Expansionary Fiscal Consolidation Under Sovereign Risk*

Carlos Esquivel† Agustin Samano‡

October 6, 2023

[Most recent version]

Abstract

This paper studies how debt limits can be expansionary in economies facing sovereign risk. We develop a sovereign debt model with capital accumulation, long-term debt, and fiscal rules. The model features two distortions: debt dilution and a pecuniary externality of private investment on default incentives. The optimal debt limit increases capital accumulation due to lower sovereign risk, generating an economic expansion in the long run. Welfare gains are a result of a significant reduction in sovereign spreads due to expectations about future borrowing and investment. Finally, we present evidence of a positive (negative) relation between debt limits and investment (spreads), which is consistent with the prediction of the model.

Keywords: Fiscal rules, Sovereign debt, Expansionary fiscal consolidation.

JEL Codes: F34, F41

*The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the World Bank Group, its Executive Directors, or the governments they represent. For helpful comments and discussions we thank Hyunju Lee, Leonardo Martínez, Vegard Nygaard, Pablo Ottonello, Radek Paluszynski, Fausto Patiño, Rong Qian, Habib Rab, and Miguel Zerecero, as well as seminar participants at Universidad Alberto Hurtado, University of Houston, and UC Irvine. All errors are our own.

†Assistant Professor at Rutgers University; Email: carlos.esquivel@rutgers.edu; Web: https://www.cesquivel.com

‡The World Bank Research Department, East Asia and Pacific Chief Economist Research Center, Kuala Lumpur, Malaysia; Email: asamanopenaloza@worldbank.org; Web: http://www.agustinsamano.com/

1 Introduction

The economic downturn from the COVID-19 pandemic and its consequent fiscal needs led to historically high public debt levels. In the aftermath, most economies face the challenge of restoring their fiscal health while attempting to strengthen their economic recovery. In contrast to advanced economies, this challenge is particularly difficult for emerging economies, which pay significant and increasing sovereign spreads (Kose, Ohnsorge, Nagle, and Sugawara (2020)). The supportive fiscal expansions from the pandemic are not sustainable and prospects of debt crises loom on the horizon of many emerging economies. However, an ambitious fiscal consolidation plan that drastically reduces the level of debt poses a conundrum for these economies. On one hand, healthy public finances could lead to lower spreads and higher economic activity in the long run. On the other hand, a fiscal consolidation plan could lead to a sharp growth deceleration in the short run. This trade-off, which is less prevalent in advanced economies, gives rise to the question of whether adopting fiscal rules that limit debt accumulation can lower spreads and, in turn, boost aggregate investment. We focus on emerging economies facing high sovereign risk. Therefore, debt reduction can be desirable because it ameliorates the distortions that arise from sovereign risk.[1]

We develop a sovereign default model of a small open economy with capital accumulation, long-term debt, and fiscal rules. Domestic households make aggregate investment decisions and lack access to financial markets. There is a benevolent government that makes optimal borrowing and default decisions on behalf of the households. The government must finance a fixed stream of expenditure in each period, for which it can levy a proportional income tax and issue debt (up to a limit). We model fiscal rules as an upper bound to the debt-to-GDP ratio, following the benchmark analysis by Hatchondo, Martinez, and Roch (2022). Whether the debt limit binds depends, then, on both the history of government borrowing and the history of capital accumulation.

There are two distortions that arise from default risk in this economy. The first is the debt dilution problem studied by Hatchondo, Martinez, and Sosa-Padilla (2016) due to the presence of long-term debt. The second is the capital externality studied by Esquivel (2023) that arises from the interaction between private investment and default incentives. When the government defaults,

[1] This is in contrast with most of the literature on expansionary fiscal consolidation, which focuses on rich economies and short run "Keynesian" and "Ricardian" effects of fiscal policy. See for instance Giavazzi and Pagano (1990), Alesina and Ardagna (2009), and Guajardo, Leigh, and Pescatori (2014); we discuss the differences between our paper and this line of work in the literature review below.

there is an exogenous dead-weight cost to productivity, so high default risk lowers expected returns to capital and depresses aggregate investment. In addition, households do not internalize how low investment increases default incentives and further limits the government's ability to rollover its debt. Potential welfare gains from imposing a debt limit come from how lowering default risk ameliorates these two externalities.[2]

We calibrate the model using quarterly data for Indonesia, a representative emerging economy that has committed to a debt rule since 2004.[3] Our main quantitative exercise consists of calculating welfare gains from implementing a limit to the debt-to-GDP ratio and computing its optimal level. The optimal debt limit yields positive welfare gains and is lower (stricter) than the average debt level in the less-constrained economy. We then study average dynamics of main macro-aggregates in the transition after the introduction of the fiscal rule.

When the economy starts with a debt level higher than what the fiscal rule allows, there is a costly fiscal consolidation transition, in which GDP, investment, and consumption decrease to finance the debt reduction. Importantly, sovereign spreads drop on impact as a response to the implementation of the fiscal rule and continue to further decline as the economy deleverages and increases its stock of capital. In the long run, the economy converges to an ergodic distribution that features higher average GDP, capital, and consumption, as well as lower spreads and debt. Overall, welfare gains come from higher consumption in the long run and lower spreads, despite the painful adjustment period at the beginning of the transition. It is important to stress that our model does not consider other channels through which spreads can affect production, such as the balance-sheet effects in Bocola (2016) or entry and exit of firms as documented by Chaumont, Melkadze, and Vardishvili (2023). These additional channels would reduce the initial economic downturn and increase the overall welfare gains of adopting debt limits relative to our main findings.

Using a panel of 28 emerging market economies, we provide evidence that supports the key predictions of the model. We sort countries into two categories: "debt rule" and "no debt rule". While both sets of countries experienced an increase in investment in the early 2000s, we show that

[2]There are other mechanisms through which default risk affects production, which we discuss in detail in the literature review below. Our modeling choice allows us to model default risk endogenously and focus on the role of aggregate capital accumulation.

[3]Following the Asian Financial Crisis of 1997-1998, Indonesia implemented a successful fiscal consolidation plan that paved the way for economic recovery. Even though the fiscal rules implemented in 2004 were part of a comprehensive fiscal consolidation plan and other structural reforms, the adoption of a debt rule in Indonesia can be associated with lower public debt, lower sovereign spreads, and higher private investment.

the surge in investment is most notable for countries with a debt rule. Furthermore, we estimate a panel fixed-effect regression to show that the positive correlation between debt rules and investment is robust to various specifications. Interestingly, we find that the coefficient associated to the debt rules becomes statistically insignificant once we consider high-income countries. This is consistent with the model in the sense that debt rules affect investment because of the distortionary effect that large spreads have on expected capital returns, which is more prevalent in emerging economies. Finally, we document a negative and statistically significant correlation between debt rules and spreads that sheds light on the role of fiscal rules in creating confidence in financial markets.

Related literature.—We mainly contribute to the literature on fiscal rules, specifically the one using sovereign debt models to quantify the effect of fiscal rules on debt levels, sovereign spreads, and social welfare (for example, Alfaro and Kanczuk (2017); Hatchondo, Martinez, and Roch (2020); Hatchondo, Martinez, and Roch (2022); Bianchi, Ottonello, and Presno (2023)); and Deng and Liu (2023).

Our theoretical approach builds on Hatchondo, Martinez, and Roch (2022), who use a sovereign debt model to evaluate common fiscal rules for a Union of heterogeneous model economies. They find that, in contrast with a common debt brake, a common spread brake allows economies with lower debt intolerance to borrow more than the ones with higher debt intolerance, generating welfare gains for all economies in the Union. While we follow Hatchondo, Martinez, and Roch (2022) by modelling fiscal rules as an upper bound to the debt-to-GDP ratio, we differ from them by adding production and capital accumulation into the model. Then, we abstract from the study of debt rules in fiscal unions and focus on the interaction between fiscal rules and investment.

Alfaro and Kanczuk (2017) use a sovereign debt model with quasi-hyperbolic preferences to quantify the welfare gains of different fiscal rules in an economy in which the government is present-biased. They find that a simple debt rule that limits the maximum amount of debt yields welfare gains virtually equal to the optimal rule. Hatchondo, Martinez, and Roch (2020) characterize the borrowing path that a government with commitment to future borrowing would choose and find that a simple debt-brake rule can achieve 60 percent of the welfare gains obtained with the optimal borrowing path. Bianchi, Ottonello, and Presno (2023) show that, during a recession, a fiscal rule that promises lower government spending once the economy is back to normal can help reduce sovereign spreads today and render a fiscal stimulus more desirable. In contemporaneous work, Deng and Liu (2023) study the impact of a balanced budget rule on the government's financing costs and balance sheet in an economy with long-term debt and centralized investment. In contrast to these papers, we focus on the interaction between debt rules and private capital accumulation. Then, we show that welfare gains from fiscal rules arise because of a significant reduction in sovereign spreads due to expectations about future borrowing and investment.

