ι. If it chooses not to default immediately again, the government regains a good credit standing.

Hence, a bad credit standing arises in equilibrium if the government defaults in the current period ($\Xi_{t-1} = 1$ and $D_t = 1$), or if it had a bad credit standing in the previous period ($\Xi_{t-1} = 0$) and failed to reenter the financial market. The evolution of the credit standing in equilibrium is

[19] The government cannot selectively default on debt—once it defaults, it defaults on the entire outstanding stock of debt, irrespective of the currency denomination. Selective default for different owners of debt is challenging due to the secondary market trading of sovereign bonds.

therefore given by[20]

$$\Xi_t = \begin{cases} 1 & \text{if } (\Xi_{t-1} = 1 \text{ and } D_t = 0) \text{ or} \\ & \quad (\Xi_{t-1} = 0 \text{ and the re-entry occurs}) \\ 0 & \text{if } (\Xi_{t-1} = 1 \text{ and } D_t = 1) \text{ or} \\ & \quad (\Xi_{t-1} = 0 \text{ and the re-entry fails to occur}) \end{cases}$$

The real budget constraint under a bad credit standing in equilibrium is:

$$G_t = \tau z_t^D N_t \tag{9}$$

3.1.5 Foreign Lenders

Foreign lenders are risk-neutral, with deep pockets that rule out corner solutions in each lender's problem. Hence, the bond price satisfies the break-even condition, equating the expected return on sovereign debt to the world risk-free return R^*—lenders receive compensation for any expected losses from either default or debasement:

$$Q_{FC,t} = \frac{1}{R^*}\mathbb{E}_t[1 - D_{t+1}]$$
$$Q_{LC,t} = \frac{1}{R^*}\mathbb{E}_t\left[\frac{1 - D_{t+1}}{\pi_{t+1}}\right]$$

where D_{t+1} denotes the government's decision to default ($D_{t+1} = 1$) or to repay ($D_{t+1} = 0$) in period $t + 1$. The foreign currency bond price $Q_{FC,t}$ captures default risk, whereas the local currency one $Q_{LC,t}$ incorporates both default and debasement risk.

3.1.6 Central Bank

I assume that, given a good credit standing ($\Xi_t = 1$), the central bank aims to achieve an inflation target $\bar{\pi}$ by determining the nominal interest rate through an interest rate rule—it commits not to debase local currency borrowing strategically:

$$i_t = \bar{i}\left(\frac{\pi_t}{\bar{\pi}}\right)^{\alpha_P} \text{ with } \alpha_P > 1 \tag{10}$$

[20] Note that, in equilibrium, the government always prefers not to default immediately after re-entry, as defaulting with zero debt is never optimal due to a fall in productivity from z_t to z_t^D.

Under a bad credit standing ($\Xi_t = 0$), the interest rate rule is expansionary, characterized by the rule below:

$$i_t = (\bar{i} - \Delta)\left(\frac{\pi_t}{\bar{\pi}}\right)^{\alpha_P} \text{ with } \alpha_P > 1 \text{ and } \Delta > 0 \tag{11}$$

Note that this expansionary interest rate rule (11) is crucial to make default *inflationary*. If, instead, the interest rate rule follows (10) upon default, with reasonable parameterization, default would be *deflationary* rather than *inflationary*, contradicting the empirical evidence of a positive co-movement between inflation expectations and default risk presented in Section 2.

Moreover, the expansionary monetary rule (11) can be rationalized by the empirical observation that default is associated with a period of fiscal distress. Consequently, following a default and periods of exclusion from the international financial market, the central bank experiences pressure to implement a relatively loose monetary policy for other objectives besides bringing down inflation to the target.[21] This reduced-form expansionary monetary rule reflects the notion that, in default periods (characterized by a bad credit standing in my model), the monetary authority pursues not only the goal of controlling the inflation rate to the target but also other objectives that are not explicitly modelled in my environment.[22] Those additional objectives exert inflationary pressure on the economy, ultimately making default inflationary. In Section 3.3, I explore the relationship among default, interest rate rules, and inflation, and highlight the necessity of the expansionary monetary rule (11) for the inflationary default.

3.2 Government Recursive Problem

I focus on recursive Markov equilibria and describe the decision problem of a discretionary government over infinite horizons. The model features one exogenous state, aggregate productivity z, which follows a Markov process with support Z and a transition function $f(z, z')$. Three endogenous states are, respectively, the stocks of debt with different currency denomination, $\vec{\mathcal{B}} \equiv [B_{FC}, B_{LC}]'$, and the past credit standing Ξ_{-1} that is equal to one if the government had good credit standing in the previous period. The state of the government is given by $(z, \vec{\mathcal{B}}, \Xi_{-1})$.

With a good credit standing in the past ($\Xi_{-1} = 1$), the value to the government $V(z, \vec{\mathcal{B}}, \Xi_{-1})$, considering the option to default, is

$$V(z, \vec{\mathcal{B}}, 1) = \max_{D \in \{0,1\}} \left\{ (1 - D) \times V^R(z, \vec{\mathcal{B}}) + D \times V^D(z) \right\}$$

[21] Galli (2020) presents evidence of a positive co-movement between default and inflation, suggesting that during times of default, the central bank adopts a loose monetary policy stance to support the fiscal government through monetary financing (seigniorage).

[22] For instance, default leads to a fall in productivity, resulting in lower output in my framework. The central bank may therefore experience pressure to mitigate default-induced output loss by pursuing expansionary monetary policy. See Na et al. (2018) for details.

where $V^R(z, \vec{\mathcal{B}})$ denotes the utility of repaying debt

$$V^R(z, \vec{\mathcal{B}}) = \max_{\vec{\mathcal{B}}'} u(C, G, N) + \beta_G \int_{z'} V(z', \vec{\mathcal{B}}', 1) f(z, z') dz' \tag{12}$$

subject to the government's budget constraint (8), the private equilibrium schedule and bond price schedules. I fully characterize both the private equilibrium and bond price (schedules) later in Section 3.2.1 and 3.2.2. The credit standing remains good ($\Xi = 1$) if full repayment takes place.

If the government defaults, the credit standing turns bad ($\Xi = 0$) and it receives the utility of defaulting $V^D(z)$ subject to the budget constraint (9) and the private equilibrium upon default:[23]

$$V^D(z) = u(C^D, G^D, N^D) + \beta_G \int_{z'} \left[\iota V^{Enter}(z', \vec{\mathbf{0}}) + (1 - \iota) V^D(z') \right] f(z, z') dz'$$

Note that, private equilibrium variables in a bad credit standing are now superscribed by the capital D. $V^{Enter}(z, \vec{\mathbf{0}})$ represents the utility when re-entry occurs, with its value being equal to $V(z, \vec{\mathbf{0}}, 1)$. Here, $\vec{\mathbf{0}} \equiv (0, 0)$ is the zero-debt vector, indicating that governments with a bad credit standing in the previous period, if they reenter the financial market (happening with a probability ι), do so with zero debt.

The default policy of a discretionary government can be characterized by repayment and default sets. I define the repayment set $\mathcal{R}(\vec{\mathcal{B}})$ as the set of aggregate productivity for which the repayment is optimal for initial debt levels $\vec{\mathcal{B}} = [B_{FC}, B_{LC}]'$:

$$\mathcal{R}(\vec{\mathcal{B}}) = \{z \in Z : V^R(z, \vec{\mathcal{B}}) \geq V^D(z)\}$$

and the complement—the default set $\mathcal{D}(\vec{\mathcal{B}})$—is the set of aggregate productivity for which default is optimal for outstanding obligations $\vec{\mathcal{B}}$:

$$\mathcal{D}(\vec{\mathcal{B}}) = \{z \in Z : V^R(z, \vec{\mathcal{B}}) < V^D(z)\}$$

Given that the government fulfills its debt obligations, the optimal debt choice is characterized by two policy functions that map today's state into tomorrow's debt levels:

$$\vec{\widetilde{\mathbb{B}}}(z, \vec{\mathcal{B}}) \equiv \begin{pmatrix} \widetilde{\mathbb{B}}_{FC}(z, \vec{\mathcal{B}}) \\ \widetilde{\mathbb{B}}_{LC}(z, \vec{\mathcal{B}}) \end{pmatrix}$$

With this characterization of debt and default decisions, I can now define private equilib-

[23] $V^D(z)$ is also equal to the utility in a history of bad credit standing ($\Xi_{-1} = 0$) and the reentry fails to occur.

rium and equilibrium bond prices, which the sovereign takes into account when making fiscal decisions.

3.2.1 Private Equilibrium (Schedules)

First, I establish the private equilibrium given that the government has a good credit standing in the current period ($\Xi = 1$):[24]

$$\text{Domestic Euler:} \quad u_C = \beta i \left[\int_{\mathcal{R}(\vec{\mathcal{B}}')} f(z,z') \frac{u_{C'}}{\pi'} dz' + \int_{\mathcal{D}(\vec{\mathcal{B}}')} f(z,z') \frac{u_{C^{D'}}}{\pi^{D'}} dz' \right] \tag{13}$$

$$\text{Real Wage:} \quad w = -\frac{u_N}{u_C} \tag{14}$$

$$\text{Household Budget:} \quad C = (1-\tau) z N \tag{15}$$

$$\begin{aligned} \text{NKPC:} \quad (\pi - \bar{\pi})\pi = \frac{\eta - 1}{\varphi}\left(\frac{w}{z} - 1\right) + \beta \Bigg[& \int_{\mathcal{R}(\vec{\mathcal{B}}')} f(z,z') \frac{u_{C'} z' N'}{u_C z N} (\pi' - \bar{\pi})\pi' dz' \\ & + \int_{\mathcal{D}(\vec{\mathcal{B}}')} f(z,z') \frac{u_{C^{D'}} z^{D'} N^{D'}}{u_C z N} (\pi^{D'} - \bar{\pi})\pi^{D'} dz' \Bigg] \end{aligned} \tag{16}$$

$$\text{Interest Rate Rule:} \quad i = \bar{i} \left(\frac{\pi}{\bar{\pi}} \right)^{\alpha_p} \tag{17}$$

Private equilibrium conditions (13)-(15) come from households' optimization problem in Section 3.1.1; equation (16) is from Section 3.1.3, intermediate goods firms' problem that produces the New Keynesian Philips Curve (NKPC); the interest rate rule conducted by the central bank in a good credit standing (17) is from Section 3.1.6.[25]

Due to the strong separability among C, G and N in the utility function (1), changes in government expenditure G alone does not affect the private allocation at all. G does not affect u_C and u_N, and none of variables in (13)-(17) are directly related to G—the private allocation stays invariant with the changes in G.

Instead, the private allocation hinges on the default risk.[26] For instance, an increase in sovereign debt issuance, which elevates default risk, expands the set $\mathcal{D}(\vec{\mathcal{B}}')$. Since default is inflationary, this expansion leads to higher expected inflation, prompting an increase in the right-hand-side of the NKPC equation (16), which calls for an increase in current inflation. The inflation-targeting central bank reacts to higher inflation, raising domestic interest rate that depresses private consumption today.

[24] This the case in which either the government fully repays the outstanding obligation, or re-entry takes place.

[25] There are 5 unknowns (C, N, π, i, w) and 5 equations, which fully solves the private equilibrium for each possible $\vec{\mathcal{B}}' = [B'_{FC}, B'_{LC}]'$.

[26] It is useful to highlight that income tax rate τ remains constant in my model—the government is unable to adjust tax rate to influence private equilibrium. The sole channel available for the government to impact private equilibrium is through default risk.

As the amount of newly issued debt governs default risk, the private allocation given repayment can be expressed as a *schedule* of $\vec{\mathcal{B}}'$. Namely, $C(z,\vec{\mathcal{B}}')$, $N(z,\vec{\mathcal{B}}')$, $\pi(z,\vec{\mathcal{B}}')$, $i(z,\vec{\mathcal{B}}')$ and $w(z,\vec{\mathcal{B}}')$. The private equilibrium in a bad credit standing is analogous to (13)-(17)—except that the monetary policy is expansionary ($\bar{i}$ replaced with $\bar{i}-\Delta$) and the aggregate productivity is lower (z replaced with z^D). To save space, I leave the full characterization of the private equilibrium upon a bad credit standing in Appendix C. The private equilibrium in a bad credit standing is a function of aggregate productivity (as the government cannot issue bonds to lenders), characterized by $C^D(z)$, $N^D(z)$, $\pi^D(z)$, $i^D(z)$ and $w^D(z)$.

3.2.2 Bond Price Schedules

Now I present bond price schedules for both foreign and local currency debt:

$$Q_{FC}(z,\vec{\mathcal{B}}') = \frac{1}{R^*}\int_{\mathcal{R}(\vec{\mathcal{B}}')} f(z,z')dz' \tag{18}$$

$$Q_{LC}(z,\vec{\mathcal{B}}') = \frac{1}{R^*}\int_{\mathcal{R}(\vec{\mathcal{B}}')} f(z,z')\frac{1}{\pi'\Big(z',\vec{\bar{\mathbb{B}}}(z',\vec{\mathcal{B}}')\Big)}dz' \tag{19}$$

Both bond prices reflect the default risk. The local currency bond price depends on an additional term—next-period inflation π' for $z' \in \mathcal{R}(\vec{\mathbb{B}}')$—which is determined by the next-period government's debt issuance policy $\vec{\bar{\mathbb{B}}}(z',\vec{\mathcal{B}}')$.[27] It reveals the time-inconsistency issue confronted by the government—for larger levels of B'_{LC}, the next-period government would opportunistically debase debt. The inability to commit future debt flows consequently leads to a significant rise in local currency bond spreads. In this sense, foreign currency borrowing is appealing, as foreign currency obligations stand resilient against debasement (inflation), thereby acting as a deterrent against discretionary governments attempting opportunistic debasement by increasing default risk.

3.2.3 Equilibrium

I consider a Markov Perfect Equilibrium, where a discretionary government takes into account that its default and borrowing policies affect the private equilibrium and the bond prices.

Definition 1. *Equilibrium. Given the aggregate state* $(z,\vec{\mathcal{B}},\Xi_{-1})$*, a recursive equilibrium consists of (i) government policies for debt issuance* $\vec{\bar{\mathbb{B}}}(z,\vec{\mathcal{B}})$*, government value functions* $V(z,\vec{\mathcal{B}},\Xi_{-1})$*, repayment sets* $\mathcal{R}(\vec{\mathcal{B}})$ *and default sets* $\mathcal{D}(\vec{\mathcal{B}})$*, (ii) private equilibrium schedules upon repayment* $C(z,\vec{\mathcal{B}}')$*,* $N(z,\vec{\mathcal{B}}')$*,* $\pi(z,\vec{\mathcal{B}}')$*,* $i(z,\vec{\mathcal{B}}')$ *and* $w(z,\vec{\mathcal{B}}')$ *(iii) private equilibrium upon default* $C^D(z)$*,*

[27] π' is contingent on the next-period productivity z' and the default risk two periods ahead (i.e., $\vec{\mathcal{B}}''$).