This paper is also related to the literature on rules versus discretion. Angeletos, Amador, and Werning (2006) study the trade-off between commitment and flexibility in a consumption savings model with taste shocks privately observed by an agent. They derive conditions under which minimum-savings policies, reminiscent to fiscal rules, characterize the solution to the principal-agent problem. Halac and Yared (2014), Halac and Yared (2018), and Halac and Yared (2022) study fiscal rules under similar environments. At the core of the conflict studied in these papers is a disagreement between an agent (the government) and a principal (incumbent citizens) over preferences for intertemporal consumption. Fiscal rules emerge as an efficient mechanism through which citizens provide incentives to the government to behave according to their best interest. While the government in our model is benevolent, a similar tension between present and future governments emerges due to the presence of long-term debt.[4]

This paper also relates to the literature that studies whether fiscal consolidation is expansionary or contractionary. On one hand, there is the idea based on textbook "Keynesian" intuition that fiscal consolidation is likely to contract aggregate demand. On the other is the "Ricardian" argument that if private agents expect fiscal discipline in the future, they will revise upwards their estimate of their permanent income, which will in turn increase current and planned consumption, resulting in an economic expansion following a fiscal consolidation. Giavazzi and Pagano (1990) present evidence of a large-scale fiscal contraction associated with a strong output expansion. In a discussion of their work, Blanchard (1990) develops a simple model to reconcile both ideas and derives two conditions under which fiscal consolidation can be expansionary: low myopia by private agents and the economy being close to the brink of requiring aggressive tax increases due to increasing debt. Our model features similar channels through which fiscal discipline affect output: a contraction in the demand for real resources from the government and an increase in households' permanent income through lower expected taxation. However, our model also includes the effects of sovereign

[4]This is the debt-dilution problem studied by Hatchondo, Martinez, and Sosa-Padilla (2016).

risk on investment, an important channel for emerging economies that is absent from these papers.

Finally, this paper is related to the literature that studies the effect of default risk on production and investment. Mendoza and Yue (2012) develop a general equilibrium model of sovereign default with production that uses a mix of domestic and imported intermediate inputs, the latter financed with working capital. Upon default, the economy loses access to financial markets, and, with this, producers lose access to imported materials, which implies a less efficient mix of intermediate inputs. Their model generates an endogenous drop in TFP following a default, a feature that is key for our results. We assume that this drop is exogenous to simplify the exposition and solution of our model. Bocola (2016) documents how default risk hampers financial intermediation by tightening the funding constraint of domestic banks that hold government debt. He develops a model of banks that hold domestic government debt in which default risk contracts credit to productive firms and generates a recession. Based on a similar mechanism, Arellano, Bai, and Bocola (2020) measure the output costs of sovereign risk by combining a sovereign debt model with firm- and bank-level data. The effects of default risk on aggregate TFP and output estimated by these papers, as well as the aggregate effects of entry and exit estimated by Chaumont, Melkadze, and Vardishvili (2023), are contemporaneous. By construction, our model does not feature any pass-through of sovereign risk to current production or TFP. Instead, we focus on the dynamic effects that the risk of future default has on present investment and, thus, on future output. We view our theoretical work as complementary to the work in this literature. Our modeling choice is intentionally more parsimonious on the details of aggregate production—we abstract from firm heterogeneity and domestic financial frictions—which allows us to model default risk endogenously and to study aggregate capital accumulation. The fact that default risk could further depress investment and production through the mechanisms documented in this literature implies that our conclusions about the welfare gains from fiscal rules are conservative.

Layout.—Section 2 presents the model and discusses the main mechanisms and trade-offs in detail. Section 3 presents the numerical solution of the model, the calibration, and the quantitative exercises. Section 4 presents the empirical analysis. Section 5 concludes.

2 Model

We mostly build on the model developed by Gordon and Guerron-Quintana (2018). Our main deviation is to assume that aggregate investment is decentralized, chosen by domestic households instead of by the sovereign. There is a small-open economy populated by a large number of identical households, a competitive firm, and a benevolent government. Production of the final consumption good is carried out by the firm, which rents capital from households. Households own the firm and all the capital in the economy but do not have access to international financial markets. The benevolent government borrows on behalf of the households from risk-neutral foreign lenders and levies a proportional tax on total household income. The government cannot commit to repaying its debt, and lenders consider default risk when pricing it.

Preferences and technology.—Households have preferences for consumption of a tradable good c_t in each period represented by $u(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma}$. They discount the future at a rate β and are relatively more impatient than international investors. That is, $\beta(1+r^*) < 1$ where r^* is the international risk-free interest rate. Households own all the capital in the economy and rent it to the firm for r_t. Capital depreciates at a rate δ and households face a quadratic capital adjustment cost $\frac{\phi}{2}\left(\frac{i_{k,t}}{k_t}\right)^2$, where $i_{k,t} = k_{t+1} - (1-\delta)k_t$ is investment and $\phi > 0$. The budget constraint of a representative household is:

$$c_t + i_{k,t} + \frac{\phi}{2}\left(\frac{i_{k,t}}{k_t}\right)^2 \leq (1-\tau_t)\left[r_t k_t + \Pi_t\right] + T_t, \tag{1}$$

where Π_t are profits from the firm, τ_t is a proportional income tax, and T_t is a lump-sum transfer from the government.

The consumption good is produced by the competitive firm with capital using technology $y_t = z_t A K_t^\alpha$, where K_t is all the capital rented by the firm, α is the capital share of income, z_t is a productivity shock, and A is a scaling parameter.[5] The productivity shock follows an AR(1) process:

$$\log z_{t+1} = (1-\rho)\log(\mu_z) + \rho\log(z_t) + \epsilon_t,$$

where ρ is the persistence parameter, $\epsilon_t \sim N\left(0, \sigma_z^2\right)$, and μ_z is mean productivity in the long-run.

[5] Implicitly, we are assuming that there is a unit of labor that is supplied inelastically by the households. We abstract from endogenous labor supply for simplicity.

Government debt and default.—The government is benevolent and makes borrowing decisions on behalf of the households. It issues long-term, non-contingent debt B_t that matures at a rate γ and pays a coupon κ on unmatured debt. The law of motion of debt is $B_{t+1} = (1-\gamma) B_t + i_{b,t}$, where $i_{b,t}$ is net debt issuance in period t. The government must finance a fixed amount of expenditure $G > 0$ each period, regardless of the state of the economy. In addition to debt, the government can levy a proportional income tax τ_t and make lump-sum transfers to the households T_t. The government's budget constraint when it is in good financial standing is:

$$G + T_t + (\gamma + \kappa(1-\gamma)) B_t = \tau_t [r_t K_t + \Pi_t] + q_t i_{b,t}, \tag{2}$$

where K_t is the aggregate capital stock and q_t is the market price of government debt.

At the beginning of each period the government can decide to default. If it does, then it is excluded from financial markets for a stochastic number of periods, and the productivity in the economy drops to $z_D(z_t) = z_t - \max\left\{0, d_0 z + d_1 z^2\right\}$, where $d_0 < 0 < d_1$.[6] Therefore, the budget constraint is

$$G + T_t = \tau_t [r_t K_t + \Pi_t]. \tag{3}$$

The government gets readmitted to financial markets with a probability θ and all debt forgiven $B = 0$. The debt is purchased by a large number of risk-neutral investors with deep pockets. Investors pay a price q_t for the government debt and have access to a one-period risk-free bond that pays the risk-free interest rate r^*.