$N^D(z)$, $\pi^D(z)$, $i^D(z)$ and $w^D(z)$ (iv) bond price schedules $Q_{FC}(z,\vec{\mathcal{B}}')$ and $Q_{LC}(z,\vec{\mathcal{B}}')$, such that following conditions hold

- *Taking private equilibrium schedules in a good credit standing $C(z,\vec{\mathcal{B}}')$, $N(z,\vec{\mathcal{B}}')$, $\pi(z,\vec{\mathcal{B}}')$, $i(z,\vec{\mathcal{B}}')$, $w(z,\vec{\mathcal{B}}')$, private equilibrium in a bad credit standing $C^D(z)$, $N^D(z)$, $\pi^D(z)$, $i^D(z)$, $w^D(z)$, bond price schedules $Q_{FC}(z,\vec{\mathcal{B}})$, $Q_{LC}(z,\vec{\mathcal{B}})$, the policy function $\vec{\tilde{\mathbb{B}}}(z,\vec{\mathcal{B}})$ as given, repayment sets $\mathcal{R}(\vec{\mathcal{B}})$ and default sets $\mathcal{D}(\vec{\mathcal{B}})$ satisfy the government's optimization problem, and government policies and values are consistent with future policies and values.*
- *The private equilibrium in a good credit standing $C(z,\vec{\mathcal{B}}')$, $N(z,\vec{\mathcal{B}}')$, $\pi(z,\vec{\mathcal{B}}')$, $i(z,\vec{\mathcal{B}}')$, $w(z,\vec{\mathcal{B}}')$ satisfy equations (13)-(17). The private equilibrium in a bad credit standing $C^D(z)$, $N^D(z)$, $\pi^D(z)$, $i^D(z)$, $w^D(z)$ satisfy equations (C1)-(C5). The bond price functions $Q_{FC}(z,\vec{\mathcal{B}}')$ and $Q_{LC}(z,\vec{\mathcal{B}}')$ satisfy equations (18) and (19).*

3.3 Is Default Inflationary?

In this subsection, I aim to explore whether a default-induced productivity loss leads to inflation, assuming the interest rate rule consistently follows (10). I will show that whether default-induced productivity loss causes inflation or not depends crucially on the probability of re-entry ι. When the probability of re-entry is small as adopted in my quantitative analysis, I find that a loss in productivity alone is insufficient to generate inflationary default.

3.3.1 Permanent Productivity Loss Upon Default

First, I delve into a case where the probability of reentry goes to zero ($\iota \to 0$). Under this specification, once the government defaults, the economy stays in a bad credit standing (the financial autarky) forever and suffers a *permanent* productivity loss. Then, whether default causes inflation or not is equivalent to questioning whether a permanent negative productivity shock leads to inflation in New Keynesian framework. I begin with the following assumption.

Assumption 1. *Default takes place when z is low.*

This assumption, valid in my quantitative model, implies that it is sufficient to compare equilibrium inflation in repayment and default scenarios for low productivity z.

In the New Keynesian model, equilibrium inflation depends on the current and future log-deviations of the productivity relative to the steady state. A negative permanent productivity shock leads to a decline in both the steady state (long-run) productivity and productivity in a downturn (short-run). Whether default causes inflation or not then depends on the extent of the fall in both long-run and short-run productivity. I find that if default-induced productivity loss results in a more significant fall in long-run productivity relative to a fall in productivity in a downturn, default causes *deflation* rather than *inflation*.

Proposition 1. *Suppose the monetary rule always follows the standard inflation-targeting rule in (10) and* $\iota \longrightarrow 0$*. If default-induced productivity loss results in larger drop in the steady-state (long-run) value of productivity, relative to the fall in (short-run) productivity value during an economic downturn, default is deflationary.*

Proof. See Appendix D. □

When long-run productivity falls more than short-run one, the degree of log-deviation decreases, causing deflation. For example, upon repayment, the steady state productivity is 100 while the productivity in a downturn is 80, indicating a log-deviation of $(80 - 100)/100 = -20\%$. When default leads to a more significant decline in steady-state productivity (from 100 to 80) relative to short-run one (from 80 to 75), the degree of log-deviation (in absolute terms) gets smaller, equal to $(75 - 80)/80 = -6.25\%$, resulting in *deflation*.

The sovereign debt literature imposes the convex cost of defaulting—larger loss in productivity for higher productivity levels—to ensure default takes place only during an economic downturn.[28] The following corollary asserts that, with the conventional convex cost of defaulting, default is *deflationary*.

Corollary 1. *Under the convex cost of defaulting and* $\iota \longrightarrow 0$*, the long-run unconditional productivity undergoes a more pronounced decrease compared to the short-run productivity fall during recessions, leading to a deflationary default.*

By contrast, if default-induced productivity loss is linear, default does not have any impact on inflation.

Corollary 2. *Under the linear productivity loss of defaulting and* $\iota \longrightarrow 0$*, both short-run and long-run productivity experience the same degree of productivity loss in percentage terms. Consequently, default does not affect inflation.*

In Appendix D, I conduct an analysis taking $\iota \longrightarrow 1$. Namely, after the government defaults, it can immediately re-enter the financial market in the next period. Consequently, default leads to only a one-time productivity loss, analogous to a temporary negative productivity shock. I show that under this specification, default induces inflation since long-run productivity remains unchanged due to the absence of prolonged productivity loss.

However, in my quantitative exercise in Section 4, I use a value of ι close to zero to match the average exclusion periods of defaulting observed in the data. As a result, default-induced

[28]This approach was first introduced in Arellano (2008), and was extended in Chatterjee and Eyigungor (2012).

productivity loss behaves more like a negative permanent productivity shock than a temporary one in my quantitative version of the model. To prevent default from causing deflation instead of inflation, as discussed in Section 3.1.6, I adopt an expansionary monetary rule (11).

3.3.2 Non-separability in the Utility Function

Thus far, I have characterized two crucial properties in my model. First, public consumption G has no direct impact on private equilibrium.[29] Second, if the monetary rule consistently follows (10) and $\iota \to 0$, default-induced productivity loss behaves like a negative permanent productivity shock and remains non-inflationary under both the convex and linear cost of defaulting. These findings, developed under the assumption of a fully separable utility function (1), are best appreciated in relation to the analysis by Arellano et al. (2023), whose primary driver of inflationary default is the non-separability of multiple final goods consumption in the utility function. A comparison with their seminal work highlights the value added of my analysis, in showing how the economic forces underlying inflationary default play out very differently, depending on the specification the utility function. As in the previous analysis, I focus on the case where $\iota \to 0$ in line with the parameterization in Arellano et al. (2023).[30] Under this specification, default leads to a non-inflationary permanent productivity loss.

Differently from Arellano et al. (2023), my model features one single final good only but with two distinct types of consumption.[31] Nevertheless, extending my model by introducing non-separability in private and public consumption will be instructive enough to capture the key channel that drives inflation in their seminal work.[32] Instead of assuming absolute separability between C and G, I now assume the following log utility function:

$$u(C,G,N) = \log\left(\left(\theta C^{\frac{\vartheta-1}{\vartheta}} + (1-\theta)G^{\frac{\vartheta-1}{\vartheta}}\right)^{\frac{\vartheta}{\vartheta-1}}\right) - \frac{N^{1+\frac{1}{\zeta}}}{1+\frac{1}{\zeta}} \tag{20}$$

where ϑ is the elasticity of substitution between private consumption C and public spending G.[33] When $\vartheta > 1$ ($\vartheta < 1$), C and G are substitutes (complements). The following lemma indicates that, when the utility function features non-separability, an additional channel exists—beyond the productivity channel studied in Section 3.3.1—that drives inflation/deflation during default:

[29] Instead, G indirectly impinges on private equilibrium through default risk determined by $\vec{\mathcal{B}}'$.

[30] The value of ι is set to 0.0417 in Arellano et al. (2023).

[31] This single-good setting eliminates the possibility of the sovereign manipulating the real exchange rate to reduce local currency debt obligation.

[32] Non-separability of home and foreign goods consumption in the utility is the key driving force of inflationary default in Arellano et al. (2023), which can be analogously represented by non-separability of private and public consumption in my model. Assuming multiple final goods will not alter the main analytical results.

[33] When $\vartheta \to 1$, the utility function exhibits full separability between C and G and reverts to (1).

Lemma 1. *Default-induced productivity loss, when $\iota \rightarrow 0$, imposes non-inflationary pressure on the economy. If the utility function is non-separable between C and G, the government spending G affects contemporaneous inflation/deflation, through a distinct channel called the non-separability channel, which operates independently of the non-inflationary productivity loss. Given the utility function (20), the non-separability channel emerges if and only if $\vartheta \neq 1$.*

Proof. See Appendix E. □

The following proposition states that whether the non-separability channel is inflationary or deflationary depends on ϑ:

Proposition 2. *When $\vartheta > 1$ ($\vartheta < 1$) and $\iota \rightarrow 0$, C and G are substitutes (complements), and the non-separability channel is inflationary (deflationary) upon default.*

Proof. See Appendix E. □

The following corollary highlights that, under high substitutability between C and G, the non-separability channel becomes highly inflationary and may dominate the non-inflationary productivity loss, thereby leading to inflationary default:

Corollary 3. *If the value of ϑ is large enough, the inflationary non-separability channel may overwhelm the non-inflationary productivity loss, resulting in inflationary default.*

Default causes a decline in productivity, followed by a fall in both private and public consumption. This leads to a substantial increase in the marginal utility of private consumption, especially when C and G exhibit strong substitutability (as $\partial u_C/\partial G < 0$ and $\partial u_C/\partial C < 0$). The notable rise in u_C triggers two inflationary effects. First, the elevated marginal utility in private consumption boosts aggregate demand, fostering increased labor demand, which, in turn, may elevate marginal costs and exert inflationary pressure on the economy. Second, the domestic Euler equation (3) implies that if u_C increases substantially, expected inflation and the domestic interest rate must also increase correspondingly to ensure the Euler equation holds in equilibrium. An increase in expected inflation calls for a rise in contemporaneous inflation in the NKPC (7).

The main driver of inflationary default in Arellano et al. (2023) is the aforementioned inflationary non-separability channel.[34] In contrast, I adopt an expansionary monetary rule to induce inflationary default, for the following reasons. First, default is associated with fiscal distress, making it challenging to assert that the country strictly adheres to inflation-targeting interest

[34] In the main quantitative exercise in Arellano et al. (2023), ϑ is set to 5 to amplify this non-separability channel, making default inflationary.

rate rule during times of fiscal strain.[35] Second, empirically, the existence of non-separability between C and G remains unclear.[36] Also, there is a lack of compelling evidence to firmly support the notion that non-separability between C and G, rather than a loose monetary stance, is the primary driver of inflationary default. Lastly, inflation driven by the non-separability between C and G is not the central focus of this paper. Non-separability influences inflation not only during default but also during periods of full debt repayment—what determines inflation is the public spending path, regardless of whether debt is fully repaid or not. As this paper primarily concentrates on how inflationary default, rather than non-separability, shapes the currency denomination in sovereign bonds, I exclude consideration of this non-separability channel.

3.4 Optimal Currency Denomination

I analyze the optimal currency denomination by addressing the tradeoff faced by the government, solving its problem (12) based on three key assumptions. First, I posit that the distribution function $f(z,z')$ is continuous. Second, I assume the differentiability of private equilibrium schedules $C(z,\vec{\mathcal{B}}')$, $N(z,\vec{\mathcal{B}}')$, $\pi(z,\vec{\mathcal{B}}')$, $i(z,\vec{\mathcal{B}}')$ and $w(z,\vec{\mathcal{B}}')$, bond price schedules $Q_{FC}(z,\vec{\mathcal{B}}')$ and $Q_{LC}(z,\vec{\mathcal{B}}')$, and the value of repaying $V^R(\cdot)$. Third, for illustrative purposes, I set the weight of the utility on government spending $\alpha_G \to \infty$ in the utility function (1), simplifying it to a function of G only. I start with the following proposition, establishing the relationship between default and inflation:

Proposition 3. *Given a relatively loose monetary rule (11) upon default, larger default risk induces higher expected inflation, resulting in higher contemporaneous inflation, i.e.,* $\frac{\partial \pi}{\partial B'_x} > 0$ *for* $x \in \{FC, LC\}$ *when larger debt issuance leads to higher default risk.*

Inflationary default provides a discretionary government with an opportunity to pursue strategic debasement. To illustrate this mechanism, I derive the first-order necessary conditions

[35] Many empirical evidences support this claim—during a crisis, both the monetary authority and the fiscal government typically utilize all available tools to boost/stabilize the economy, diverging from strict adherence to a specific policy rule. See Section 3.1.6 for details.

[36] Empirically, there exists no definitive consensus regarding the complementarity or substitutability between private and public consumption. Karras (1994), Blanchard and Perotti (2002), Galí, López-Salido, and Vallés (2007) and Ganelli and Tervala (2009) indicate that a positive public spending shock is positively associated with private consumption. By contrast, Burnside, Eichenbaum, and Fisher (2004) and Mountford and Uhlig (2009) argue that private consumption does not respond to public spending shocks. Dawood and Francois (2018) find that public spending acts as a substitute in many African economies.

of the sovereign's problem with respect to $\vec{\mathcal{B}}' = [B'_{FC}, B'_{LC}]'$:

$$u_G\left[Q_{FC} + \frac{\partial Q_{FC}}{\partial B'_{FC}}B'_{FC} + \frac{\partial Q_{LC}}{\partial B'_{FC}}B'_{LC} + \tau z\frac{\partial N}{\partial B'_{FC}} + \frac{B_{LC}}{\pi^2}\frac{\partial \pi}{\partial B'_{FC}}\right] = \beta_G\int_{\mathcal{R}'} u_{G'}f(z,z')dz' \tag{21}$$

$$u_G\left[Q_{LC} + \frac{\partial Q_{FC}}{\partial B'_{LC}}B'_{FC} + \frac{\partial Q_{LC}}{\partial B'_{LC}}B'_{LC} + \tau z\frac{\partial N}{\partial B'_{LC}} + \frac{B_{LC}}{\pi^2}\frac{\partial \pi}{\partial B'_{LC}}\right] = \beta_G\int_{\mathcal{R}'} \frac{u_{G'}}{\pi'}f(z,z')dz' \tag{22}$$

where $\mathcal{R}'$ represents the repayment set in the subsequent period. The left-hand side of each first-order condition represents the marginal gain from issuing one additional unit of debt concerned, whereas the right-hand side of the first-order condition reflects the marginal cost of the additional issuance. Next, I divide Q_{FC} in (21) and Q_{LC} in (22), yielding the following equations:

$$u_G\left[1 + \frac{\partial Q_{FC}}{\partial B'_{FC}}\frac{B'_{FC}}{Q_{FC}} + \frac{\partial Q_{LC}}{\partial B'_{FC}}\frac{B'_{LC}}{Q_{FC}} + \frac{\tau z}{Q_{FC}}\frac{\partial N}{\partial B'_{FC}} + \frac{B_{LC}}{Q_{FC}\pi^2}\frac{\partial \pi}{\partial B'_{FC}}\right] = \beta_G R^*\mathbb{E}[u'_G|\mathcal{R}'] \tag{23}$$

$$\begin{aligned} &u_G\left[1 + \frac{\partial Q_{FC}}{\partial B'_{LC}}\frac{B'_{FC}}{Q_{LC}} + \frac{\partial Q_{LC}}{\partial B'_{LC}}\frac{B'_{LC}}{Q_{LC}} + \frac{\tau z}{Q_{LC}}\frac{\partial N}{\partial B'_{LC}} + \frac{B_{LC}}{Q_{LC}\pi^2}\frac{\partial \pi}{\partial B'_{LC}}\right] \\ &= \beta_G R^*\mathbb{E}[u_{G'}|\mathcal{R}']\left(1+\frac{Cov(u_{G'},\frac{1}{\pi'}|\mathcal{R}')}{\mathbb{E}[\frac{1}{\pi'}|\mathcal{R}']\mathbb{E}[u_{G'}|\mathcal{R}']}\right) \end{aligned} \tag{24}$$

where $\mathbb{E}[\cdot|\mathcal{R}']$ and $Cov[\cdot|\mathcal{R}']$ denote, respectively, the conditional expectations and covariance across the repayment state in the next period.

These two equations clarify how currency denomination of sovereign debt is determined by the hedging benefit of local currency debt and the discipline benefit of foreign currency debt. The right-hand-side of (24) captures the hedging benefits of local currency debt. If inflation tends to increase in a bad state (i.e. high $u_{G'}$ state)—either when the productivity (and hence tax revenue) is low, or when default risk is so high that the government faces high borrowing cost, or both—, then local currency debt is a good hedge as debt obligation falls in bad times, as indicated by the covariance term $Cov(u_{G'}, 1/\pi'|\mathcal{R}') < 0$. Note that, foreign currency debt does not have this hedging property as future debt repayment does not depend on inflation, as evident in the right-hand-side of (23).

Comparing the left-hand-side of (23) and (24) reveals the discipline benefit of foreign currency debt. The price of both types of debt concerned is contingent on default risk—larger debt issuance shrinks the future repayment set $\mathcal{R}'$, thereby lowering bond prices. Differently from foreign currency debt, however, the price of local currency debt hinges on an additional term—expected inflation, i.e., debasement risk. A discretionary government cannot commit to future debt flow, opening the door to opportunistic debasement by future discretionary governments. If the government today issued a large amount of local currency debt B'_{LC}, the next-period discretionary government would strategically increase default risk two periods ahead (by increasing $\vec{\mathcal{B}}''$), thereby raising π' to debase maturing B'_{LC}. This is ex-ante reflected in the local currency bond price function (19), as the bond price is determined by expected inflation $\pi'(z', \vec{\mathcal{B}}'')$ next period, which is determined by the policy choice of the next-period government $\vec{\widetilde{\mathbb{B}}}(z', \vec{\mathcal{B}}') \equiv [\widetilde{\mathbb{B}}_{FC}(z', \vec{\mathcal{B}}'), \widetilde{\mathbb{B}}_{LC}(z', \vec{\mathcal{B}}')]'$.[37]

In contrast, foreign currency debt disciplines the opportunistic behaviours of future discretionary governments. As foreign currency debt cannot be debased, opting for foreign currency borrowing restrains future discretionary governments from raising inflation strategically (via pursuing default risk) to debase debt obligations. This discipline benefit of foreign currency debt is reflected in bond price—Q_{LC} is more sensitive to changes in debt levels than Q_{FC} when there is a strong incentive to engage in strategic debasement, specifically either when there is a large outstanding stock of local currency debt and/or the economy is in a downturn.

Thus far, the focus has been on the relationship among default, debasement, and bond prices. Now I shift the focus to the relationship between default risk and aggregate output (in turn related to tax revenue of the sovereign). Larger debt issuance increases default risk, leading to higher expected inflation and, consequently, contemporaneous inflation. Following the monetary rule upon repayment (10), the domestic interest rate rises in response to an increase in inflation, depressing aggregate private consumption demand. This, in turn, reduces labor demand by intermediate goods firms, leading to a decline in equilibrium labor supply and, consequently, lower output.[38] The following proposition asserts that, with larger default risk (due to larger debt issuance), contemporaneous inflation increases, while the equilibrium labor supply falls.

Proposition 4. *Larger default risk induces higher expected inflation, resulting in higher contemporaneous inflation. Default-risk-driven high inflation in turn depresses aggregate private consumption demand and, consequently, the equilibrium labor supply (and the aggregate output). Namely,* $\frac{\partial N}{\partial B'_x} < 0$ *for* $x \in \{FC, LC\}$ *when larger debt issuance leads to higher default risk.*

Proof. See Appendix F. ☐

Proposition 4 illustrates that, a rise in expected inflation due to higher default risk leads to lower output. This implies that, if expected inflation responds more strongly to debt issuance in local currency than that in foreign currency, additional local currency borrowing results in a more substantial decline in output.

[37]Note that, in equation (23) and (24), the terms $\frac{B_{LC}}{Q_{FC}\pi^2}\frac{\partial \pi}{\partial B'_{FC}}$ and $\frac{B_{LC}}{Q_{LC}\pi^2}\frac{\partial \pi}{\partial B'_{LC}}$ capture the benefit from engaging in strategic debt debasement by raising default risk in current period. Risk-neutral lenders in the previous period ex-ante take into account this opportunistic behaviour in local currency bond pricing.

[38]Arellano et al. (2023) refer to this default-risk induced lower aggregate output as *default amplification* channel. This channel is analogous to a cost-push shock, where aggregate output declines while inflation increases.

Corollary 4. *When expected inflation rises more significantly with an additional issuance of local currency debt than with foreign currency debt, a marginal increase in B'_{LC} leads to a more significant fall in equilibrium labor supply (and also aggregate output) than that in B'_{FC}.*

This occurs when the government has a strong incentive to engage in opportunistic debasement in future periods. Specifically, with a large local currency debt burden and/or low aggregate productivity, future discretionary governments then seek more default risk to debase local currency debt, raising expected inflation. In such a case, foreign currency debt, by disciplining future discretionary governments, helps lower expected inflation, mitigating a fall in the current-period output by reducing default-risk-driven inflation expectations.

I take the ratio of two first-order conditions (24) and (23). The optimal currency denomination in sovereign bonds is then determined by equating the hedging benefits of local currency bonds

$$\text{Hedging Benefit} = \left(1 + \frac{Cov(u_{G'}, \frac{1}{\pi'}|\mathcal{R}')}{\mathbb{E}[\frac{1}{\pi'}|\mathcal{R}']\mathbb{E}[u_{G'}|\mathcal{R}']}\right)$$

and the discipline benefits of foreign currency bonds:[39]

$$\text{Discipline Benefit} = \frac{1 + \frac{\partial Q_{FC}}{\partial B'_{LC}}\frac{B'_{FC}}{Q_{LC}} + \frac{\partial Q_{LC}}{\partial B'_{LC}}\frac{B'_{LC}}{Q_{LC}} + \frac{\tau z}{Q_{LC}}\frac{\partial N}{\partial B'_{LC}} + \frac{B_{LC}}{Q_{LC}\pi^2}\frac{\partial \pi}{\partial B'_{LC}}}{1 + \frac{\partial Q_{FC}}{\partial B'_{FC}}\frac{B'_{FC}}{Q_{FC}} + \frac{\partial Q_{LC}}{\partial B'_{FC}}\frac{B'_{LC}}{Q_{FC}} + \frac{\tau z}{Q_{FC}}\frac{\partial N}{\partial B'_{FC}} + \frac{B_{LC}}{Q_{FC}\pi^2}\frac{\partial \pi}{\partial B'_{FC}}}$$

A relative significance of these two benefits are determined by the shapes of private equilibrium schedules, bond price schedules as functions of foreign and local currency debt as well as aggregate productivity. In illustrating the tradeoff, I have shown that foreign currency debt has a discipline benefit, as the government cannot opportunistically debase foreign currency bonds, and that local currency debt serves as a good hedge as inflation increases and debt repayment falls in bad times. This tradeoff is closely related to the work by Arellano and Ramanarayanan (2012), in which the government endogenously chooses the maturity structure in sovereign bonds. In their seminal work, long-term debt offers a hedge, as its value falls in bad times, whereas short-term debt provides incentive (discipline) benefits, as it is immune to debt dilution. My model features a similar tradeoff, where foreign currency debt serves as a discipline tool, providing incentives to avoid seeking default risk (for opportunistic debasement), whereas local currency debt acts akin to long-term debt, whose real value (maturing obligation) falls in bad times.

[39] Note that, although both terms $\frac{B_{LC}}{Q_{LC}\pi^2}\frac{\partial \pi}{\partial B'_{LC}}$ and $\frac{B_{LC}}{Q_{FC}\pi^2}\frac{\partial \pi}{\partial B'_{FC}}$ indicate the marginal benefit from engaging in opportunistic debasement, it has already been reflected in the previous-period local currency bond price. Hence, I classify this component into the discipline benefit category.

3.5 Discussion

The core driving force behind strategic debasement in my model is inflationary default. I show that, even when the monetary authority adheres to the standard inflation-targeting interest rate rule in normal times (repayment states), a discretionary fiscal government can still debase local currency debt by elevating default risk and, consequently, contemporaneous inflation. Foreign currency debt, immune to debasement, offers a discipline benefit relative to local currency debt that arises exclusively from the fiscal government's lack of commitment (to repayment and to future debt choices). In this context, I delve into the relationship of my analysis to other relevant work on the currency denomination of sovereign bonds and monetary policy in emerging economies.

The role of monetary credibility in shaping the currency denomination of sovereign debt has been investigated in Du et al. (2020). These authors show that when a country lacks the ability to commit to a monetary rule, it will resort to discretionary inflation ex post to devalue local currency debt, to smooth consumption beyond what is optimal from an ex ante perspective. However, this discretionary monetary policy entails a cost, as foreign lenders anticipate the ex post optimal inflation choices, leading to an escalation in the cost of local currency borrowing. This is inefficient from an ex ante point of view, due to the fact that a rise in borrowing cost offsets the ex post benefits of debt debasement. Consequently, to mitigate inefficiency stemming from a lack of monetary policy commitment, the government opts to borrow more in foreign currency.[40]

Ottonello and Perez (2019) explore how discretionary monetary policy and the real exchange rate affect the currency composition of sovereign debt. Similar to the findings in Du et al. (2020), the government increases its borrowing in foreign currency to avoid costly inflation ex post, arising from a lack of commitment to monetary policy. Additionally, they highlight an additional channel that drives foreign currency borrowing—a lack of commitment to the real exchange rate.[41] The government's inability to commit to future real exchange rates (in turn related to future consumption flows that affect the relative price between tradable and non-tradable goods) gives rise to opportunistic real exchange rate manipulation aimed at local currency debt debasement.

Ottonello and Perez (2019) show that, analogous to my model, foreign currency debt carries a discipline benefit, which restrains discretionary governments from engaging in opportunistic

[40]Du et al. (2020) use a rise in local currency borrowing costs, stemming from a lack of monetary commitment, to illustrate and emphasize this inefficiency. To reduce expected borrowing costs, the government increases borrowing in foreign currency. These authors assume a high level of risk aversion among lenders, making borrowing much more expensive in local currency and thus exacerbating inefficiencies originating from a lack of monetary commitment.

[41]In Du et al. (2020), the real exchange rate follows an exogenous process that eliminates the possibility of devaluation driven by the real exchange rate manipulation.

devaluation ex post, whereas local currency debt offers a hedge. However, a key distinction arises in the source of this discipline benefit. Unlike my work, where the discipline benefit originates from a lack of commitment to *debt repayment* and *future debt policies*, Ottonello and Perez (2019) attribute it to a lack of commitment to both *monetary policy* and the *real exchange rate*. Moreover, there are differences in the policy choices for the government to strategically devalue local currency debt between these two models. Specifically, Ottonello and Perez (2019) suggest that, for the government to debase local currency debt via real exchange rate manipulation, the government should consume *less* (i.e. deleverage) to induce real exchange rate depreciation by lowering the relative price of non-tradable goods. In contrast, in my model, the government should consume *more* (to increase debt issuance) to elevate default risk for debasement.

Engel and Park (2022) examine the dynamics of currency denomination under a defaultable committed monetary policy. They find that the existence of an outside option to default on the committed monetary rule places constraints on the local currency borrowing. Again, foreign currency borrowing is associated with a discipline benefit, but in this case it originates from a lack of commitment to fully adhere to a previously committed monetary policy. The key insight is that a larger local currency borrowing makes defaulting on the previously committed monetary rule more appealing for future discretionary governments. To deter future governments from defaulting on a committed monetary rule—an opportunistic behaviour that is costly ex ante (as it is reflected in bond prices)—the government today tilts its borrowing towards foreign currency. In essence, Engel and Park (2022) delve into the interplay between a *defaultable monetary rule* and the currency composition of sovereign debt. In contrast, my model focuses on the interaction between *fiscal solvency* given a committed monetary rule (at least in repayment states) and debt denomination.

4 Quantitative Analysis

I solve the model numerically to assess its quantitative performance on the dynamic patterns of the optimal currency denomination in sovereign bonds and inflation expectations in emerging economies. The model is calibrated to Colombia, chosen as a relevant reference due to its business cycle characteristics, which are comparable to those of other emerging economies—its output, inflation (expectations), and CDS spreads are close to the median in my sample of 15 inflation-targeting emerging economies.[42] I evaluate the model's performance against the data and compare implications with alternative model specifications.

[42]Colombia is used as a reference in other studies examining the currency composition of sovereign bonds. See, for instance, Lee (2022).

4.1 Calibration

The model period is a quarter. I choose parameter values by drawing from existing studies and conducting a moment-matching exercise, to align the model with key characteristics of Colombian data. The mean and standard deviation moments of data in Table 4 are esimated using Colombian data from 2009Q4 to 2021Q4. Correlations of data are estimated using data from all countries in my dataset from 2009Q4 to 2021Q4, owing to the lack of extensive time series data available for each individual country.[43]

Assuming a relative risk aversion equal to 1, the utility function is given by:

$$u(C, G, N) = \log(C) + \alpha_G \log(G) - \frac{N^{1+\frac{1}{\zeta}}}{1 + \frac{1}{\zeta}}$$

I extend my model to integrate long-term bonds to match the average maturity of Colombian government debt. Following Chatterjee and Eyigungor (2012), I introduce bonds that mature probabilistically. In each period, a bond pays a coupon κ and carries a probability λ of maturing. Consequently, the flow of debt payments is $(\kappa + \lambda)$, where λ represents the inverse of maturity. This feature makes the maturing debt "memoryless", eliminating the need to track the entire distribution of maturities over time.

Default involves a loss of aggregate productivity and exclusion from international financial markets. I posit that aggregate productivity follows an AR(1) process $\log z_t = \rho_z \log z_{t-1} + \sigma_z \epsilon_t$, where $\sigma_z \sim N(0, 1)$. If the government remains in a default state, following Chatterjee and Eyigungor (2012), I assume that productivity experiences a convex loss, such that

$$z^D = z - \max\{0, d_0 z + d_1 z^2\} \tag{25}$$

The first set of parameters, directly assigned and outlined in Table 3, includes the relative risk aversion γ, Frisch elasticity ζ, intermediate goods elasticity η, the Rotemberg price adjustment cost φ, inflation target $\bar{\pi}$, interest rate rule intercept $\bar{i}$, interest rate rule coefficient α_P, persistence of aggregate productivity shock ρ_z, volatility of productivity shock σ_z, tax rate τ, inverse of debt maturity λ, quarterly coupon rate κ, reentry probability ι, international risk-free rate r^*, and utility shock parameters $\sigma_{\mathbf{v}}$ and $\rho_{\mathbf{v}}$.

Specifically, the Frisch elasticity is set to 0.33 following Gali and Monacelli (2005); intermediate goods elasticity η is set equal to 5, corresponding to 25% markup in accordance with estimates in Edmond, Midrigan, and Xu (2023) and Díez, Fan, and Villegas-Sánchez (2021); the Rotemberg adjustment cost φ is determined using the first-order equivalence between Calvo

[43]For instance, one outlier in each individual country could significantly alter the correlation due to short time horizons of data. To mitigate this limitation, I look at the average correlation across all sample countries.

Table 3: Parameters selected directly

Parameters	Description	Values	Notes
Parameters selected directly			
γ	Relative risk aversion	1.0	Conventional value
ζ	Frisch elasticity	0.33	Gali and Monacelli (2005)
η	Intermediate goods elasticity	5.0	25% markup
φ	Price adjustment costs	30	Price adjustment twice a year
$\bar{\pi}$	Inflation target	1.0073	Annual inflation target 3%
$\bar{i}$	Interest rate rule intercept	$\bar{\pi}/\beta$	The steady state condition
α_P	Interest rate rule coefficient	1.6	Klau and Mohanty (2004)
ρ_z	Persistence of aggregate productivity shock	0.85	International real business cycle studies
σ_z	Std of aggregate productivity shock	0.012	International real business cycle studies
τ	Tax rate	0.30	Tax revenues over GDP
λ	Inverse of debt maturity	0.05	5-year debt duration in Colombia
κ	Coupon payment	0.02	8% annual coupon rate
ι	Market re-entry probability	0.0417	6-year exclusion, Benjamin and Wright (2009)
r^*	International risk-free rate	0.5%	Quarterly US Treasury yield
$\sigma_{\mathbf{v}}$	Utility shock variance	0.008	Set for numerical convergence
$\rho_{\mathbf{v}}$	Utility shock correlation	0.3	Dvorkin, Sánchez, Sapriza, and Yurdagul (2021)
Parameters from moment matching			
β	Private discount factor	0.9994	Average domestic interest rate
β_G	Government discount factor	0.9618	Average external debt to GDP ratio
α_G	Weight G in the utility function	0.58	Average G to GDP ratio
d_0	Default productivity loss	-0.1955	Average 5-year FC debt spread
d_1		0.2415	
Δ	Loose monetary rule upon default	0.205	Average inflation

and Rotemberg pricing frictions—a Calvo frequency of price changes of roughly twice per year would imply the value for φ at 30; the inflation target $\bar{\pi}$ aligns with the Colombian central bank's 3% annual inflation target; the interest rate rule intercept $\bar{i}$ is set to the steady-state condition $\bar{\pi}/\beta$; the value of α_P is well within the range of estimates in Klau and Mohanty (2004). Given the limited time span of the data, determining the precise persistence of the productivity process is challenging. Therefore, the persistence parameter ρ_z is set to a reference value of 0.85, and the volatility of productivity innovations σ_z is set at 0.012, that are comparable to values employed in many international real business cycle studies.