Fiscal rules.—In general, a fiscal rule is a correspondence $\mathcal{F} : \mathbb{R}_+^3 \to \mathbb{P}\left(\mathbb{R}^3\right)$ that maps the state space of the economy into the power set of $\mathbb{R}^3$. That is, given a state (z_t, K_t, B_t), the fiscal rule $\mathcal{F}$ returns a set of admissible values for each of the government's policy instruments (τ_t, T_t, B_{t+1}). Hereafter we focus on fiscal rules of the form:

$$\mathcal{F}(z_t, K_t, B_t) = \left\{(\tau, T, B) \,|\, \tau \geq 0, T \geq 0, B \leq \max\left\{\chi z_t K_t^{\alpha}, (1-\gamma) B_t\right\}\right\} \tag{4}$$

[6] We use the quadratic formulation introduced by Chatterjee and Eyigungor (2012) for a pure exchange economy. As discussed by Arellano (2008), an asymmetric cost of default that is increasing in z_t (such as this one) allows the model to generate a counter-cyclical current account and spreads, and default episodes "in bad times", all of which are features of the data for emerging economies. Mendoza and Yue (2012) show that these types of costs from default can be the result of a richer production structure in which some imported materials require working capital financing. For simplicity, we assume this exogenous form instead.

where $\chi \in (0,1)$. This formulation imposes that the debt-to-GDP ratio cannot exceed χ. If outstanding debt is already higher than this limit for a given realization of z_t, then it must be reduced by at least the fraction γ that matured.[7] In addition, we limit the tax instruments to positive proportional income taxes and positive lump-sum transfers to the households.

Timing.—At the beginning of a period, the government observes (z_t, K_t, B_t) and makes its default and fiscal policy decisions. Then, the households observe the government's choices and make their consumption and investment decisions. Finally, at the end of the period, lenders observe all choices and price the debt accordingly. We assume that the government can commit to policy within the same period. That is, if at the beginning of the period the government announces repayment and a debt issuance $i_{b,t}$, then it issues that amount at the end of the period and pays $(\gamma + \kappa(1-\gamma)) B_t$ to the lenders. These assumptions allow us to rule out the multiplicity of equilibria studied by Cole and Kehoe (2000) because lenders price the debt after the government announces its policy and commits to it within the same period. We can also rule out the multiplicity studied by Galli (2021) because lenders price the debt after the capital allocation has been chosen.

2.1 Recursive formulation and equilibrium

The aggregate state of the economy is (z,x), where $x = (K,B)$ is the endogenous state. Let $g = (\tau, T, B')$ be the vector of fiscal policy in a given period, and let $d = 0$ denote that the government is in good financial standing and $d = 1$ that the government is in default.

Households.—The value of a representative household when $d = 0$ is

$$H^P(z,k,x,g) = \max_{k'} \left\{ u(c) + \beta \mathbb{E}\left[(1-d') H^P\left(z',k',x',g^P\right) + d' H^D\left(z',k',K',g^D\right)\right]\right\} \quad (5)$$

$$\begin{aligned} s.t. \qquad & c + i + \frac{\phi}{2}\frac{(i)^2}{k} \leq (1-\tau)\left[r(z,x,d)k + \Pi(z,x,d)\right] + T \\ & i = k' - (1-\delta)k \\ & x' = \Gamma_x^P(z,x,g), \quad g^P = \Gamma_g^P(z',x'), \quad g^D = \Gamma_g^D(z',K'), \quad d' = \Gamma_d(z',x') \end{aligned}$$

where Γ_x^P is the household's belief about the law of motion of the endogenous state x in repayment,

[7] Here, we follow Hatchondo, Martinez, and Roch (2022). This assumption allows a highly indebted government to smooth the adjustment toward the debt limit.

Γ_g^P and Γ_g^D are the household's beliefs of fiscal policy in repayment and default, respectively, Γ_d the household's belief about the government's default decisions, the rental rate of capital is $r(z,x,g) = [(1-d)z + dz_D(z)]\,\alpha K^{\alpha-1}$, and profits are $\Pi(z,x,g) = [(1-d)z + dz_D(z)]\,(1-\alpha)K^{\alpha}$. The value of the household when $d = 1$ is

$$H^D(z,k,K,g) = \max_{k'}\left\{u(c) + \beta\mathbb{E}\left[\theta(1-d')H^P\left(z',k',x',g^P\right) + (1-\theta+\theta d')H^D\left(z',k',K',g^D\right)\right]\right\} \tag{6}$$

$$\begin{aligned} s.t. \qquad & c + i + \frac{\phi}{2}\frac{(i)^2}{k} \le (1-\tau)\left[r(z_D(z),x)\,k + \Pi(z_D(z),x)\right] \\ & i = k' - (1-\delta)k \\ & x' = \Gamma_x^D(z,x,g), \quad g^P = \Gamma_g^P(z',x'), \quad g^D = \Gamma_g^D(z',K'), \quad d' = \Gamma_d(z,x) \end{aligned}$$

where Γ_x^D is the household's belief about the law of motion of the endogenous state x in default.

Government.—At the beginning of a period in which the government is in good financial standing, its value is

$$V(z,x) = \max_{d\in\{0,1\}}\left\{dV^D(z,K) + (1-d)V^P(z,x)\right\} \tag{7}$$

where d is its default decision. The value of repaying the debt is

$$V^P(z,x) = \max_{g\in\mathcal{F}(z,x)}\left\{u\left(c^P(z,K,x,g)\right) + \beta\mathbb{E}\left[V(z',x')\right]\right\} \tag{8}$$

$$\begin{aligned} s.t. \quad & G + T + (\gamma + \kappa(1-\gamma))B = \tau z K^{\alpha} + q(z,x')\left[B' - (1-\gamma)B\right] \\ & K' = k^P(z,K,x,g) \end{aligned}$$

where c^P and k^P are the household's policy functions for consumption and capital in repayment, respectively. The government chooses its fiscal policy g subject to the constraints implied by the fiscal rule $\mathcal{F}$ and to its budget constraint; and takes into account how fiscal policy affects aggregate household's decisions. The value of defaulting is

$$V^D(z,K) = \max_{g\in\mathcal{F}(z,x)} \left\{ u\left(c^D(z,K,x,g)\right) + \beta\mathbb{E}\left[\theta V^D(z',K') + (1-\theta)V(z',x')\right]\right\} \tag{9}$$

$$\begin{aligned} s.t. \quad & G+T = \tau z_D(z) K^\alpha \\ & B' = 0, \qquad K' = k^D(z,K,K,g) \end{aligned}$$

where c^D and k^D are the policy functions for consumption and capital in default.

Equilibrium.—An equilibrium is value and policy functions for the government, value, policy and beliefs functions for the households, and a price schedule for government debt q such that: (i) given q and the policy functions for the households, the value and policy functions of the government solve the problems in (7) through (9); (ii) given all prices and beliefs, the value and policy functions for the households solve the problems in (5) and (6); (iii) household's beliefs are consistent with government policy functions and household's policy functions evaluated at the aggregate state; and (iv) the price schedule of debt satisfies

$$q(z,x') = \frac{\mathbb{E}\left[(1-d')(\gamma+(1-\gamma)(\kappa+q(z',x'')))\right]}{1+r^*} \tag{10}$$

where $x'' = \left(k^P\left(z',K',x',g^P\right), B(z',x')\right)$.

2.2 Centralized Investment

A key friction in the model is the government's inability to directly pin down the economy's capital allocation. This gives rise to the pecuniary externality from aggregate investment studied by Esquivel (2023), who shows that the decentralized economy features inefficiently low levels of capital accumulation due to the presence of default risk.

As a benchmark for capital accumulation, we introduce the problem of a benevolent social planner who jointly makes borrowing and investment decisions. The value of the planner is

$$\hat{V}(z,x) = \max_{\hat{d}\in\{0,1\}} \left\{ d\hat{V}^D(z,K) + (1-d)\hat{V}^P(z,x)\right\} \tag{11}$$

where $\hat{d}$ is the planners default choice. If the planner decides to repay, then its value is

$$\hat{V}^P(z,x) = \max_{x'} \left\{ u(c) + \beta \mathbb{E}\left[\hat{V}(z',x')\right] \right\} \tag{12}$$

$$s.t. \qquad c + I + \frac{\phi}{2}\frac{(I)^2}{K} + (\gamma + \kappa(1-\gamma))B + G \le zK^\alpha + \hat{q}(x',z)\left[B' - (1-\gamma)B\right]$$

$$K' = I + (1-\delta)K, \quad (\tau, T, B') \in \mathcal{F}(z,x)$$

where it chooses both K' and B' subject to the economy's resource constraint and subject to the debt limit implied by the fiscal rule $\mathcal{F}$. Similarly, in default the value of the planner is

$$\hat{V}^D(K,z) = \max_{K'} \left\{ u(c) + \beta\theta \mathbb{E}\left[\hat{V}(0,K',z')\right] + \beta(1-\theta)\mathbb{E}\left[\hat{V}^D(K',z')\right] \right\} \tag{13}$$

$$s.t. \qquad c + I + \frac{\phi}{2}\frac{(I)^2}{K} + G \le z_D(z)K^\alpha$$

$$K' = I + (1-\delta)K$$

where it directly chooses K'.

The definition of equilibrium for the planner is analogous to the decentralized case. In particular, $\hat{q}$ satisfies an equation similar to (10). However, the price schedule that the planner faces is not the same as the one the government faces in the decentralized equilibrium because $\hat{q}$ is a function of the planner's future default, capital, and borrowing decisions, which are different to those implied by the decentralized equilibrium, as discussed in the following subsection.

2.3 Discussion of the investment externality

When the government is in default, productivity is lower than it would be if the government was in good financial standing, which follows from the assumption $z \le z_D(z)$. As discussed by Mendoza and Yue (2012), such a decrease in TFP can result from the economy losing access to certain imported inputs during default crises, which would result in inefficient bundles of production materials. We make this simplifying assumption to focus on how expectations of lower productivity due to default risk depress investment. The Euler equation of a representative household is

$$u'\left(c_t^P\right)P_{k,t} = \beta\mathbb{E}\left[(1-d_{t+1})\,u'\left(c_{t+1}^P\right)R_t^P + d_t u'\left(c_{t+1}^D\right)R_t^D\right] \tag{14}$$

where $P_{k,t} = 1 + \phi \frac{I_t}{K_t}$ is the shadow price of investment in t and the return to capital is

$$R^P_{t+1} = \left(1 - \tau^P_{t+1}\right) \alpha z_{t+1} A K^{\alpha-1}_{t+1} + (1-\delta) P_{k,t+1} + \frac{\phi}{2} \left(\frac{I_{t+1}}{K_{t+1}}\right)^2 \tag{15}$$

in repayment and

$$R^D_{t+1} = \left(1 - \tau^D_{t+1}\right) \alpha z_D \left(z_{t+1}\right) A K^{\alpha-1}_{t+1} + (1-\delta) P_{k,t+1} + \frac{\phi}{2} \left(\frac{I_{t+1}}{K_{t+1}}\right)^2 \tag{16}$$

in default. As the probability of default increases, the expected return to capital decreases due to $z_D(z_{t+1}) \le z$, which lowers household's incentives to invest. Note that this effect is different from the pass-through of sovereign risk documented by Bocola (2016), where default risk lowers contemporaneous production by hampering financial intermediation through tighter funding constraints for domestic banks that hold government debt. Considering such a channel would amplify the effect of default risk on investment by tightening the resource constraint before default happens.

In addition to default risk depressing investment, households do not internalize how their investment decision affects default risk. To illustrate this, assume that $\hat{q}$ and all other objects are differentiable. Then, the Euler equation for capital from the planner's problem in repayment is:

$$u'\left(\hat{c}^P_t\right)\left[\hat{P}_{k,t} - \frac{\partial \hat{q}\left(z_t, \hat{x}_{t+1}\right)}{\partial K} \hat{\imath}_{b,t}\right] = \beta \mathbb{E}\left[\left(1 - \hat{d}_{t+1}\right) u'\left(\hat{c}^P_{t+1}\right) \hat{R}^P_t + \hat{d}_t u'\left(\hat{c}^D_{t+1}\right) \hat{R}^D_t\right] \tag{17}$$

where the term $\frac{\partial \hat{q}(z_t, \hat{x}_{t+1})}{\partial K_{t+1}} \hat{\imath}_{b,t}$ denotes that the planner understands how its choice of K_{t+1} affects its the borrowing terms and, in turn, the resource constraint in t.

It can be shown that, under the assumptions we have made for z_D (and if $\hat{q}$ is differentiable), the derivative $\frac{\partial \hat{q}}{\partial K} \ge 0$.[8] This implies that households underinvest in periods where borrowing needs are positive $\hat{\imath}_{b,t} \ge 0$ because they do not internalize that additional investment improves the economy's ability to borrow. This inefficiency would not exist absent default risk ($\hat{q}$ would be constant) and is more severe in states for which $\hat{q}$ is "steeper", which, as we show in the quantitative analysis in Section (3), is the case in periods of distress.

[8] See Esquivel (2023) for a general proof and a discussion of the minimal assumptions. Intuitively, investment lowers default risk because it improves the ability to service the debt in the following period. In addition, capital increases both the value of default and of repayment, but it increases the latter more at the margin because it is less productive in default.

In Section (3) we show under a standard calibration that debt limits are welfare improving because lower default risk ameliorates the severity of this inefficiency. In addition, we show that the fiscal consolidation that follows the implementation of such fiscal rules is expansionary in the long-run because the economy accumulates more capital.

3 Quantitative analysis

We solve numerically for the decentralized and the planner equilibria using value function iteration. Following Hatchondo, Martinez, and Sapriza (2010), we compute the limit of the finite-horizon version of the economy. For the planner, we jointly solve for optimal investment and borrowing decisions using a non-linear optimization routine in each iteration. For the decentralized economy, we use Newton's method to find investment decisions that solve the household's Euler equation for a given borrowing level. To find the optimal borrowing choice, we use a non-linear optimization routine where the objective function takes into account how each potential choice affects the solution to the household's Euler equation. We approximate value functions and the price schedules for debt using linear interpolation, and compute expectations over the productivity shock using a Gauss-Legendre quadrature.

3.1 Calibration

We calibrate the model using quarterly data for Indonesia from 2000 to 2019, a representative emerging economy that has committed to a debt rule since 2004. There are two sets of parameters: one with values that we take either from the literature or directly from the data and another chosen to match some moments. We use the planner's problem for the moment-matching exercise.[9]

Table 1 presents the first set of parameters. The risk-free interest rate is $r^* = 0.01$ and the CRRA parameter is $\sigma = 2$. The capital share is $\alpha = 0.33$, the capital depreciation rate is $\delta = 0.05$, and the parameters governing the stochastic process for productivity are $\rho = 0.95$ and $\sigma_z = 0.027$, which are

[9]The numerical solution of the model is computationally demanding given the dimensionality of the state space. The computation of the decentralized equilibrium—which would ideally be used in a moment-matching calibration exercise—is an order of magnitude slower than that of the central planner—which is typically used in moment-matching calibration exercises in the literature. The last two columns in the second part of Table 2 present the targeted moments for both the planner and the decentralized economy.

all standard values. The probability of reentry $\theta = 0.0325$, which gives an average exclusion period of 26 quarters, as in Chatterjee and Eyigungor (2012). We also take the debt duration parameter $\gamma = 0.05$ and the coupon rate $\kappa = 0.03$ from Chatterjee and Eyigungor (2012). Finally, we set $\chi = \infty$ so that our benchmark case does not have an upper bound for debt.

Table 1: Parameters Calibrated from the Data

Parameter	Description	Value	Source / Target
σ	Risk aversion	2	Standard
r^*	Risk-free interest rate	0.01	Annual US-Treasury bills rate = 4.0%
δ	Capital depreciation rate	0.05	Standard
γ	Bond maturity rate	0.05	Chatterjee and Eyigungor (2012)
κ	Bonds coupon rate	0.03	Chatterjee and Eyigungor (2012)
θ	Probability of re-entry	0.0325	Chatterjee and Eyigungor (2012)
A	Scaling parameter	0.63	Steady-state GDP=1.0
G	Fixed government expenditure	0.10	10% of Steady-state GDP
χ	Debt limit	∞	No debt limit for Benchmark
α	Capital share	0.33	Standard
ρ	Persistence of productivity	0.95	Standard
σ_z	Volatility of productivity	0.027	Standard

The discount factor β, productivity loss parameters d_0 and d_1, and the adjustment cost parameter ϕ are set to jointly match an average debt-to-GDP ratio of 0.40, a relative volatility of investment to GDP of 2.7, an average spread of 2.6%, and a standard deviation of spreads of 0.9%.

Table 2: Parameters Calibrated by Simulation

Parameter	Description	Value	Target	Planner (targeted)	Decentralized) (not targeted)
β^F	Discount factor	0.971	Debt-to-GDP ratio = 0.40	0.37	0.38
ϕ	Capital adjustment cost	7.679	$\sigma_i/\sigma_y = 2.7$	2.5	3.3
ξ_0	Default cost parameter	−0.284	Av. spread = 2.6%	2.4%	3.4%

ξ_1	Default cost parameter	0.422	Std. Spreads = 0.90%	1.2	2.2

The last two columns of Table 2 report the these moments for the planner and the decentralized equilibrium using the same calibration. The decentralized economy experiences higher and more volatile spreads, a higher relative volatility of investment, and a slightly higher debt-to-GDP ratio.