The tax rate τ is calibrated to 0.3 to align with the tax revenue of GDP ratio in Colombia. To achieve a debt maturity of 20 quarters (5 years) and an annual coupon rate of 8%, I set $\lambda = 0.05$ and $\kappa = 0.02$. The quarterly reentry probability in default state is established at $\iota = 4.16\%$, corresponding to an expected exclusion period of about 6 years, in accordance with Benjamin and Wright (2009). The risk-free interest rate r^* is set at 0.5%, roughly equivalent to the real quarterly return on US treasury yield. Finally, the model incorporates utility shocks

$\mathbf{v}$ that influence the relative values of repayment and default. These shocks are integrated into the computational technique following Dvorkin et al. (2021) and Gordon (2019). These utility shocks introduce subtle perturbations to the portfolio and default-repayment choices, enhancing model convergence, especially in models featuring two distinct long-term defaultable bonds. Characterized by two parameters, $\rho_{\mathbf{v}}$ and $\sigma_{\mathbf{v}}$, I choose the lowest possible value of $\sigma_{\mathbf{v}}$ that guarantees the convergence of the model, and $\rho_{\mathbf{v}}$ is well within the range of values adopted in Dvorkin et al. (2021). The full specification of long-term debt model with utility shocks is provided in Appendix I, including the algorithm for the computation and simulation of the model. In Appendix G, I carry out a sensitivity analysis with respect to the utility shock $\mathbf{v}$ and show that variations in $\mathbf{v}$ have negligible effects on the primary moments in the model.

The second set of parameters, outlined at the bottom of Table 3, is chosen to match specific moments observed in the Colombian economy. These six parameters comprise the discount factor of private households β and of the government β_G, the weight on the utility of government spending α_G, the parameters of the default cost function d_0 and d_1, and the degree of loose monetary rule upon default Δ. The moments targeted for calibration encompass the average values of domestic interest rate, external debt to GDP ratio, public spending to GDP ratio, 5-year foreign currency bond spread, and inflation.

The results of the moment-matching exercise are illustrated in Table 4, with values of moments all annualized.[44] The second column of the table reports values of moments in my baseline specification. Evidently, the matching exercise is highly successful. The targeted moments in my baseline closely match the data. Untargeted moments also match the data very well. The share of FC borrowing accounts for 79.82% in the model, close to the mean FC debt share 78.75% in the data. The standard deviation of FC debt in the model aligns with its data counterpart. Both mean and standard deviation of LC debt spread closely approximate the corresponding data values. However, the model overestimates the volatility of inflation, primarily caused by inflationary default. In Section 4.3, I examine a model specification where default is orthogonal to inflation, to address the role of inflationary default in inflation volatility and debt denomination.

The performance of the correlation with expected inflation is notably strong in my baseline. The model overestimates the correlation between CDS spread and expected inflation in comparison to data, as default risk alongside the productivity shock is the only driver of inflation in the model.[45] The correlations between inflation expectations and (i) FC debt share, as well as (ii) relative cost of borrowing in LC over FC are very close to the data.

[44] Note that, I leave default frequency observed in the data blank, as default is a rare event, especially among emerging economies that have already adopted the inflation-targeting monetary regime.

[45] In practice, inflation expectations are also affected by monetary shocks, which are not considered in the model.

Table 4: Cyclicality, data, and models

Targeted Moment (annualized)	Data	Baseline	NK-Linear	NK-LC
Mean				
Domestic interest rate (%)	4.26	4.31	3.13	5.49
External debt to GDP ratio (%)	18.4	18.5	18.5	18.8
G to GDP ratio (%)	29.8	29.3	29.4	29.3
5-year FC debt spread (%)	1.39	1.39	0.76	-
Inflation (%)	3.61	3.62	2.90	4.20
Untargeted Moment (annualized)				
Mean				
FC debt share in external borrowing (%)	78.75	79.82	49.84	-
Spread of 5-year LC debt (%)	4.66	4.94	3.65	5.95
Standard deviation				
Spread of FC debt σ_{FC} (%)	0.42	0.42	0.15	-
Spread of LC debt σ_{LC} (%)	0.91	0.77	0.51	3.81
σ_{FC}/σ_{LC}	0.46	0.55	0.29	-
Inflation (%)	1.81	3.21	1.82	8.00
Correlation with expected inflation				
FC debt share	0.198	0.197	-0.360	-
Relative cost of borrowing (LC over FC)	0.758	0.719	0.999	-
5-year FC debt spread (CDS spread)	0.598	0.892	0.093	-

Notes: The correlation between FC debt share and expected inflation is computed assuming the government behaves as if the value of the utility shock is zero. To specifically examine how discipline and hedging benefits shape currency denomination, I focus on the correlation between FC debt share and inflation expectations abstracted from the utility shocks.

4.2 Spread and Policy Functions

In this subsection, I illustrate the key factors that drive currency denomination in sovereign bonds. I first highlight how bond spreads, default risk, and expected inflation vary with debt issuance. Then, I show the currency denomination in sovereign bonds and its relationship with expected inflation. All policy functions and spreads are evaluated at the mean of aggregate productivity.

Figure 2 plots the spread of external borrowing, expected inflation as well as the probability of defaulting, while keeping $B'_{LC} = 0$ and varying B'_{FC}. The left panel of the figure displays, respectively, the spread of FC debt (green, left Y-axis) and LC debt (orange, right Y-axis). Notably, neither type of debt is at the risk-free level (zero spread), a well-known feature of long-term debt due to the fact that, the price of long-term debt incorporates an additional premium embedded in the price tomorrow, which is contingent on the choice of debt tomorrow. Both spreads increase with higher levels of debt issuance. To facilitate a visual comparison of how

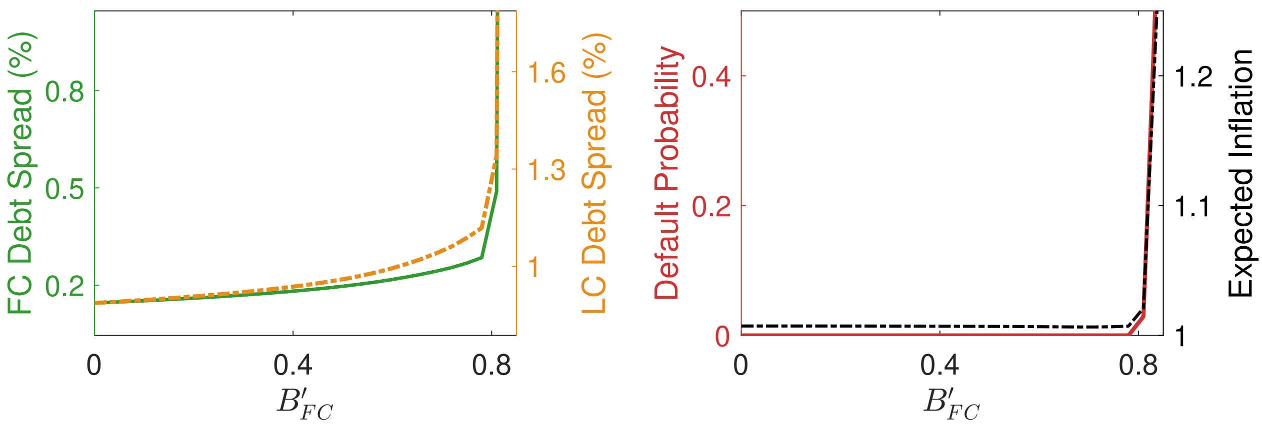

Figure 2: Bond spreads, default probability, and expected inflation varying B'_{FC}, given $B'_{LC} = 0$

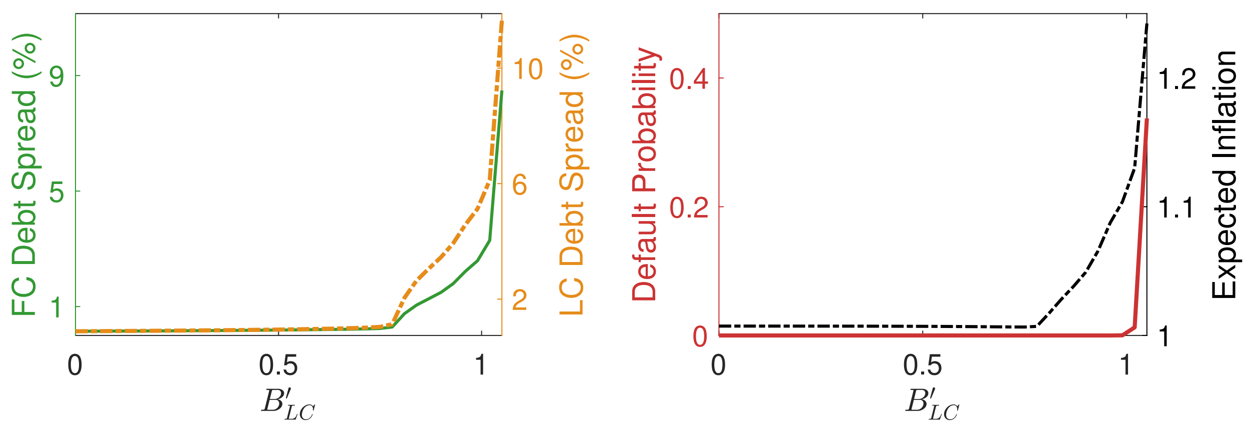

Figure 3: Bond spreads, default probability, and expected inflation varying B'_{LC}, given $B'_{FC} = 0$

both spreads increase with larger issuances of B'_{FC}, I adjust both left and right Y-axes such that when $B'_{FC} = 0$, FC and LC spreads are located at the same point on the panel. Then, the distance between orange dashed line and green solid line indicates the extent to which the spread in LC increases relative to FC spread as levels of B'_{FC} rise. Clearly, the spread of LC borrowing exhibits a more substantial increase than that of FC borrowing, for elevated levels of FC debt issuance. A high stock of debt implies fewer resources available for government public spending, thereby heightening the attractiveness of local currency debt debasement, if any. This inclination towards debasement is reflected in the spread of local currency—an increase in LC debt spread hence is more pronounced than that in FC for larger levels of B'_{FC}, as shown in the panel.

The right panel of Figure 2 depicts expected inflation (a dahsed black line, right Y-axis) and the probability of defaulting next period (a red solid line, left Y-axis) varying B'_{FC}. The economy is exposed to the risk of defaulting in the upcoming period if B'_{FC} exceeds 0.79. In cases where borrowing is only conducted in foreign currency (B'_{LC} is fixed at zero in the figure), default risk next period is the main driver of expected inflation—for B'_{FC} larger than 0.79, both default risk and expected inflation starts to surge. Below 0.79, inflation remains mostly constant. The immunity to debasement, a characteristic of FC debt, restrains the next-period government from pursuing opportunistic default risk to elevate inflation, a strategic move typically employed for local currency borrowing. This disciplining feature of foreign currency borrowing indeed contains a strategic rise in inflation, resulting in a co-movement between expected inflation and the probability of defaulting next period.

Figure 3 is analogous to Figure 2, except that the main focus shifts from FC debt issuance to LC debt issuance, which takes $B'_{FC} = 0$ as given and varies B'_{LC}. A notable observation emerges on the right panel of Figure 3—expected inflation rises with larger local debt issuance. This indicates that local currency borrowing provides a hedge against default risk—default risk lowers local currency debt burden, as inflation is positively associated with default (risk).[46] The second observation is that both FC and LC spreads in Figure 3 tend to rise smoothly relative to those in Figure 2. For instance, LC spread rises smoothly to 6% as B'_{LC} increases to 1, whereas a 'cliff' is observed for FC borrowing B'_{FC} larger than 0.8 on the left panel of Figure 2. The smooth rise in spread reflects opportunistic behaviour of discretionary governments—with larger issuance of B'_{LC}, the next-period government strategically seeks for default risk to debase local currency borrowing. Consequently, either type of bond spread increases with larger issuance of local currency borrowing (due to an increase in future default risk). However, the spread of LC borrowing increases more relative to FC borrowing because of the government's inability to commit future debt flows (i.e. future inflation paths). This can be seen on the left panel of Figure 3—the gap between orange dashed line and green solid line, an indicator of the degree of the relative borrowing cost in LC over FC, enlarges with larger B'_{LC}.

A strategic rise in inflation, for debt debasement, can also be found on the right panel of Figure 3. Differently from the right panel of Figure 2, there seems a disconnect between the probability of defaulting next period and expected inflation. With a larger issuance of B'_{LC}, it becomes more appealing for the next-period government to strategically increase its default risk (i.e. raising $\vec{\mathcal{B}}''$) to debase local currency borrowing. In other words, a rise in B'_{LC} leads to an increase in default risk two periods ahead (not shown in the figure), ultimately leading to a rise in expected inflation as can be seen in the panel. Expected inflation in this scenario is then largely driven by the opportunistic inflation of the next-period government, rather than the next-period default risk itself. This behaviour has already been reflected in the bond price. The left panel of Figure 3 shows that, both FC and LC debt spreads increase sharply along with an increase in expected inflation (starting from $B'_{LC} = 0.75$).

[46] Local currency debt also provides an insurance against negative aggregate productivity shock, which leads to an increase in marginal costs, ultimately resulting in a rise in inflation.

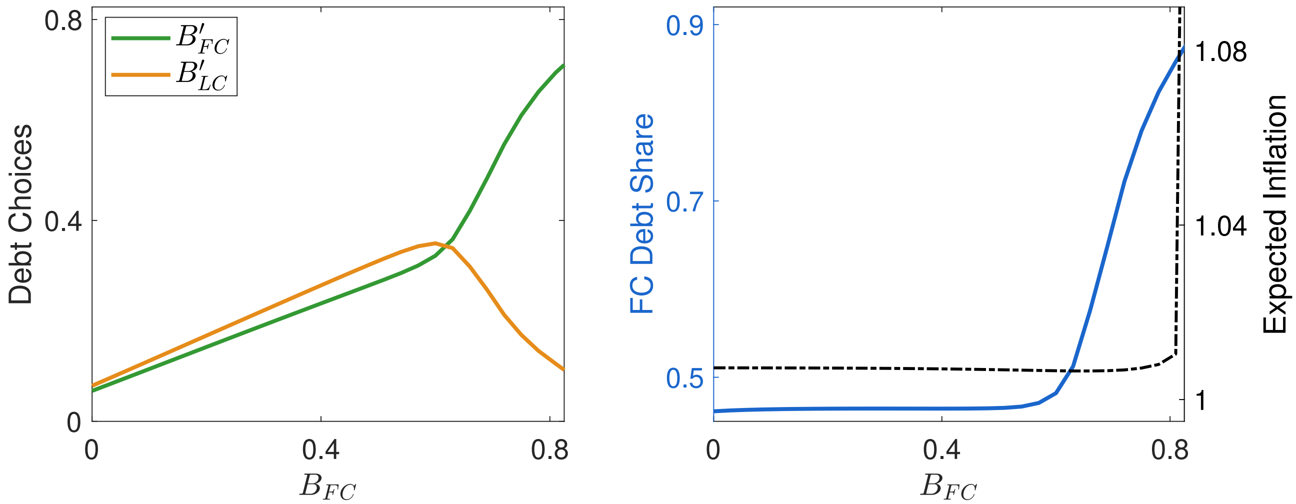

Figure 4: Choice of debt issuance, the share of FC borrowing, and expected inflation

Notes: The left panel of the figure illustrates the optimal FC and LC borrowing for different levels of B_{FC}, taking $B_{LC} = 0$ as given. As FC and LC debt choices become a distribution with the presence of the utility shock, on the left panel I plot the mean of FC and LC debt choices, for each value of B_{FC}. The FC debt share on the right panel is computed by dividing the mean of FC borrowing by the mean of total external borrowing.