Table 3 evaluates the performance of the model in explaining some untargeted moments from the data. In the last 100 years, Indonesia had one episode of debt restructuring in 1966. The model generates an average default frequency of 1 percent in both the planner and the decentralized economies.

Table 3: Untargeted moments

Moment	Data	Planner	Decentralized
Default Frequency	0.01	0.01	0.01
σ_c/σ_y	0.96	1.05	1.03
$\sigma_{\frac{CA}{y}}$	1.60	1.67	2.29
$Corr(\frac{CA}{y}, y)$	−0.33	−0.53	−0.53

Consumption is slightly more volatile than output in the model, which is a feature of many emerging economies (although not in the case of Indonesia). The volatility of the current account in the planner economy (the one used for the matching exercise) is very close to that in the data, while the decentralized economy features a more volatile current account. Finally, the model generates a countercyclical current account, which is a salient feature of emerging economies.

3.2 Optimal debt limit

We now compute the optimal value for χ as the limit to the debt-to-GDP ratio that maximizes welfare gains in the long-run. We define welfare gains of χ as the percentage increase in permanent consumption that would leave the representative household indifferent between adopting the debt limit or not. That is, welfare gains $\lambda(\chi)$ satisfy

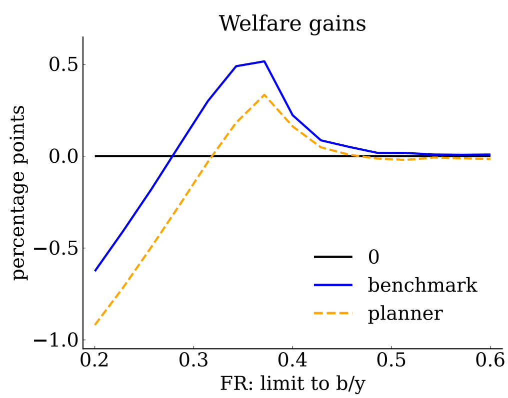
$$\mathbb{E}_0\left[\sum_{t=0}^{\infty}\beta^t u\left((1+\lambda(\chi))\, c_t^{\text{no DL}}\right)\right] = \mathbb{E}_0\left[\sum_{t=0}^{\infty}\beta^t u\left(c_t^{\text{DL}=\chi}\right)\right]$$

where $\left\{c_t^{\text{no DL}}\right\}_{t=0}^{\infty}$ and $\left\{c_t^{\text{DL}=\chi}\right\}_{t=0}^{\infty}$ are series of consumption simulated from the model with no debt limit and with the debt limit equal to χ, respectively.

Imposing debt limits in our model can be desirable for two reasons. First, because it limits the degree to which future governments can dilute existing debt. This is the case even for the benevolent social planner. Second, because it lowers default risk and, with it, the distortions to private investment associated with default: lower productivity and higher distortionary taxes due to financial autarky.

Figure 1 shows welfare gains for different values of χ. In order to disentangle the role of debt dilution and distortions to investment, we compute welfare gains for the benchmark decentralized economy and for the social planner.

Figure 1: Welfare gains, different debt limits



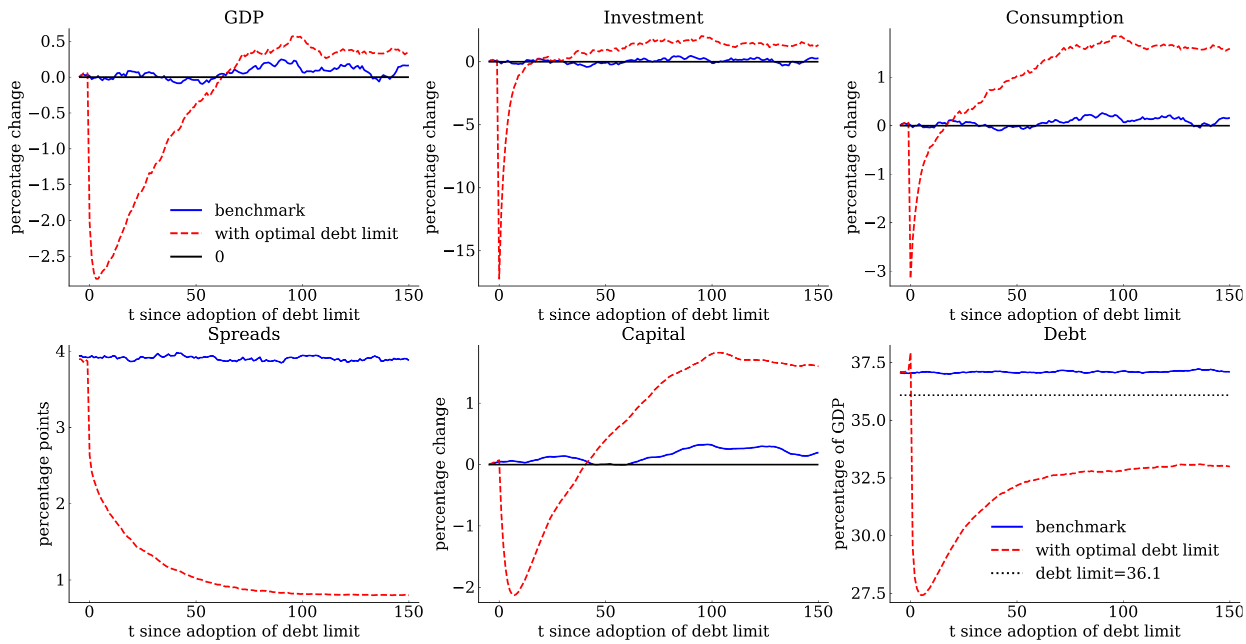
The gains are, evidently, larger for the benchmark economy, and roughly half of the gains come from investment distortions. It is important to recall that we are not including contemporary distortions to production from high spreads, which could potentially yield higher gains from lowering default risk.

We compute the optimal value for χ by approximating the curves in Figure 1 with a cubic spline and finding its maximizer. While each distortion adds to the potential gains of implementing the debt limit, they barely change the optimal value of χ, which is 0.36 for the benchmark case and the case with lump-sum taxes, and 0.37 for the social planner.

3.3 Expansionary fiscal consolidation

Figure 2 presents the average of 10,000 paths for the decentralized economy with and without the implementation of the optimal debt limit at $t = 0$. The economy that implements it (dashed-red line) goes through a painful fiscal consolidation in the short-run, where GDP, investment, and consumption decline to finance a gradual debt reduction. Importantly, this debt reduction is feasible thanks to a large decline in spreads on impact.

Figure 2: Average transition paths

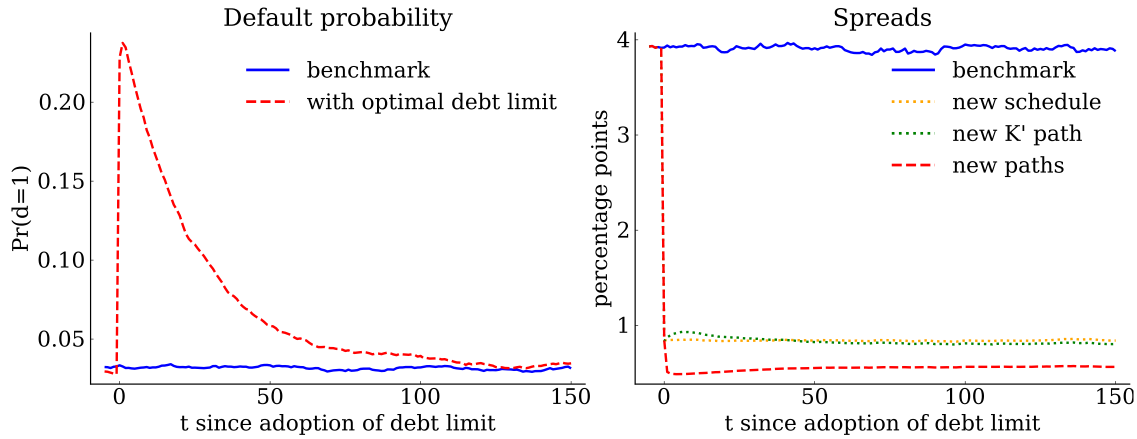


Each line corresponds to the average of 10,000 paths. The starting point of each path is taken from simulating the economy for 1,001 periods and dropping the first 1,000 to remove the influence of initial conditions.