Debt issuance, as discussed in Section 3.4, not only affects bond prices, but also has implications for aggregate output. In Appendix H, I present the impact of debt issuance on aggregate output considering distinct currency denomination. I find that substantial issuance of debt, regardless of currency denomination, results in a decline in aggregate output due to a rise in default-risk-induced inflation (expectations).[47] However, when comparing currency denomination of debt that lead to the same levels of default risk, local currency borrowing triggers a much more significant rise in expected inflation, consequently resulting in a more pronounced fall in aggregate output. In essence, local currency borrowing tends to elevate expected inflation to a greater extent, leading to a more substantial output decline. This making foreign currency borrowing even more appealing, as it helps mitigate the degree of output fall driven by default-risk-induced inflation.

Now, I delve into the optimal currency denomination. In Figure 4, I assume the outstanding stock of LC debt equal to zero ($B_{LC} = 0$) and vary B_{FC}. As before, the aggregate productivity remains at its mean value. On the left panel, the solid green and orange lines represent, respectively, the sovereign's FC and LC debt choices for different levels of B_{FC}. Note that, with a larger outstanding debt stock, the government opts for relatively more FC borrowing. This inclination is further highlighted on the right panel of Figure 4 by the blue solid line (left Y-axis)—the share of FC borrowing increases with larger B_{FC}. This shift is a consequence of the escalating cost of borrowing in LC compared to FC as the level of debt issuance grows, prompting the government

[47]An increase in inflation expectations due to default risk leads to a rise in inflation, which calls for a rise in domestic interest rate, leading to a fall in private consumption and labor supply. See Proposition 4 for details.

to switch towards FC borrowing with higher levels of inherited liabilities.

Indeed, the increase in the relative cost of borrowing in LC over FC, accompanied by larger debt issuance as depicted in Figure 2 and 3, is attributed to the government's inability to commit to refraining from raising default risk for opportunistic debasement. Consequently, the government elevates the share of FC borrowing to discipline the next-period government, averting a strategic rise in expected inflation, ultimately lowering ex ante borrowing cost both in FC and LC. The black dashed line on the right panel of Figure 3 (left Y-axis) shows that expected inflation remains moderate for B_{FC} in the region $[0.0, 0.8]$, thanks to higher share of FC borrowing.[48]

4.3 Decomposition and Experiment

In my baseline calibration, I conducted an analysis that integrated inflationary default and a discretionary government, as the primary factors that drive the currency composition of sovereign debt. In this subsection, I redirect the focus to the core experiment of the paper, where I assess the pivotal role of inflationary default in shaping debt denomination. Specifically, my objective is to decompose and extract a portion of the FC borrowing share driven by inflationary default. Subsequently, I elaborate on how inflationary default contributes to shaping the correlation between debt denomination and expected inflation. Finally, I briefly illustrate welfare gains from the optimal debt denomination.

4.3.1 Orthogonality between Inflation and Default

To start, I employ an alternative model specification where default is *orthogonal* to inflation. In this context, given that default is orthogonal to inflation, a discretionary government can no longer manipulate default risk to opportunistically alter inflation. Consequently, the government no longer needs to borrow in foreign currency to discipline future governments. For the purpose of achieving orthogonality, I adopt linear default costs along with $\Delta = 0$ and $\iota \to 0$.[49] Corollary 2 asserts that default is orthogonal to inflation when the default-induced productivity loss is linear.[50] I denote this alternative specification as the *NK-Linear* model. Following Aguiar et al. (2022), I adjust the cost of defaulting to match the average external debt to GDP ratio in my NK-Linear specification. This leads to $d_0 = 0.0392$ (and $d_1 = 0$) in (25). The third column of Table 4 reports the simulation results for the NK-Linear model.

[48] For B_{FC} larger than 0.8, the next-period default risk dominates expected inflation—the probability of defaulting next period is very high, leading to a surge in expected inflation.

[49] This corresponds to the case where default leads to a permanent productivity loss, reentry to the financial market barely happens, and the monetary rule always follows (10).

[50] Under a linear cost of defaulting and $\iota \to 0$, both long-run and short-run productivity undergo an identical percentage point decline, resulting in zero impact of default on inflation. See Corollary 2 and Appendix E for details.

First, bond spreads in NK-Linear specification are lower than those in baseline. Notably, the spread in LC debt falls more than that in FC debt, as the government is no longer able to strategically manipulate inflation (via default risk). Moreover, the average inflation and its standard deviation are markedly lower than the baseline. This is because, in NK-Linear model, inflation depends only on aggregate productivity rather than default risk.

Remarkably, the proportion of FC debt is significantly lower under the NK-Linear specification relative to the baseline. The disparity in the share of FC borrowing amounts to $79.82 - 49.84 \approx 30\%$! This drastic change is attributed to the fact that the government no longer needs to borrow in foreign currency for disciplining purposes. Approximately 30% of FC borrowing share in baseline can be attributed to a positive correlation between inflation and default, a relationship that becomes obsolete in the NK-Linear model.

Lastly, the NK-Linear model features a negative correlation between the share of FC borrowing and inflation expectations. When LC debt provides a higher degree of hedging benefit (i.e. higher expected inflation), the government opts to borrow relatively more in LC. This stands in sharp contrast to the baseline, where a positive correlation exists between the proportion of FC borrowing and inflation expectations—the government borrows more in FC when LC borrowing provides a greater degree of hedge. In baseline, the positive correlation arises from the government's inability to commit future repayment and debt choices—it can opportunistically increase default risk to devalue local currency borrowing, thus making LC borrowing prohibitively expensive, especially when it offers a greater degree of insurance. By contrast, under the NK-Linear specification, the government loses the ability to strategically debase LC debt, resulting in a reduced cost of borrowing in LC. This lower cost prompts the government to seek larger amounts of local currency borrowing, especially during economic downturn (i.e. high expected inflation). This crucial distinction explains the opposite sign of the correlation between the baseline and NK-Linear model.

4.3.2 Welfare Gains from the Optimal Denomination

The paper has shown that engaging in foreign currency borrowing functions as a mechanism to discipline the future governments, resulting in a reduction of ex ante borrowing costs and an enhancement of overall welfare. Here, I quantify the welfare gain from the optimal currency denomination, by conducting the last experiment of the model specification wherein debt denomination is only in local currency. The last column of Table 4 reports the relevant moments within this specification, referred to as the *NK-LC* model.

The first observation is that the average inflation is higher in the NK-LC specification compared to the baseline. This is attributed to the government's consistent pursuit of default risk to strategically debase local currency debt. This opportunistic behaviour is ex ante reflected in LC bond price—the average spread of LC debt is the highest among all specifications in the table. Inflation volatility is also at its peak, as discretionary governments actively manipulate default risk to alter inflation for debt debasement. I find that, if the government is constrained from issuing foreign currency debt, the default frequency rises from 1.35% in baseline to 2.02% in NK-LC model. Indeed, LC debt exhibits characteristics similar to *long-term* debt; its value can be diminished triggered by the issuance of new debt—issuing new debt reduces the value of existing LC debt because it raises the probability of default, raising expected inflation and, consequently, contemporaneous inflation. By contrast, FC debt is analogous to *short-term* debt, as its value remains immune to default-risk-induced inflation.

I compute the welfare gains of optimal currency denomination at the mean level of productivity and zero debt, relative to the NK-LC model. The gain in consumption equivalence terms in my baseline, relative to the NK-LC model, amounts to 0.13%.[51] As is customary in the business cycle literature, the welfare differences are small across models.

5 Conclusion

This paper examines three stylized facts regarding the currency denomination in sovereign bonds in inflation-targeting emerging economies. First, when expected inflation rises, the government shifts its borrowings towards foreign currency. Second, rising inflation expectations are associated with an increase in the relative cost of borrowing in local currency over foreign currency. Lastly, default is inflationary.

I develop a New Keynesian model with endogenous sovereign default and debt denomination to study how fiscal solvency affects the currency composition of sovereign debt, particularly under inflationary default. The decision regarding currency denomination is determined by the relative significance of discipline benefits of foreign currency debt and hedging benefits of local currency debt. Calibration results indicate that the model effectively captures three key stylized facts highlighted at the beginning. My model also suggests that 30% of the proportion of foreign currency borrowing is attributed to inflationary default, stressing the importance of fiscal solvency to reduce foreign currency borrowing.

Finally, this paper introduces a framework that bridges two crucial aspects in emerging economies—central banks pursuing inflation stability during non-crisis periods and sovereign risk in government debt. It offers a structured approach to study the tradeoffs confronted by discretionary governments in the presence of inflationary default and the inflation-targeting monetary rule in non-crisis times. This framework can be further extended to explore optimal monetary policy, and the welfare implications of monetary cooperation, as studied in Corsetti

[51] I derive consumption equivalent C_E from household welfare V_E, as $V_E = \log(C_E)/(1-\beta)$.

and Pesenti (2001), but in the context of default risk. I leave these for future research.

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A Expected Inflation and Inflation Targeting Year

I take the medium institutional forecast values of expected inflation obtained from Bloomberg. Table A1 shows the inflation targeting year for the countries in my sample. Malaysia was viewed as an inflation targeter, but it did not adopt inflation targeting officially. Figure A1 plots the share of foreign currency borrowing in total external borrowing and expected inflation over the periods when inflation targeting has been adopted as the monetary regime in each country of my sample.

Table A1: Inflation Targeting Year

Country	Inflation targeting year
Brazil	1999
Chile	1999
Colombia	1999
Hungary	2001
India	2015
Indonesia	2005
Peru	2002
Poland	2002
Philippines	2002
Russia	2015
South Africa	2000
Thailand	2000
Turkey	2006

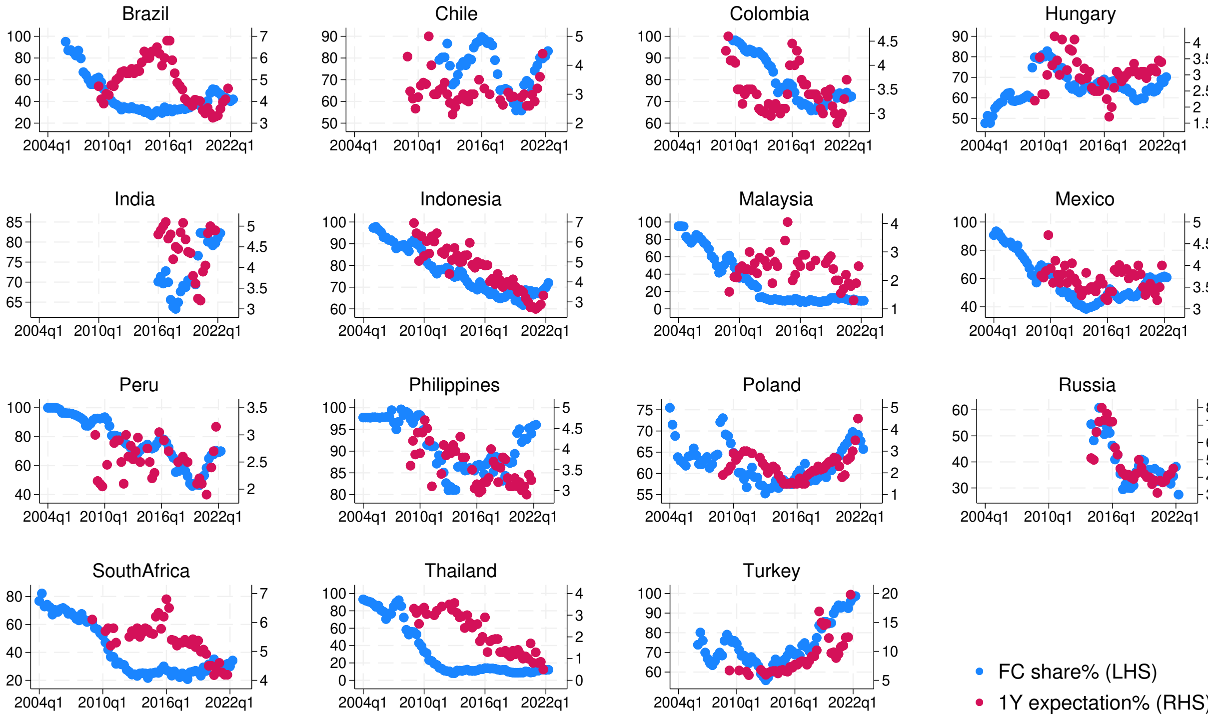

Figure A1: The Share of Foreign Currency Borrowing and Expected Inflation

B Additional Tables

Table B1: Changes in the Stock of Debt and Inflation Expectations (First-Difference Regression)

	The Growth of FC Debt Stock over LC Debt Stock $\Delta F_{it}\% - \Delta D_{it}\%$	
	(1)	(2)
$\Delta\mathbb{E}_t[\pi_{i,t+4}]$ (%)	2.817***	2.834***
	(0.669)	(0.657)
ΔInflation (%)	0.0647	0.0892
	(0.288)	(0.288)
ΔReal Exchange Rate Depreciation (%)		-0.0443
		(0.0380)
ΔReal GDP Growth Rates (%)		-0.0115
		(0.107)
External Sovereign Debt to GDP (%)		0.0611
		(0.0567)
Capital Openness		-0.707
		(0.555)
Private Credit to GDP (%)		0.0346
		(0.0372)
Observations	581	581
R-squared	0.436	0.444

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are reported in parentheses. All specifications include country and quarterly date fixed effects. The dependent variable is the difference between the growth rate of FC debt stock and that of LC debt stock.

Table B2: FC Debt Share and Inflation Expectations, Controlling Global Factors

	FC Debt Share $FCshare$ (%)		
	(1)	(2)	(3)
$\mathbb{E}_t[\pi_{i,t+4}]$ (%)	2.081***	1.487***	1.535***
	(0.575)	(0.475)	(0.417)
Inflation (%)	0.310	0.708***	0.551***
	(0.299)	(0.241)	(0.209)
Real Exchange Rate Depreciation (%)		-0.0253	0.0309
		(0.0420)	(0.0341)
Real GDP Growth Rates (%)		-0.270***	0.142
		(0.0879)	(0.109)
External Sovereign Debt to GDP (%)		-0.215**	-0.237***
		(0.0907)	(0.0641)
Capital Openness		0.602	-0.177
		(0.778)	(0.686)
Private Credit to GDP (%)		-0.410***	-0.183***
		(0.0606)	(0.0529)
US GDP Growth Rates (%)			-0.619***
			(0.206)
log VIX			8.394***
			(0.998)
US 10-year treasury (%)			2.468***
			(0.489)
Federal Fund Rate (%)			-2.343***
			(0.369)
Observations	639	639	639
R-squared	0.883	0.903	0.927
Macro control	No	Yes	Yes
Global control	No	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are reported in parentheses. All specifications include country fixed effects. The dependent variable is the share of FC debt in total public external debt.