After the initial fiscal consolidation, the economy converges to long-run averages that feature higher consumption, GDP, investment, and capital with a lower debt-to-GDP ratio and significantly lower spreads. Positive welfare gains are achieved despite the initial decline in consumption because consumption in the long-run is significantly higher and servicing the debt is significantly cheaper.

Interestingly, spreads drop on impact despite an increase in the probability of default during the adjustment periods, as shown in the left panel of Figure 3. To illustrate why this is the case, the right panel makes a decomposition of the different factors that drive the decrease in spreads. The yellow-dotted line presents the new price schedule with the fiscal rule evaluated at the average paths from the benchmark economy. Even with the benchmark paths for capital and debt, spreads are significantly lower due to expectations of lower debt and higher capital in all future periods.

Figure 3: Default probability and change in spreads decomposition

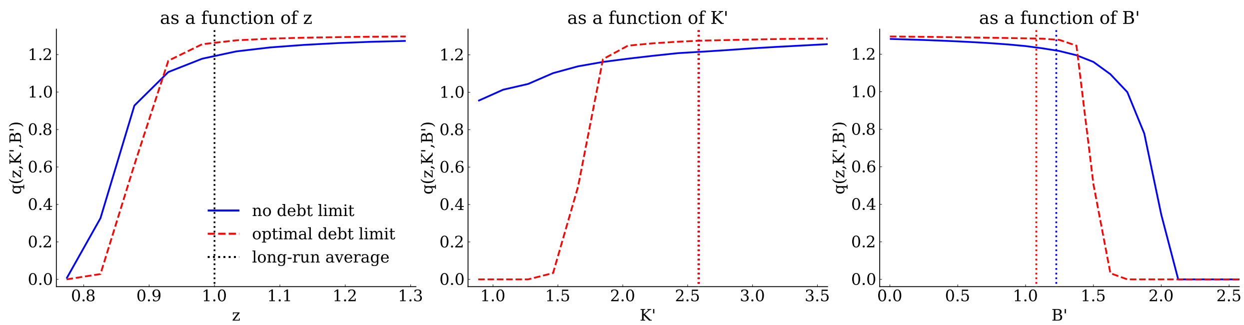


For the left panel, each line corresponds to the average of 10,000 paths. The starting point of each path is taken from simulating the economy for 1,001 periods and dropping the first 1,000 to remove the influence of initial conditions. For the right panel, each line corresponds to the price schedule from the economy with the fiscal rule evaluated at average paths for z, K', and B', except for the blue solid line, which is the benchmark path of spreads in Figure 2

The green-dotted line presents the same price schedule evaluated at the benchmark path of debt (i.e. without debt reduction) and the new average path for capital ("new K' path"). As can be seen in Figure 2, capital first drops and then surpasses the benchmark level at around the 40th quarter. The green-dotted line reflects this with spreads being initially larger than the yellow line and then lower once capital surpasses its benchmark level. Finally, the red-dashed line presents the new price schedule evaluated at the average paths for debt and capital from the economy with the fiscal rule.

Note that the government keeps the debt level way below the debt limit, despite the low spreads. Figure 4 presents the price schedule $q(z, K', B')$ for the benchmark economy with no debt limit and for the economy with the optimal χ. The left panel presents q as a function of productivity z, the middle panel shows it as a function of capital for next period K', and the right panel as a function of new debt B'. In each of the three panels, q is evaluated at the benchmark long-run averages for the pair of variables that are not on the horizontal axis. The vertical lines depict long-run average values for the benchmark (blue) and the economy with the optimal debt limit (red).

Figure 4: Bonds price schedule $q(z, K', B')$



Each line is the price of bonds $q(z, K', B')$ for the decentralized economy with no debt limit (solid-blue line) and the decentralized economy with the optimal debt limit (dashed-red line). The vertical lines depict the average long-run values of each variable for each case. In each panel, q is evaluated at the benchmark long-run averages for the pair of variables that are not on the horizontal axis.

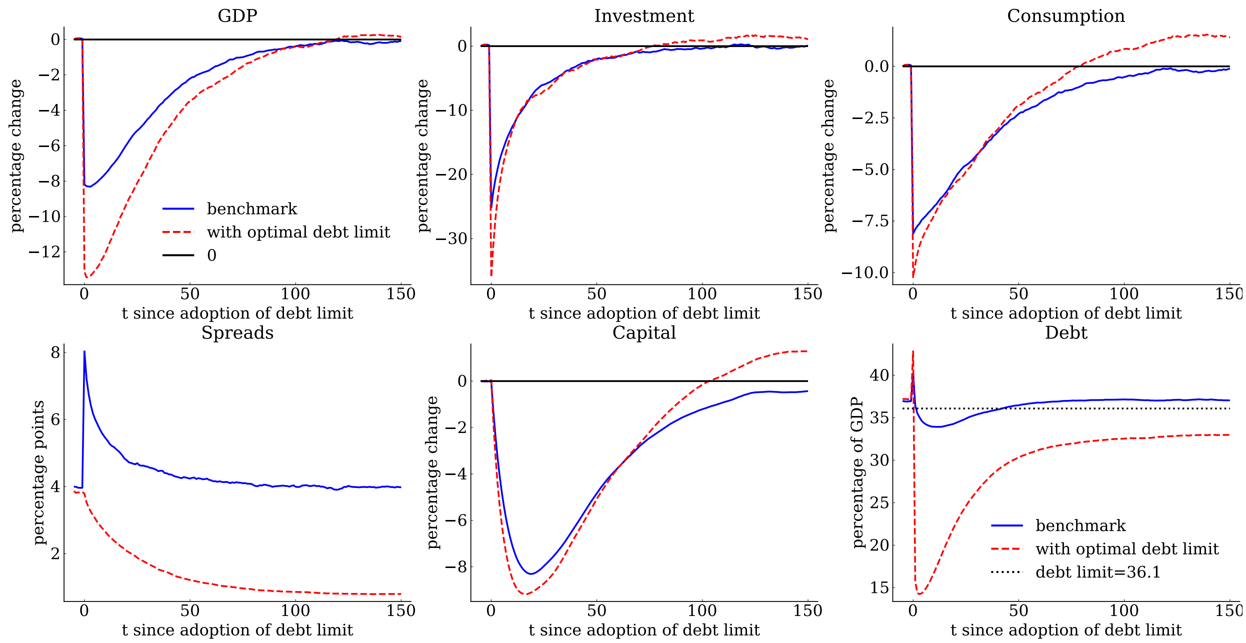
The price schedule is higher and flatter with the debt limit (dashed-red line) for the long-run average values (the vertical lines). However, it is also steeper for states that are close to a debt crisis—low productivity, low capital, and high debt. So, while the government faces lower and less increasing spreads on average, increasing the debt too much would push the economy closer to the region where q becomes steep. In addition, recall that the investment externality depends on how sensitive q is to capital (see equation (17)). The middle panel shows how the magnitude of this externality is lower for long-run values of capital in the economy with the debt limit, which is why this economy accumulates more capital in the long-run.

3.4 Fiscal consolidation after a large downturn

Figure (5) presents a similar exercise but for an economy that experienced a negative productivity shock of three standard deviations in $t = 0$. The blue-solid line is the economy with no debt limit and the dashed-red line is the economy that implements the optimal debt limit in period $t = 0$, when the crisis hits.[10]

[10] We are using the same value for $\chi = 0.36$. Interestingly, this value does not change much if the maximization of welfare gains is done considering this crisis as an initial state.

Figure 5: Average transition paths after large downturn



Each line corresponds to the average of 10,000 paths. The starting point of each path is taken from simulating the economy for 1,001 periods and dropping the first 1,000 to remove the influence of initial conditions.

The contraction on impact is, naturally, much larger for the economy that implements the debt limit in $t = 0$. However, consumption and investment recover much faster thanks to the lower level of spreads, which still go down despite the large negative shock. This illustrates the large role that expectations about future fiscal policy play on spreads, which are much more significant than the negative productivity shock itself. On the other hand, spreads virtually double on impact in the benchmark economy and consumption has barely recovered after 120 quarters.