Table B3: FC Debt Share and Inflation Expectations for Shorter Time Horizons

	FC Debt Share $FCshare$ (%)		
	(1)	(2)	(3)
$\mathbb{E}_t[\pi_{i,t+1}]$ (one quarter ahead, %)	1.141**		
	(0.460)		
$\mathbb{E}_t[\pi_{i,t+2}]$ (six months ahead, %)		1.053**	
		(0.416)	
$\mathbb{E}_t[\pi_{i,t+4}]$ (one year ahead, %)			1.739***
			(0.365)
Inflation (%)	0.0590	0.280	0.270
	(0.424)	(0.318)	(0.184)
Real Exchange Rate Depreciation (%)	-0.0490	-0.0542	-0.0907**
	(0.0397)	(0.0400)	(0.0386)
Real GDP Growth Rates (%)	0.0855	0.0619	0.0319
	(0.116)	(0.116)	(0.119)
External Sovereign Debt to GDP (%)	-0.344***	-0.342***	-0.299***
	(0.0656)	(0.0657)	(0.0675)
Capital Openness	-1.445**	-1.358*	-1.007
	(0.720)	(0.708)	(0.711)
Private Credit to GDP (%)	-0.0561	-0.0481	-0.0976**
	(0.0421)	(0.0412)	(0.0411)
Observations	702	697	639
R-squared	0.942	0.943	0.947

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are reported in parentheses. All specifications include country and quarterly date fixed effects. The dependent variable is the share of FC debt in total public external debt.

Table B4: LC and FC Bond Yields, and Inflation Expectations

	LC Bond Yield y_{it}^{LC} (%)		FC Bond Yield y_{it}^{FC} (%)	
	(1)	(2)	(3)	(4)
$\mathbb{E}_t[\pi_{i,t+4}]$ (%)	0.657***	0.702***	0.169***	0.165***
	(0.0768)	(0.0672)	(0.0299)	(0.0306)
Inflation (%)	0.205***	0.167***	0.0947***	0.0772***
	(0.0334)	(0.0292)	(0.0157)	(0.0146)
Real Exchange Rate Depreciation (%)		0.00280		-0.0107***
		(0.00749)		(0.00258)
Real GDP Growth Rates (%)		-0.00445		0.00540
		(0.0226)		(0.00899)
External Sovereign Debt to GDP (%)		0.0853***		0.0473***
		(0.0125)		(0.00604)
Capital Openness		-0.0383		-0.339***
		(0.126)		(0.0635)
Domestic Credit to GDP (%)		0.0418***		0.00435
		(0.0114)		(0.00478)
Observations	591	591	559	559
R-squared	0.880	0.907	0.824	0.872

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are reported in parentheses. All specifications include country and quarterly date fixed effects. In column (1) and (2), the dependent variable is five-year LC bond yields; in column (3) and (4), the dependent variable is five-year FC bond yields.

Table B5: Relative Cost of Borrowing in LC over FC and Inflation Expectations, Controlling Global Factors

	LC Yield Over FC Yield $y_{it}^{LC} - y_{it}^{FC}$ (%)		
	(1)	(2)	(3)
$\mathbb{E}_t[\pi_{i,t+4}]$ (%)	0.553***	0.595***	0.588***
	(0.0704)	(0.0719)	(0.0756)
Inflation (%)	0.100***	0.0950***	0.0780***
	(0.0296)	(0.0284)	(0.0282)
Real Exchange Rate Depreciation (%)		0.0165**	0.0190***
		(0.00642)	(0.00640)
Real GDP Growth Rates (%)		0.0144	-0.00577
		(0.0129)	(0.0191)
External Sovereign Debt to GDP (%)		0.0325**	0.0329***
		(0.0127)	(0.0114)
Capital Openness		0.564***	0.470***
		(0.160)	(0.157)
Private Credit to GDP (%)		0.0115*	0.0194**
		(0.00671)	(0.00861)
US GDP Growth Rates (%)			0.0710
			(0.0445)
log VIX			0.374**
			(0.151)
US 10-year treasury (%)			0.154*
			(0.0826)
Federal Fund Rate (%)			-0.205***
			(0.0698)
Observations	511	511	511
R-squared	0.838	0.851	0.857
Macro control	No	Yes	Yes
Global control	No	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are reported in parentheses. All specifications include country fixed effects. The dependent variable is the relative cost of borrowing in LC over FC.

Table B6: CDS Spread and Inflation Expectations, Controlling Global Factors

	CDS Spread $CDS_{\$,it}$ (%)		
	(1)	(2)	(3)
$\mathbb{E}_t[\pi_{i,t+4}]$ (%)	0.147***	0.156***	0.151***
	(0.0401)	(0.0411)	(0.0321)
Inflation (%)	0.114***	0.115***	0.108***
	(0.0189)	(0.0188)	(0.0156)
Real Exchange Rate Depreciation (%)		-0.0156***	-0.0112***
		(0.00324)	(0.00277)
Real GDP Growth Rates (%)		-0.0288***	0.0239**
		(0.00636)	(0.0103)
External Sovereign Debt to GDP (%)		0.0416***	0.0394***
		(0.00869)	(0.00718)
Capital Openness		-0.0668	-0.235***
		(0.0905)	(0.0713)
Private Credit to GDP (%)		-0.0156***	0.00239
		(0.00426)	(0.00422)
US GDP Growth Rates (%)			-0.0934***
			(0.0186)
log VIX			0.646***
			(0.0754)
US 10-year treasury (%)			0.0378
			(0.0393)
Federal Fund Rate (%)			-0.144***
			(0.0303)
Observations	491	453	453
R-squared	0.609	0.588	0.713
Macro control	No	Yes	Yes
Global control	No	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are reported in parentheses. All specifications include country fixed effects. The dependent variable is five-year US dollar denominated CDS spread.

C Private Equilibrium in a Bad Credit Standing

Under a bad credit standing, the private allocation is featured by the following equations. For illustration purposes, I set $\iota \longrightarrow 0$. A case with $\iota > 0$ can be solved analogously. In Appendix I, I outline the algorithm for numerically solving the full equilibrium where $\iota > 0$. Similar to the scenario with a good credit standing in Section 3.2.1, there are 5 unknowns and 5 equations.

$$\text{Domestic Euler:} \quad u_{C^D} = \beta i \int_{z'} f(z,z') \frac{u_{C^{D'}}}{\pi^{D'}} dz' \tag{C1}$$

$$\text{Real Wage:} \quad w^D = -\frac{u_{N^D}}{u_{C^D}} \tag{C2}$$

$$\text{Household BC:} \quad C^D = (1-\tau) z^D N^D \tag{C3}$$

$$\text{NKPC:} \quad (\pi^D - \bar{\pi})\pi = \frac{\eta - 1}{\varphi}\left(\frac{w^D}{z^D} - 1\right) + \beta \int_{z'} f(z,z') \frac{u_{C^{D'}} z^{D'} N^{D'}}{u_{C^D} z^D N^D} (\pi^{D'} - \bar{\pi})\pi^{D'} dz' \tag{C4}$$

$$\text{Interest rate rule:} \quad i^D = (\bar{i} - \Delta)\left(\frac{\pi^D}{\bar{\pi}}\right)^{\alpha_p} \tag{C5}$$

The main difference between private equilibrium in a good and bad credit standing is colored in red in the preceding set of equations. First, the aggregate productivity drops from z to z^D as a default penalty. Second, the monetary policy is expansionary.

D Default, Productivity Loss, and Inflation

In this section, I conduct the analysis where default causes productivity loss and how ι affects inflation after default. First, I focus on the case where $\iota \longrightarrow 0$.

I compare inflation under two scenarios: full debt repayment over the periods, and default in period 0 by the government. For the sake of tractability, I employ a deterministic version of my model that excludes any uncertainty. The aggregate productivity upon repayment follows the path $\{z_t\}_{t=0}^{\infty}$, depicted with a solid line in Figure D1. At time 0, the economy faces low productivity, and gradually recovers to its steady state—from period 2 onward, productivity stays at the steady state $\bar{z}$ forever. Although this example does not account for any uncertainty or/and fluctuations in productivity beyond period 2, the path of z captures the primary characteristic of AR(1) process[52] during an economic downturn—over the periods, given that z follows AR(1) process, the economy gradually rebounds from a recession and fluctuates around the unconditional mean of the random variable z.

Default leads to a permanent productivity loss, as illustrated by the dotted line in Figure

[52] z in my quantitative model follows AR(1) process.

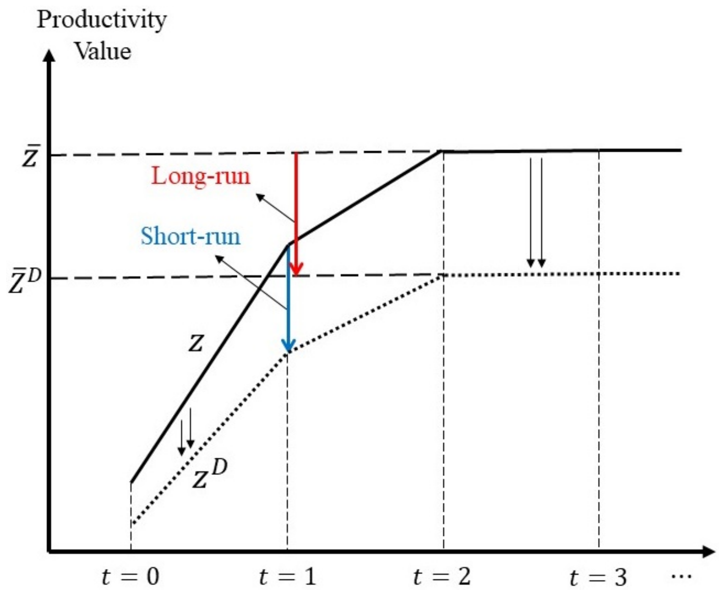

Figure D1: Aggregate productivity paths, and short-run and long-run components in (D5).

D1. The corresponding steady-state value of productivity declines from $\bar{z}$ to $\bar{z}^D$. For the sake of simplicity, I assume the relative risk aversion γ and inflation target $\bar{\pi}$ both equal to one in the following analysis. I log-linearize all relevant variables in (13)-(17), under full repayment and default scenarios, respectively. A detailed log-linearization characterization is provided in Appendix D.1. Following the log-linearization, I can show that, upon repayment:

$$\hat{\pi}_1 = -\frac{\chi}{1+\alpha_P\chi}\hat{z}_1 \tag{D1}$$

$$\hat{\pi}_0 = -\frac{\chi}{1+\alpha_P\chi}\hat{z}_0 + \frac{\beta-(\alpha_P-1)\chi}{1+\alpha_P\chi}\hat{\pi}_1 \tag{D2}$$

$$\text{with } \chi \equiv \frac{\eta-1}{\varphi}\left(1+\frac{1}{\zeta}\right)$$

If default took place in period 0, the log-linearization results are:

$$\hat{\pi}_1^D = -\frac{\chi}{1+\alpha_P\chi}\hat{z}_1^D \tag{D3}$$

$$\hat{\pi}_0^D = -\frac{\chi}{1+\alpha_P\chi}\hat{z}_0^D + \frac{\beta-(\alpha_P-1)\chi}{1+\alpha_P\chi}\hat{\pi}_1^D \tag{D4}$$

Here, $\hat{x}_t$ ($\hat{x}_t^D$) represents the log-linearized variable x (x^D) around the steady state $\bar{x}$ ($\bar{x}^D$) in period t (e.g., $\hat{z}_0 \equiv (z_0-\bar{z})/\bar{z}$ denotes the log-linearized productivity around steady state $\bar{z}$ in period 0). Note that, regardless of whether the government defaulted or not, from period 2, the economy stays at steady state indefinitely hence $\hat{\pi}_t = \hat{z}_t = 0$ and $\hat{\pi}_t^D = \hat{z}_t^D = 0$ for

$t \geq 2$. In either scenario, period-1 inflation is higher than the steady state inflation, due to higher marginal costs driven by low productivity relative to steady-state productivity ($\hat{z}_1 < 0$ and $\hat{z}_1^D < 0$). Inflation in period 0 is the highest among all periods, which is jointly determined by the lowest period-0 productivity and period-1 inflation.

Default results in a permanent productivity loss, which may impact inflation in both period 0 and 1. The change in equilibrium inflation after default $\pi_t^D - \pi_t$ can be decomposed into two components—short-run and long-run. Using period 1 as the reference time point, default leads to a decline in productivity at time 1 ($z_1^D < z_1$). Assuming the long-run productivity remains unchanged, this drop in productivity imposes inflationary pressure as the degree of deviation $|\frac{z_1^D - \bar{z}}{\bar{z}}|$ enlarges relative to $|\hat{z}_1| = |\frac{z_1 - \bar{z}}{\bar{z}}|$. This is illustrated with the blue arrow in Figure D1, representing the positive short-run component in equation (D5) below:

$$\hat{\pi}_1^D - \hat{\pi}_1 = -\frac{\chi}{1+\alpha_P \chi}(\hat{z}_1^D - \hat{z}_1) = \frac{\chi}{1+\alpha_P \chi}\left[\overbrace{\hat{z}_1 - \left(\frac{z_1^D - \bar{z}}{\bar{z}}\right)}^{\text{short-run, } > 0} + \overbrace{\left(\frac{z_1^D - \bar{z}}{\bar{z}} - \hat{z}_1^D\right)}^{\text{long-run, } < 0}\right] \tag{D5}$$

However, default not only causes a productivity loss today but also in the future—$\bar{z}$ decreases to $\bar{z}^D$, imposing a deflationary pressure on the economy. A decline in steady-state productivity reduces deviation, as illustrated with the red arrow in Figure D1 and equation (D5). Whether default causes more inflation or not depends on the relative significance between these two components.

Note that, when $\iota \rightarrow 1$, the long-run component is equal to zero in (D5), as long-run productivity is unaffected by the occurrence of default due to immediate reentry afterwards. Consequently, default-induced productivity loss resembles a temporary negative productivity shock, triggering inflation. This can be observed from the inflationary short-run component in (D5).

D.1 Log-linearization

I present the log-linearization results for (13)-(17). Log-linearization results upon default can be derived analogously.

Period 1:

$$
\begin{aligned}
-\hat{C}_1 &= \hat{i}_1 \\
\hat{w}_1 &= \hat{C}_1 - \frac{1}{\zeta}\hat{N}_1 \\
\hat{C}_1 &= \hat{z}_1 + \hat{N}_1 \\
\hat{\pi}_1 &= \frac{\eta - 1}{\varphi}(\hat{w}_1 - \hat{z}_1) \\
\hat{i}_1 &= \alpha_P \hat{\pi}_1
\end{aligned}
$$

Period 0:

$$
\begin{aligned}
-\hat{C}_0 &= \hat{i}_0 - \hat{C}_1 - \hat{\pi}_1 \\
\hat{w}_0 &= \hat{C}_0 - \frac{1}{\zeta}\hat{N}_0 \\
\hat{C}_0 &= \hat{z}_0 + \hat{N}_0 \\
\hat{\pi}_0 &= \frac{\eta - 1}{\varphi}(\hat{w}_0 - \hat{z}_0) + \beta\hat{\pi}_1 \\
\hat{i}_0 &= \alpha_P \hat{\pi}_0
\end{aligned}
$$

E Non-separability and Inflation

In this section, I provide an insightful mechanism that sheds light on inflation driven by the non-separability of the utility function given $\iota \to 0$. For the sake of tractability, akin to the analysis in Appendix D, I focus on the economy following a deterministic path of productivity depicted in Figure D1. Without loss of generality, I posit that the economy enters the steady state from period 2.

Adopting the utility function (20), the marginal utility $u_{C,t}$ in Euler equation (3) is equal to

$$
u_{C,t} = \theta C_t^{-1/\vartheta}\left(\theta C_t^{\frac{\vartheta-1}{\vartheta}} + (1-\theta)G_t^{\frac{\vartheta-1}{\vartheta}}\right)^{-1}
$$

Note that, when $\vartheta \to 1$, the log utility function is fully separable between C_t and G_t, and $u_{C,t}$ no longer depends on G_t. Equations below show the period-1 log-linearization results.

$$
\begin{aligned}
-\frac{1}{\vartheta}\hat{C}_1 - \left(1-\frac{1}{\vartheta}\right)\left[w_{C^*}\hat{C}_1 + (1-w_{C^*})\hat{G}_1\right] &= \hat{i}_1 \\
\text{where } w_{C^*} \equiv \frac{\theta(C^*)^{(\vartheta-1)/\vartheta}}{\theta(C^*)^{(\vartheta-1)/\vartheta} + (1-\theta)(G^*)^{(\vartheta-1)/\vartheta}} &\in (0,1) \\
\hat{w}_1 &= \frac{1}{\vartheta}\hat{C}_1 + \left(1-\frac{1}{\vartheta}\right)\left[w_{C^*}\hat{C}_1 + (1-w_{C^*})\hat{G}_1\right] - \frac{1}{\zeta}\hat{N}_1 \\
\hat{C}_1 &= \hat{z}_1 + \hat{N}_1 \\
\hat{\pi}_1 &= \frac{\eta-1}{\varphi}(\hat{w}_1 - \hat{z}_1) \\
\hat{i}_1 &= \alpha_P \hat{\pi}_1
\end{aligned}
$$

Analogous equations can be derived for period 0. These log-linearized equations generate

$$
\begin{aligned}
\hat{\pi}_1 &= -\frac{\chi}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{z}_1 - \frac{\Gamma_G}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{G}_1 && \text{(E1)} \\
\hat{\pi}_0 &= -\frac{\chi}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{z}_0 - \frac{\Gamma_G}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{G}_0 + \frac{\beta-(\alpha_P-1)(\chi+\Gamma_G)}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{\pi}_1 \\
\hat{\pi}_1^D &= -\frac{\chi}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{z}_1^D - \frac{\Gamma_G}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{G}_1^D && \text{(E2)} \\
\hat{\pi}_0^D &= -\frac{\chi}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{z}_0^D - \frac{\Gamma_G}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{G}_0^D + \frac{\beta-(\alpha_P-1)(\chi+\Gamma_G)}{1+\alpha_P\chi+\alpha_P\Gamma_G}\hat{\pi}_1^D \\
\text{with } \Gamma_G &\equiv \frac{\eta-1}{\varphi}\frac{1}{\zeta}\left[\frac{1}{\frac{1}{\vartheta}+(1-\frac{1}{\vartheta})w_{C^*}} - 1\right] \gtreqless 0 \text{ when } \vartheta \gtreqless 1
\end{aligned}
$$

Γ_G represents a separability wedge, which emerges only when C and G are non-separable in the utility function.[53] When $\vartheta > 1$ ($\vartheta < 1$), C and G are substitutes (complements) and $\Gamma_G > 0$ ($\Gamma_G < 0$).

Clearly, owing to non-separability, inflation now depends not only on the productivity deviation ($\hat{z}^D$ and $\hat{z}$) but also on public spending deviation ($\hat{G}^D$ and $\hat{G}$). When the government fully repays debt, it can borrow from lenders to smooth public consumption G, resulting in much smaller fluctuation (and deviation from the steady state) relative to default (i.e. $|\hat{G}_t| \ll |\hat{G}_t^D|$ for $t = 0, 1$). In addition, as the government cannot borrow to smooth consumption in a state of default, G_0^D and G_1^D is unambiguously smaller than the steady-state value $\bar{G}^D$, implying $\hat{G}_0^D < \hat{G}_1^D < 0$.

Consequently, depending on the sign of Γ_G, larger public spending deviation upon default

[53] When $\vartheta \to 1$, the utility exhibits full separability between C and G, resulting in $\Gamma_G = 0$. The log-linearized equations then revert to (D1)-(D4) in Appendix D.

leads to either inflation or deflation. I specifically focus on the equilibrium inflation in period 1, by subtracting equation (E1) using (E2).[54] This is illustrated in equation (E3) below:

$$\hat{\pi}_1^D - \hat{\pi}_1 = \overbrace{\frac{\chi}{1+\alpha_P\chi+\alpha_P\Gamma_G}(\hat{z}_1 - \hat{z}_1^D)}^{\text{Productivity Channel}} + \overbrace{\frac{\Gamma_G}{1+\alpha_P\chi+\alpha_P\Gamma_G}(\hat{G}_1 - \hat{G}_1^D)}^{\text{Non-separability Channel}} \tag{E3}$$

Default-induced inflation/deflation can be decomposed into two channels—the productivity channel and the non-separability channel.[55] When C and G feature complementarity (i.e. $\vartheta < 1$), Γ_G is negative. In this case, as $\hat{G}_1^D$ is much more negative than $\hat{G}_1$ ($\hat{G}_1^D < \hat{G}_1$), the non-separability channel imposes deflationary pressure on the economy. Conversely, when C and G features substitutability (i.e. $\vartheta > 1$), a wedge Γ_G becomes positive, and thus the non-separability channel imposes inflationary pressure. Note that, the productivity channel, which is non-inflationary[56], is present irrespective of non-separability and is not contingent on the complementarity/substitutability between C and G. If C and G exhibit strong substitutability, the inflationary non-separability channel may overwhelm the non-inflationary productivity channel, resulting in inflationary default.

F Inflationary Default and Output

In this section, I provide a mechanism showing how default risk depresses output. Without loss of generality, I assume that the productivity remains at $\bar{z}$ throughout the periods, as depicted in Figure F1. I posit that, in period 1, default occurs with probability p^D, followed by an economic recovery to the steady state with full repayment from period 2 onwards. While this example does not incorporate productivity uncertainty, it highlights how the change in the probability of defaulting p^D affects the equilibrium output and labor supply at time 0. The government in my model indeed "picks" p^D by choosing how much debt to issue.

For all periods, the productivity remains at $\bar{z}$—$\hat{z}_t = 0$ for $\forall t \geq 0$. Moreover, the economy enters the steady state from period 2, and therefore $\hat{\pi}_t = 0$ for $t \geq 2$. In period 1, default may occur, and it is inflationary due to a loose interest rate rule specified in (11)—$\hat{\pi}_1^D > 0$. Following the period-0 log-linearization results (D2), I can show that

[54] Focusing on period-0 inflation does not alter the key results shown below.

[55] The productivity channel can be further decomposed into long-run and short-run productivity components, as illustrated in Appendix D.

[56] See Collorary 1 and 2 for details.

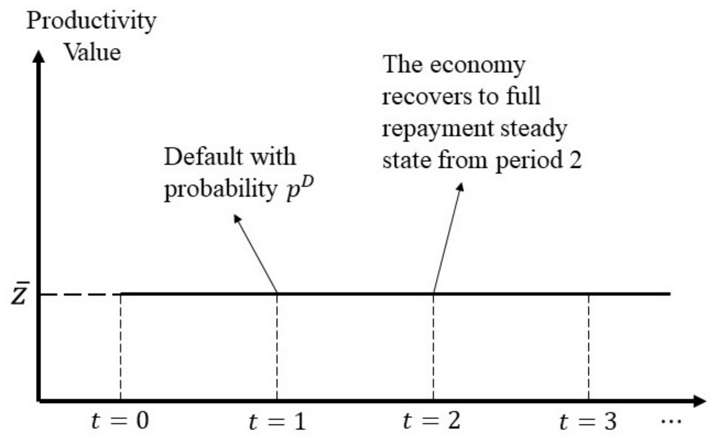

Figure F1: Aggregate productivity paths

$$\hat{\pi}_0 = \frac{\beta - (\alpha_P - 1)\chi}{1 + \alpha_P \chi} p^D \hat{\pi}_1^D \text{ with } \chi \equiv \frac{\eta - 1}{\varphi}\left(1 + \frac{1}{\zeta}\right)$$

Note that, if the government repays in period 0 (with a probability of $1 - p^D$), inflation remains at the target in period 1. Clearly, a rise in default risk ($p^D \uparrow$) results in higher period-0 inflation. This would, in turn, lead to higher contemporaneous domestic interest rate, subsequently lower consumption and labor supply.

To prove Proposition 4, I introduce the following assumption, which holds in my rich quantitative version of the model:

Assumption F1. *Given that $\alpha_P \beta > 1$, adopting a loose monetary rule (10) leads to higher aggregate consumption and inflation rate relative to a scenario following the rule (11), i.e. $\hat{C}_1^D > 0$ and $\hat{\pi}_1^D > 0$. However, a rise in aggregate consumption is relatively modest in comparison to the increase in inflation. Namely, $\hat{\pi}_1^D \gg \hat{C}_1^D$.*

Assumption F1 ensures that the inflation surge triggered by default leads to a higher domestic interest rate, subsequently causing lower aggregate consumption. Log-linearization gives the following equations:

$$\hat{C}_0 = -p^D \left[(\alpha_P \beta - 1)\hat{\pi}_1^D - \hat{C}_1^D\right] < 0$$
$$\hat{N}_0 = \hat{C}_0$$

Given that $\alpha_P \beta - 1 > 0$ and $\hat{\pi}_1^D \gg \hat{C}_1^D$, inflation resulting from default risk diminishes period-0 consumption, as the central bank responds by increasing the domestic interest rate. The reduced demand for aggregate consumption leads to a lower equilibrium labor supply, ultimately causing a decline in aggregate output. Note that higher default risk (increased p^D) further diminishes equilibrium labor supply and output, as $\partial \hat{C}_0/\partial p^D < 0$ and $\partial \hat{N}_0/\partial p^D < 0$.

G Sensitivity to the Utility Shock

The introduction of utility shocks plays a crucial role in achieving convergence in long-term debt models. It is well-documented in Chatterjee and Eyigungor (2012) that without such shocks, these models do not converge. However, it is important to note, as pointed out by Dvorkin et al. (2021), that these shocks are likely to impact the moments of the model. In Table G1, we observe that changes in $\rho_{\mathbf{v}}$ and $\sigma_{\mathbf{v}}$ barely affect alter the moments of the model.

Table G1: Moments varying $\rho_{\mathbf{v}}$ and $\sigma_{\mathbf{v}}$

Targeted Moment (annualized)	Baseline	$\rho_{\mathbf{v}} \times 0.83$	$\rho_{\mathbf{v}} \times 1.15$	$\sigma_{\mathbf{v}} \times 0.85$	$\sigma_{\mathbf{v}} \times 1.15$
Mean					
Domestic interest rate (%)	4.31	4.27	4.38	4.24	4.39
External debt to GDP ratio (%)	18.5	18.3	18.7	18.4	18.6
G to GDP ratio (%)	29.3	29.3	29.3	29.3	29.3
5-year FC debt spread (%)	1.39	1.34	1.44	1.31	1.46
Inflation (%)	3.62	3.59	3.65	3.58	3.66
Untargeted Moment (annualized)					
Mean					
FC debt share in external borrowing (%)	79.82	81.13	78.60	81.07	78.54
Default frequency (%)	1.35	1.31	1.39	1.28	1.41
Spread of 5-year LC debt (%)	4.94	4.87	5.01	4.82	5.05
Standard deviation					
Spread of FC debt σ_{FC} (%)	0.42	0.36	0.47	0.37	0.47
Spread of LC debt σ_{LC} (%)	0.77	0.74	0.82	0.74	0.83
σ_{FC}/σ_{LC}	0.55	0.48	0.57	0.50	0.57
Inflation (%)	3.21	3.02	3.40	3.04	3.39
Correlation with expected inflation					
FC debt share	0.197	0.197	0.201	0.202	0.206
Relative cost of borrowing (LC over FC)	0.719	0.750	0.696	0.741	0.706
5-year FC debt spread (CDS spread)	0.892	0.889	0.906	0.887	0.905

Notes: The correlation between FC debt share and expected inflation is computed assuming the government behaves as if the value of the utility shock is zero. To specifically examine how discipline and hedging benefits shape currency denomination, I focus on the correlation between FC debt share and inflation expectations abstracted from the utility shocks.

H Changes in Output with Debt Issuance

In this section, I illustrate the impact of a rise in expected inflation and default risk on aggregate output. Figure H1 plots equilibrium labor supply, inflation, and expected inflation along with default probabilty, varying B'_{FC} (left three panels, with $B'_{LC} = 0$) and B'_{LC} (right three panels, with $B'_{FC} = 0$). The bottom two panels are identical to the right panel of Figure 2 and 3, and the top two panels and middle two panels depict, respectively, equilibrium labor supply and inflation.

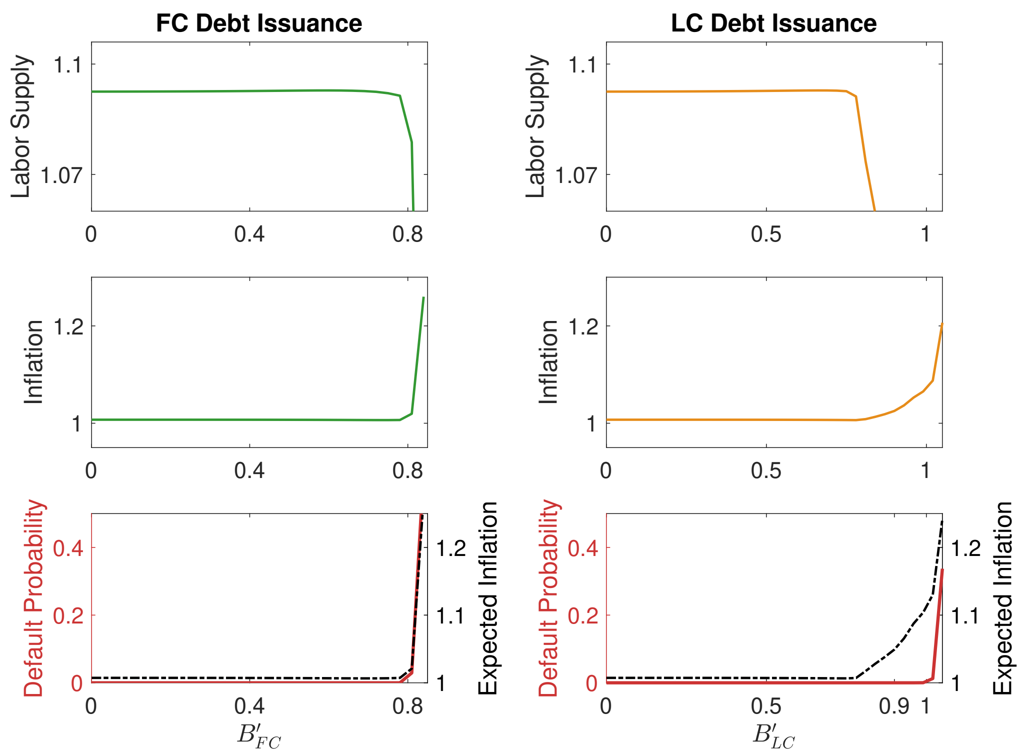

Figure H1: Changes in labor supply and inflation varying B'_{FC} (green) or B'_{LC} (orange)

As discussed in the main text, for the same level of default risk, local currency borrowing tends to raise expected inflation much more than foreign currency borrowing, causing a sharp increase in contemporaneous inflation and a drastic fall in aggregate labor supply. For instance, when $B'_{LC} = 0.9$, the probability of defaulting is zero, but expected inflation is high due the anticipated debt debasement by the next-period government. Consequently, contemporaneous inflation, as well as labor supply, experiences a substantial decline. By contrast, expected inflation, labor supply, and inflation, barely change with foreign currency borrowing, given that the level of issuance does not entails default risk (i.e. for B'_{FC} lower than 0.79 on the right three panels of the figure).

Hence, as foreign currency borrowing helps contain expected inflation, it simultaneously mitigates the decline in aggregate output, rendering foreign currency borrowing appealing. See Corollary 4 for details.