4 Empirical Analysis

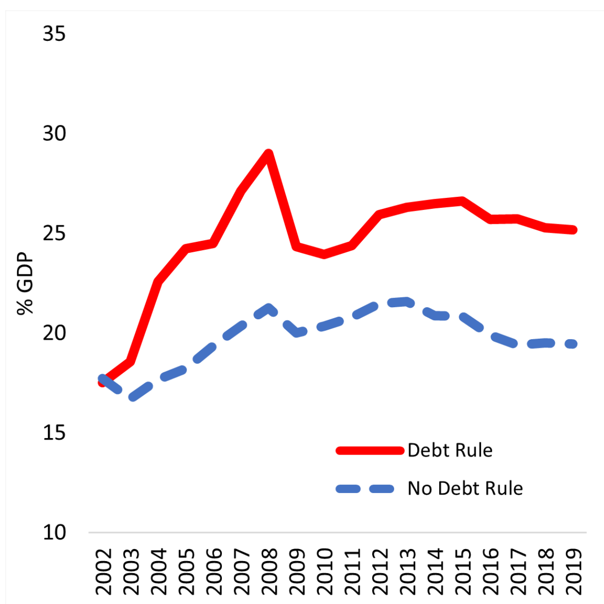
In this section we present evidence of the relationship between fiscal rules, investment, and sovereign spreads that are implied by the model. We use data from 2000 to 2019 for a sample of 28 emerging market economies, which are commonly used in the literature.[11]

[11] The countries in our panel include Argentina, Brazil, Bulgaria, China, Colombia, Dominican Republic, Egypt, El Salvador, Indonesia, Iraq, Jordan, Kazakhstan, Lebanon, Malaysia, Mexico, Morocco, Panama, Peru, Philippines, Romania, Russia, Serbia, South Africa, Thailand, Turkey, Ukraine, Venezuela, and Vietnam.

4.1 Debt Rules and Investment

A central prediction of the theory presented above is that countries with debt rules accumulate more capital relative to countries without them. To examine whether this prediction holds in the data, we use the IMF Fiscal Rules Dataset to sort countries into two categories: "debt rule" and "no debt rule". Then, we use the IMF Investment and Capital Stock Dataset to explore investment trends among these two categories. Figure 6 shows that while both sets of countries experienced an increase in investment in the early 2000s, the surge is most notable for countries with a debt rule. In the appendix, Figure 7 shows that this pattern also holds for private investment.

Figure 6: Total Investment, Debt Rule vs No Debt Rule



Private and public investment. Countries are sorted based on the existence of a debt rule for more than 10 years; those with a rule for less than 10 years are excluded from both categories. The Debt rule series includes Bulgaria (2003-2019), Indonesia (2004-2019), Malaysia (2002-2019), Panama (2002-2019), and Romania (2007-2019). The No debt rule series includes Argentina (2002-2019), Brazil (2002-2019), China (2002-2019), Colombia (2002-2019), Dominican Republic (2005-2019), Egypt (2002-2019), El Salvador (2007-2019), Iraq (2006-2019), Jordan (2002-2011), Lebanon (2006-2019), Mexico (2002-2019), Morocco (2007-2019), Philippines (2002-2019), Russia (2002-2019), South Africa (2002-2019), Turkey (2002-2019), Ukraine (2003-2019), Venezuela (2002-2019).

Since the association between debt rules and investment might be driven by other confounding factors, we estimate the following panel fixed-effect regression:

$$log\,(I/y)_{i,t} = \alpha_i + \beta_1\,(D_r)_{i,t-1} + \beta_2 log\,(\hat{y})_{i,t-1} + \beta_3 log\,(B/y)_{i,t-1} + \gamma_i + \eta_t + \varepsilon_{i,t}$$

where γ_i represents time-invariant country-fixed effects and η_t denotes time-fixed effects. The term $(I/y)_{i,t}$ denotes the total investment, normalized by GDP for country i at time t. In addition, $(D_r)_{i,t}$ represents a dummy variable that assigns 1 if there is a debt rule in country i at period t and 0 otherwise, $(\hat{y})_{i,t}$ is the cyclical component of GDP for country i at period t, and $(B/y)_{i,t}$ denotes the level of public debt normalized by GDP for country i at period t. The term $\varepsilon_{i,t}$ denotes the regression residuals.

Table 4 shows that, other things equal, the positive correlation between debt rules and investment is statistically significant and robust to various controls and specifications. Specification (1) presents the correlation between debt rules and total investment after controlling by GDP and debt levels. Specification (2) controls for time fixed effects, specification (3) controls for time and country fixed effects, and specification (4) presents the analysis for high-income countries instead of emerging economies.[12] The estimate in column (3) suggests that debt rules are associated with investment being 11 percentage points of GDP higher. In the Appendix, Table 6 presents an alternative specification in which the explanatory variables are lagged one period to control for endogeneity. Overall, the positive correlation between debt rules and investment holds for emerging economies.

Importantly, the β_1 coefficient becomes statistically insignificant once we consider high-income countries, which is consistent with the model's insight that debt rules affect investment because of the distortionary effect of spreads on expected capital returns, which is more prevalent in emerging economies. On the other hand, the coefficient associated with the cyclical component of GDP is positive and significant, suggesting, as expected, that investment is positively associated with economic activity (regardless of the income level). Finally, the coefficient associated with public debt is negative and statistically significant, which is consistent with the findings in the debt overhang literature regarding the negative effects of debt levels on investment.

In a nutshell, all the correlations between investment and the dependent variables in Table 4 are consistent with the existing literature and the predictions of our model.

[12]Based on data availability, the high-income countries in the sample include Australia, Austria, Bahrain, Belgium, Chile, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Netherlands, New Zealand, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States and Uruguay.

Table 4: Panel Regressions: Debt Rules and Investment

	Dependent variable: $log(I/y)$			
	(1)	(2)	(3)	(4)
DebtRule	**0.210****	**0.114****	**0.114***	**0.0122**
	(**0.0607**)	(**0.0525**)	(**0.0565**)	(**0.0339**)
$log(\hat{y})$	0.0193*	0.0221*	0.0252*	0.0318***
	(0.0106)	(0.0126)	(0.0133)	(0.0115)
$log(B/y)$	−0.201***	−0.153***	−0.177***	−0.0925*
	(0.0568)	(0.0560)	(0.0584)	(0.0487)
Time Fixed Effects	No	Yes	Yes	Yes
Country Fixed Effects	No	No	Yes	Yes
Observations	230	230	230	238
R-squared	0.30	0.53	0.53	0.26
Number of countries	28	28	28	32

$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

4.2 Debt Rules and Sovereign Spreads

To further document the role of fiscal rules in creating confidence in financial markets, we study the relation between sovereign spreads and the adoption of debt rules. We change the dependent variable from the previous subsection and estimate the following panel fixed-effect regression:

$$log\,(r_s)_{i,t} = \alpha_i + \beta_1\,(D_r)_{i,t-1} + \beta_2 log\,(\hat{y})_{i,t-1} + \beta_3 log\,(B/y)_{i,t-1} + \gamma_i + \eta_t + \varepsilon_{i,t}$$

where r_s is the 5-year CDS implied annual spread in government yields for country i at time t.

Table 5 shows that, other things equal, there is a negative and statistically significant correlation between debt rules and sovereign spreads that is robust to various controls and specifications. Having a debt rule in place is associated with a β_1 percent drop in sovereign spreads. Overall, our empirical results are consistent with previous empirical studies that document that fiscal rules are negatively associated with sovereign spreads.[13]

Table 5: Panel Regressions: Debt Rules and Sovereign Spreads

	Dependent variable: $log(r_s)$			
	(1)	(2)	(3)	(4)
DebtRule	$\mathbf{-0.552}^{***}$	$\mathbf{-0.459}^{**}$	$\mathbf{-0.446}^{**}$	$\mathbf{-0.732}^{***}$
	(**0.170**)	(**0.205**)	(**0.213**)	(**0.141**)
$log(\hat{y})$	−0.0496	−0.0561	−0.0567	−0.0363
	(0.0341)	(0.0376)	(0.0412)	(0.0342)
$log(B/y)$	0.664^{***}	0.533^{***}	0.593^{***}	0.605^{***}
	(0.156)	(0.179)	(0.194)	(0.203)
Time Fixed Effects	No	Yes	Yes	Yes
Country Fixed Effects	No	No	Yes	Yes
Observations	230	230	230	238
R-squared	0.17	0.61	0.61	0.85
Number of countries	28	28	28	32

$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

5 Conclusion

We developed a quantitative sovereign default model with capital accumulation, long-term debt, and fiscal rules. We found that the optimal debt limit generates an economic expansion in the long- run, fueled by higher capital accumulation due to lower default risk. Moreover, there are sizeable welfare gains from this policy, most of which are a result of a significant reduction in spreads due to expectations about future borrowing and investment. This highlights the importance of institutional mechanisms that provide a credible commitment regarding fiscal discipline, besides its actual implementation. We also presented evidence of how the relations implied by the model between debt limits, sovereign spreads, and investment are featured in data for emerging economies.