I Long-term Debt Model with the Utility Shock

In what follows, I present the value functions, policies, private equilibrium schedules, and bond price schedules, all contingent on the utility shock $\mathbf{v}$. I assume that foreign currency debt takes values from a discretized space $\mathbf{B}_{FC} = \{B_{FC,1}, \cdots, B_{FC,\mathcal{F}}\}$ with $|\mathbf{B}_{FC}| = \mathcal{F}$, and local currency debt is selected from $\mathbf{B}_{LC} = \{B_{LC,1}, \cdots, B_{LC,\mathcal{L}}\}$ with $|\mathbf{B}_{LC}| = \mathcal{L}$. The available debt choices can be represented by $\mathcal{F} \times \mathcal{L}$ matrix as follows:

$$\begin{bmatrix} (B_{FC,1}, B_{LC,1}) & (B_{FC,1}, B_{LC,2}) & \dots & (B_{FC,1}, B_{LC,\mathcal{L}}) \\ (B_{FC,2}, B_{LC,1}) & (B_{FC,2}, B_{LC,2}) & \dots & (B_{FC,2}, B_{LC,\mathcal{L}}) \\ \vdots & \vdots & \ddots & \vdots \\ (B_{FC,\mathcal{F}}, B_{LC,1}) & (B_{FC,\mathcal{F}}, B_{LC,2}) & \dots & (B_{FC,\mathcal{F}}, B_{LC,\mathcal{L}}) \end{bmatrix}$$

Define the vector $\vec{\mathbf{B}}$ by vectorizing the above matrix, which contains $\mathcal{J} \equiv \mathcal{F} \times \mathcal{L}$ elements:

$$\vec{\mathbf{B}} \equiv [\overbrace{(B_{FC,1}, B_{LC,1}), (B_{FC,2}, B_{LC,1}), \cdots, (B_{FC,\mathcal{F}}, B_{LC,1})}^{\mathcal{F} \text{ elements}}, \overbrace{(B_{FC,1}, B_{LC,2}), \cdots, (B_{FC,\mathcal{F}}, B_{LC,2})}^{\mathcal{F} \text{ elements}}, \cdots, \\ (B_{FC,1}, B_{LC,\mathcal{L}}), \cdots, (B_{FC,\mathcal{F}}, B_{LC,\mathcal{L}})]'$$

$\vec{\mathcal{B}}_k$ is then the kth elements of vector $\vec{\mathbf{B}}$.

A utility shock vector, denoted as $\mathbf{v}$, is of size $\mathcal{J} + 1$, corresponding to the number of all possible debt choices in the vector $\vec{\mathbf{B}}$, along with one additional element to account for the choice of default. The distribution of these shocks is assumed to follow a Generalized Extreme Value distribution. I further assume that the vector $\mathbf{v}$ is i.i.d. over time.

Following Dvorkin et al. (2021), the ex-ante value of the utility before the realization of the utility shock, when the aggregate productivity is z and the outstanding stock of debt is $\vec{\mathcal{B}}_i$, is expressed as:

$$V(z, \vec{\mathcal{B}}_i) = \sigma_v \ln\left(\left[\sum_{k=1}^{\mathcal{J}} \exp\left(\frac{u(C_k, G_{i,k}, N_k) + \beta_G \mathbb{E}_{z'|z}\left[V(z', \vec{\mathcal{B}}_k)\right]}{\rho_{\mathbf{v}}\sigma_{\mathbf{v}}}\right)\right]^{\rho_{\mathbf{v}}} + \exp\left(\frac{V^D(z)}{\sigma_{\mathbf{v}}}\right)\right)$$

where $C_k(z) \equiv C(z, \vec{\mathcal{B}}_k)$, $N_k(z) \equiv N(z, \vec{\mathcal{B}}_k)$, and $G_{i,k}(z) \equiv G(z, \vec{\mathcal{B}}_i, \vec{\mathcal{B}}_k)$. V^D is the utility of defaulting, derived using the following equation:

$$V^D(z) = u(C^D(z), G^D(z), N^D(z)) + \beta_G \mathbb{E}_{z'|z}\left[\iota V(z', \vec{\mathbf{0}}) + (1-\iota)V^D(z')\right]$$

$\vec{\mathbf{0}} \equiv (0,0)$ is the zero-debt vector, indicating that defaulted governments, if they reenter the financial market (happening with a probability ι), enter with zero debt.

The probability of choosing $\vec{\mathcal{B}}_j$ by the sovereign, given the outstanding debt stock $\vec{\mathcal{B}}_i$ and the current-period productivity z, is expresses as:

$$p^B(\vec{\mathcal{B}}_j; z, \vec{\mathcal{B}}_i) = \frac{\exp\left(\frac{u(C_j(z), G_{i,j}(z), N_j(z)) + \beta_G \mathbb{E}_{z'|z}\left[V(z', \vec{\mathcal{B}}_j)\right]}{\rho_{\mathbf{v}}\sigma_{\mathbf{v}}}\right)}{\sum_{k=1}^{\mathcal{J}} \exp\left(\frac{u(C_j(z), G_{i,k}(z), N_j(z)) + \beta_G \mathbb{E}_{z'|z}\left[V(z', \vec{\mathcal{B}}_k)\right]}{\rho_{\mathbf{v}}\sigma_{\mathbf{v}}}\right)}$$

The probability of defaulting is

$$p^D(z, \vec{\mathcal{B}}_i) = \frac{\exp\left(\frac{V^D(z)}{\sigma_{\mathbf{v}}}\right)}{\left[\sum_{k=1}^{\mathcal{J}} \exp\left(\frac{u(C_j(z), G_{i,k}(z), N_j(z)) + \beta_G \mathbb{E}_{z'|z}\left[V(z', \vec{\mathcal{B}}_k)\right]}{\rho_{\mathbf{v}}\sigma_{\mathbf{v}}}\right)\right]^{\rho_v} + \exp\left(\frac{V^D(z)}{\sigma_{\mathbf{v}}}\right)}$$

The foreign currency long-term bond price, given that debt issuance is set at $\vec{\mathcal{B}}_j$, is:

$$Q_{FC}(z, \vec{\mathcal{B}}_j) = \frac{1}{1+r^*}\mathbb{E}_{z'|z}\left[\left(1 - p^D(z', \vec{\mathcal{B}}_j)\right) \times \left(\kappa + \lambda + \sum_{k=1}^{\mathcal{J}} (1-\lambda) Q_{FC}(z', \vec{\mathcal{B}}_k) p^B(\vec{\mathcal{B}}_k; z, \vec{\mathcal{B}}_j)\right)\right] \quad \text{(I1)}$$

The local currency long-term bond price depends on an additional term—expected inflation:

$$Q_{LC}(z, \vec{\mathcal{B}}_j) = \frac{1}{1+r^*}\mathbb{E}_{z'|z}\left[\left(1 - p^D(z', \vec{\mathcal{B}}_j)\right) \times \left(\sum_{k=1}^{\mathcal{J}} p^B(\vec{\mathcal{B}}_k; z, \vec{\mathcal{B}}_j) \times \frac{\kappa + \lambda + (1-\lambda) Q_{LC}(z', \vec{\mathcal{B}}_k)}{\pi(z', \vec{\mathcal{B}}_k)}\right)\right] \quad \text{(I2)}$$

I.1 Numerical Algorithm

The numerical solution method outlined below is similar to Arellano et al. (2023), except that the utility function features full separability. First, I establish private equilibrium schedules taking the expectation terms $\mathcal{M}$ and $\mathcal{H}$ as given, shown below

$$\text{Domestic Euler:} \qquad u_C = \beta i \mathcal{M}(z, \vec{\mathcal{B}}') \tag{I3}$$

$$\text{Real Wage:} \qquad w = -\frac{u_N}{u_C} \tag{I4}$$

$$\text{Household Budget:} \qquad C = (1-\tau) z N \tag{I5}$$

$$\text{NKPC:} \qquad (\pi - \bar{\pi})\pi = \frac{\eta - 1}{\varphi}\left(\frac{w}{z} - 1\right) + \frac{\beta}{u_C z N}\mathcal{H}(z, \vec{\mathcal{B}}') \tag{I6}$$

$$\text{Interest Rate Rule:} \qquad i = \bar{i}\left(\frac{\pi}{\bar{\pi}}\right)^{\alpha_p} \tag{I7}$$

where

$$\mathcal{M}(z, \vec{\mathcal{B}}') \equiv \int_{\mathcal{R}(\vec{\mathcal{B}}')} f(z, z') \frac{u_{C'}}{\pi'} dz' + \int_{\mathcal{D}(\vec{\mathcal{B}}')} f(z, z') \frac{u_{C^{D'}}}{\pi^{D'}} dz'$$

$$\mathcal{H}(z, \vec{\mathcal{B}}') \equiv \int_{\mathcal{R}(\vec{\mathcal{B}}')} f(z, z') u_{C'} z' N' (\pi' - \bar{\pi}) \pi' dz' + \int_{\mathcal{D}(\vec{\mathcal{B}}')} f(z, z') u_{C^{D'}} z^{D'} N^{D'} (\pi^{D'} - \bar{\pi}) \pi^{D'} dz'$$

Hence, in the presence of utility shocks:

$$\mathcal{M}(z, \vec{\mathcal{B}}_j) = \int_Z f(z, z') \left(1 - p^D(z', \vec{\mathcal{B}}_j)\right) \sum_{k=1}^{\mathcal{J}} p^B(\vec{\mathcal{B}}_k; z, \vec{\mathcal{B}}_j) \frac{u_{C_k(z')}}{\pi_k} dz' + \int_Z f(z, z') p^D(z', \vec{\mathcal{B}}_j) \frac{u_{C^D(z')}}{\pi^D(z')} dz' \tag{I8}$$

$$\mathcal{H}(z, \vec{\mathcal{B}}_j) = \int_Z f(z, z') \left(1 - p^D(z', \vec{\mathcal{B}}_j)\right) \sum_{k=1}^{\mathcal{J}} p^B(\vec{\mathcal{B}}_k; z, \vec{\mathcal{B}}_j) u_{C_k(z')} z' N_k(z') (\pi_k(z') - \bar{\pi}) \pi_k(z') dz' + \int_Z f(z, z') p^D(z', \vec{\mathcal{B}}_j) u_{C^D(z')} z^{D'} N^D(z') (\pi^D(z') - \bar{\pi}) \pi^D(z') dz' \tag{I9}$$

where $\pi_k(z) \equiv \pi(z, \vec{\mathcal{B}}_k)$.

1. Start with initial guesses for the value functions V, the expectation terms $\mathcal{M}$ and $\mathcal{H}$, as well as bond price schedules Q_{FC} and Q_{LC}. For each possible debt choice $\vec{\mathcal{B}}_j$ ($j \in \mathcal{J}$), solve the corresponding private equilibrium schedules taking $\mathcal{M}$ and $\mathcal{H}$ as given.

   (a) Guess $C_j(z)$ and $N_j(z)$. Using equation (I3) to derive $i_j(z) \equiv i(z, \vec{\mathcal{B}}_j)$.

   (b) With $i_j(z)$ and equation (I7), derive the corresponding $\pi_j(z)$.

   (c) Derive real wages $w_j(z) \equiv w(z, \vec{\mathcal{B}}_j)$ using the guess of $C_j(z)$ and $N_j(z)$ and equation (I4).

(d) Derive a new value of labor supply $\hat{N}_j(z)$ using the guess of $C_j(z)$ and (I5).

(e) Use the current guess $N_j(z)$, newly derived $w_j(z)$ and $\pi_j(z)$, and the NKPC (I6) to derive a new value of private consumption $\hat{C}_j(z)$.

(f) Check whether $|C_j(z) - \hat{C}_j(z)| < 1e^{-7}$ and $|N_j(z) - \hat{N}_j(z)| < 1e^{-7}$. If not, update $C_j(z)$ and $N_j(z)$ until they satisfy the private equilibrium convergence criterion.

These steps generate private equilibrium schedules in repayment states: $C(z, \vec{\mathcal{B}}_j)$, $N(z, \vec{\mathcal{B}}_j)$, $\pi(z, \vec{\mathcal{B}}_j)$, $i(z, \vec{\mathcal{B}}_j)$, $w(z, \vec{\mathcal{B}}_j)$, where $j \in \mathcal{J}$.

2. Solve the private equilibrium in a state of default analogously. The solution encompasses $C^D(z)$, $N^D(z)$, $\pi^D(z)$, $i^D(z)$, $w^D(z)$.

3. Solve the government's optimization problem in the absence of utility shocks, taking the private equilibrium schedules and bond price schedules as given. This generates a new value function $\bar{V}(z, \vec{\mathcal{B}})$, which would be realized under the assumption that all taste shocks are zero.

4. Derive the new ex-ante value of utility before the utility shock realization $\hat{V}$, and derive the probability p^B and p^D for each $i \in \mathcal{J}$ and $j \in \mathcal{J}$ using the following equations:

$$\hat{V}(z, \vec{\mathcal{B}}_i) = \bar{V}(z, \vec{\mathcal{B}}_i) + \sigma_v \ln \left(\left[\sum_{k=1}^{\mathcal{J}} \exp\left(\frac{u(C_k, G_{i,k}, N_k) + \beta_G \mathbb{E}_{z'|z}\left[V(z', \vec{\mathcal{B}}_k)\right] - \bar{V}(z, \vec{\mathcal{B}}_i)}{\rho_{\mathbf{v}} \sigma_{\mathbf{v}}} \right) \right]^{\rho_{\mathbf{v}}} + \exp\left(\frac{V^D(z) - \bar{V}(z, \vec{\mathcal{B}}_i)}{\sigma_{\mathbf{v}}} \right) \right)$$

$$p^B(\vec{\mathcal{B}}_j; z, \vec{\mathcal{B}}_i) = \frac{\exp\left(\frac{u(C_j(z), G_{i,j}(z), N_j(z)) + \beta_G \mathbb{E}_{z'|z}\left[V(z', \vec{\mathcal{B}}_j)\right] - \bar{V}(z, \vec{\mathcal{B}}_i)}{\rho_{\mathbf{v}} \sigma_{\mathbf{v}}} \right)}{\sum_{k=1}^{\mathcal{J}} \exp\left(\frac{u(C_j(z), G_{i,k}(z), N_j(z)) + \beta_G \mathbb{E}_{z'|z}\left[V(z', \vec{\mathcal{B}}_k)\right] - \bar{V}(z, \vec{\mathcal{B}}_i)}{\rho_{\mathbf{v}} \sigma_{\mathbf{v}}} \right)}$$

$$p^D(z, \vec{\mathcal{B}}_i) = \frac{\exp\left(\frac{V^D(z) - \bar{V}(z, \vec{\mathcal{B}}_i)}{\sigma_{\mathbf{v}}} \right)}{\left[\sum_{k=1}^{\mathcal{J}} \exp\left(\frac{u(C_j(z), G_{i,k}(z), N_j(z)) + \beta_G \mathbb{E}_{z'|z}\left[V(z', \vec{\mathcal{B}}_k)\right] - \bar{V}(z, \vec{\mathcal{B}}_i)}{\rho_{\mathbf{v}} \sigma_{\mathbf{v}}} \right) \right]^{\rho_v} + \exp\left(\frac{V^D(z) - \bar{V}(z, \vec{\mathcal{B}}_i)}{\sigma_{\mathbf{v}}} \right)}$$

5. Use $p^B(\vec{\mathcal{B}}_j; z, \vec{\mathcal{B}}_i)$ and $p^D(z, \vec{\mathcal{B}}_i)$ $(i, j \in \mathcal{J})$ to derive new expectation terms $\hat{\mathcal{M}}$ and $\hat{\mathcal{H}}$ using (I8) and (I9), and new bond price schedules $\hat{Q}_{FC}$ and $\hat{Q}_{LC}$ using (I1) and (I2).

6. Check the convergence for value function V, expectation terms $\mathcal{M}$ and $\mathcal{H}$, and bond price schedules Q_{FC} and Q_{LC}. If the newly derived utility values are closer than $1e^{-6}$ and expectations and prices are closer than $1e^{-5}$ in the sup norm, stop iteration. Else, update and go back to step 1.

The model is subject to an AR(1) aggregate productivity shock z, discretized across 15 equally spaced grid points, covering ± 3 standard deviations of its unconditional distribution. For local currency debt, I employ 38 grid points spanning $[0, 1.11]$ equally spaced, and for foreign currency debt, 32 grid points spanning $[0, 0.93]$ equally spaced. All model moments are computed as sample averages obtained by simulating the economy over 10,000 periods for 100 times, while excluding default periods and the initial 20 periods (5 years) following each reentry after default.