[13] See for example, Islamaj, Sommers, and Samano (2023).

As noted in the paper, there are important mechanisms that we are not modeling which could make the expansions from debt limits even higher. Developing models that can accommodate distortions to contemporaneous production from high spreads, as well as capital accumulation with endogenous default is an exciting avenue for future research. In addition, alternative designs to debt limits, such as the spread-break proposed by Hatchondo, Martinez, and Roch (2022), could result in even higher welfare gains from a more efficient reduction of default risk. Finally, we are silent about comprehensive fiscal consolidation plans that could weight potential trade-offs between lowering expenditure or raising taxes, which we leave for future research.

References

Alesina, Alberto F. and Silvia Ardagna. 2009. "Large Changes in Fiscal Policy: Taxes Versus Spending." Working Paper 15438, National Bureau of Economic Research. 1

Alfaro, Laura and Fabio Kanczuk. 2017. "Fiscal rules and sovereign default." Tech. rep., National Bureau of Economic Research. 3

Angeletos, George-Marios, Manuel Amador, and Ivan Werning. 2006. "Commitment vs. Flexibility." *Econometrica* 74 (2):365–396. 4

Arellano, Cristina. 2008. "Default Risk and Income Fluctuations in Emerging Economies." *American Economic Review* 98 (3):690–712. 7

Arellano, Cristina, Yan Bai, and Luigi Bocola. 2020. "Sovereign Default Risk and Firm Heterogeneity." Tech. rep. 5

Bianchi, Javier, Pablo Ottonello, and Ignacio Presno. 2023. "Fiscal Stimulus under Sovereign Risk." *Journal of Political Economy* 131 (9):2328–2369. 3

Blanchard, Olivier. 1990. "Comment to: Can Severe Fiscal Contractions Be Expansionary?" Working Paper 3372, National Bureau of Economic Research. 4

Bocola, Luigi. 2016. "The Pass-Through of Sovereign Risk." *Journal of Political Economy* 124 (4):879–926. 2, 5, 12

Chatterjee, Satyajit and Burcu Eyigungor. 2012. "Maturity, Indebtedness, and Default Risk." *American Economic Review* 102 (6):2674–2699. 7, 14

Chaumont, Gaston, Givi Melkadze, and Ia Vardishvili. 2023. "Sovereign Risk and Economic Activity: The Role of Firm Entry and Exit." Tech. rep., Available at SSRN. 2, 5

Cole, Harold L. and Timothy J. Kehoe. 2000. "Self-Fulfilling Debt Crises." *Review of Economic Studies* 67:91–116. 8

Deng, Minjie and Chang Liu. 2023. "Public Financing Under Balanced Budget Rules." *mimeo* . 3, 4

Esquivel, Carlos. 2023. "Underinvestment and Misallocation Under Sovereign Risk." 1, 10, 12

Galli, Carlo. 2021. "Self-fulfilling debt crises, fiscal policy and investment." *Journal of International Economics* 131:103475. 8

Giavazzi, Francesco and Marco Pagano. 1990. "Can Severe Fiscal Contractions Be Expansionary? Tales of Two Small European Countries." Working Paper 3372, National Bureau of Economic Research. 1, 4

Gordon, Grey and Pablo A. Guerron-Quintana. 2018. "Dynamics of investment, debt, and Default." *Review of Economic Dynamics* 28:71–95. 6

Guajardo, Jaime, Daniel Leigh, and Andrea Pescatori. 2014. "Expansionary Austerity? International Evidence." *Journal of the European Economic Association* 12 (4):949–968. 1

Halac, Marina and Pierre Yared. 2014. "Fiscal Rules and Discretion Under Persistent Shocks." *Econometrica* 82 (5):1557–1614. 4

———. 2018. "Fiscal Rules and Discretion in a World Economy." *American Economic Review* 108 (8):2305–2334. 4

———. 2022. "Fiscal Rules and Discretion Under Limited Enforcement." *Econometrica* 90 (5):2093–2127. 4

Hatchondo, Juan Carlos, Leonardo Martinez, and Francisco Roch. 2020. "Constrained efficient borrowing with sovereign default risk." . 3

———. 2022. "Fiscal Rules and the Sovereign Default Premium." *American Economic Journal: Macroeconomics* 14 (4):244–73. 1, 3, 8, 25

Hatchondo, Juan Carlos, Leonardo Martinez, and Horacio Sapriza. 2010. "Quantitative properties of sovereign default models: Solution methods matter." *Review of Economic Dynamics* 13 (4):919–933. 13

Hatchondo, Juan Carlos, Leonardo Martinez, and Cesar Sosa-Padilla. 2016. "Debt Dilution and Sovereign Default Risk." *Journal of Political Economy* 124 (5):1383–1422. 1, 4

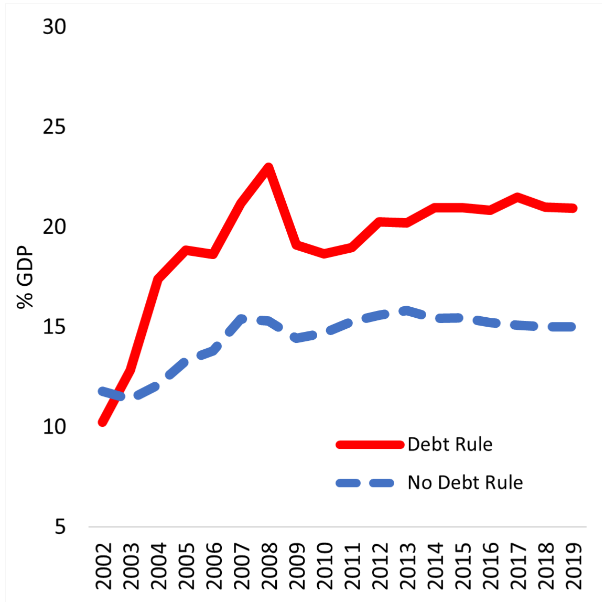
Islamaj, Ergys, Scott Sommers, and Agustin Samano. 2023. “The Sovereign Spread Compressing Effect of Fiscal Rules During Global Crises.” *mimeo* . 24

Kose, M. Ayhan, Franziska Ohnsorge, Peter Nagle, and Naotaka Sugawara. 2020. “Caught by the Cresting Debt Wave.” *IMF Finance & Development Magazine* :40–43. 1

Mendoza, Enrique G. and Vivian Z. Yue. 2012. “A General Equilibrium Model of Sovereign Default and Buisness Cycles.” *Quarterly Journal of Economics* 127:889–946. 5, 7, 11

Appendix A. Supportive Empirical Evidence

Figure 7: Private Investment, Debt Rule vs No Debt Rule



Countries are sorted based on the existence of a debt rule for more than 10 years; those with a rule for less than 10 years are excluded from both categories. Debt rule countries include Bulgaria (2003-2019), Indonesia (2004-2019), Malaysia (2002-2019), Panama (2002-2019), and Romania (2007-2019). Countries without debt rule include Argentina (2002-2019), Brazil (2002-2019), China (2002-2019), Colombia (2002-2019), Dominican Republic (2005-2019), Egypt (2002-2019), El Salvador (2007-2019), Iraq (2006-2019), Jordan (2002-2011), Lebanon (2006-2019), Mexico (2002-2019), Morocco (2007-2019), Philippines (2002-2019), Russia (2002-2019), South Africa (2002-2019), Turkey (2002-2019), Ukraine (2003-2019), Venezuela (2002-2019).

Table 6: Baseline Regressions: Lagging Independent Variables

	Dependent variable: $log(I/y)$			
	(1)	(2)	(3)	(4)
L.DebtRule	$\mathbf{0.209}^{***}$	$\mathbf{0.126}^{*}$	$\mathbf{0.128}^{*}$	$\mathbf{-0.0477}$
	(0.0803)	**(0.0709)**	**(0.0744)**	**(0.0331)**
L.$log(\hat{y})$	−0.0131	−0.00228	−0.00138	0.0223^{*}
	(0.0131)	(0.0147)	(0.0150)	(0.0124)
L.$log(B/y)$	-0.274^{***}	-0.260^{***}	-0.274^{***}	−0.0430
	(0.0689)	(0.0717)	(0.0729)	(0.0522)
Time Fixed Effects	No	Yes	Yes	Yes
Country Fixed Effects	No	No	Yes	Yes
Observations	212	212	212	210
R-squared	0.33	0.53	0.53	0.30
Number of countries	28	28	28	32

$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$