Expansionary Fiscal Consolidation Under Sovereign Risk*

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October, 2024

Abstract

We develop a sovereign default model with capital accumulation, long-term debt, and fiscal rules with two distortions: debt dilution and private underinvestment. Fiscal rules generate a long-run economic expansion because they mitigate default risk caused by dilution, which increases capital accumulation. In the short-run, however, the economy goes through a costly transition where consumption and investment drop to finance debt reduction. We quantify these dynamic trade-offs and compute welfare gains of fiscal rules using a calibration for Argentina. A debt limit of 44 percent of GDP attains maximal welfare gains of 0.5 percent. Its implementation generates short-lived drops in consumption and investment of 5 and 7 percent, respectively, and a long-run GDP expansion of 1.2 percent. We relax the assumption of commitment to the rule and discuss how the threat of exclusion from implementing future rules provides enough incentives to avoid deviations. Welfare gains more than double in this case.

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

JEL Codes: F34, F41

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*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 comments we thank Manuel Amador, Javier Bianchi, Tobey Kass, Tim Kehoe, Hyunju Lee, Leonardo Martínez, Juan Pablo Nicolini, Vegard Nygaard, Pablo Ottonello, Radek Paluszynski, Fausto Patiño, Rong Qian, Habib Rab, Francisco Roch, John Shea, Luminita Stevens, Miguel Zerecero, and seminar participants at U. Alberto Hurtado, the Minneapolis Fed, University of Houston, UC Irvine, University of Maryland, SED 2023, and the 2023 ITAM Alumni Conference. All errors are our own.

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1 Introduction

Significant fiscal expansions following the economic downturn from the COVID-19 pandemic led to historically high levels of public debt. In the aftermath, most economies face the challenge of restoring their fiscal balance without hampering their economic recovery. While there is some evidence that fiscal consolidations can be expansionary, this challenge can be particularly difficult for emerging economies that pay high interest rate spreads.[1] Moreover, most of the theoretical work that studies such expansions focuses on advanced economies for which default risk is low and debt is held domestically.[2] With debt crises looming on the horizon, highly indebted emerging economies cannot solely rely on policy prescriptions from this literature.

We introduce a novel mechanism through which fiscal consolidation can be expansionary in the presence of default risk. The key policy prescription is to consolidate following the introduction of a fiscal rule. We argue that the fiscal rule mitigates two distortions that have been studied in the sovereign default literature: dilution of long-term debt (Hatchondo, Martinez, and Sosa-Padilla (2016)) and underinvestment (Esquivel (2024)). By mitigating these distortions fiscal discipline induced by the rule lowers default risk and increases capital accumulation in the long-run. In the short-run, however, the implementation of the fiscal rule may result in a costly transition with depressed investment and consumption to finance debt reduction.

To study this trade-off and formalize the mechanism we develop a quantitative sovereign debt model with capital accumulation, long-term debt, and fiscal rules.[3] Domestic households make aggregate investment decisions and lack access to international financial markets, while a benevolent government makes optimal borrowing and default decisions on their behalf. We model debt rules as an upper bound to the debt-to-GDP ratio, following the benchmark analysis of Hatchondo, Martinez, and Roch (2022). Different from previous work, a feature of our model is that whether the limit binds depends on the history of capital accumulation and on the realization of a productivity shock. As is standard, we assume that when the government defaults it is excluded from financial markets for a random number of periods and there is an exogenous cost to productivity. The latter implies that default risk lowers the expected return to capital, which depresses investment.

[1] Giavazzi and Pagano (1990) document two cases of expansionary fiscal consolidations in Denmark and Ireland in the 1980s. Alesina and Ardagna (2009) documenting similar cases for a larger set of advanced economies

[2] See Bertola and Drazen (1993), Bi (2012), Bi, Leeper, and Leith (2013), Barseghyan and Battaglini (2016)

[3] The model builds on the quantitative literature following the seminal work of Eaton and Gersovitz (1981).

Debt dilution and underinvestment interact with each other. As in Hatchondo, Martinez, and Sosa-Padilla (2016), dilution substantially increases default risk. High default risk lowers the expected marginal return to capital, to which households respond by investing less. Esquivel (2024) shows that low capital accumulation further increases default risk and limits the ability of the government to roll-over its debt, which households do not internalize. Fiscal rules contain debt dilution by limiting future debt issuance (see Hatchondo, Martinez, and Roch (2022)), which in turn lowers default risk and ameliorates underinvestment from households. It is by mitigating the interaction of these dynamic frictions that the introduction of a fiscal rule generates an expansionary fiscal consolidation in the model.

We calibrate the model with no fiscal rule to Argentina, which is an economy that faces high default risk and frequent default episodes. Then, we use the model to quantify the short-run and long-run trade-offs of introducing a fiscal rule and compute the welfare gains taking these into account. The debt limit that maximizes these gains is 44.2 percent of GDP and generates welfare gains of 0.5 percent in consumption equivalent units.

The average transition path features an initial drop in consumption and investment of 5 and 7 percent, respectively, which finance the debt reduction. These drops are short-lived and consumption is higher after four quarters. In the long-run, average consumption is 1.35 percent higher. This highlights the importance of accounting for the costly transition when computing the welfare gains of implementing the rule (which are less than half of this number). Average spreads drop on impact from 7 to 2 percent and remain low in the long-run. This large reduction in spreads is a result of the reduction in outstanding debt and of a shift in its price schedule, reflecting expectations of future fiscal discipline imposed by the rule. Each of these channels explains roughly half of the reduction in spreads. The average debt-to-GDP ratio converges to 0.42, and GDP in the long-run is on average 1.2 percent larger, showing that the fiscal consolidation was, indeed, expansionary.

In the benchmark case, we assume that the fiscal rule imposes a balanced budget whenever the limit binds, which is why consumption and investment drop by so much initially. We explore fiscal consolidation plans that allow for the primary deficit to be positive, but limited, when the debt limit binds. These plans pose a trade-off between flexibility during the transition and undermining the benefits of the debt limit in the long-run. The optimal deficit limit to implement the 0.42 debt limit is 1.58 percent of GDP and delivers modestly larger welfare gains of 0.52 with similar transition paths. The similarity on the paths suggests that the short-run costs during the transition are more than compensated by the long-run benefits that result from expectations of future fiscal discipline.

We then relax the assumption of commitment to the fiscal rule. This exercise is particularly valuable for economies that may face difficulties in generating institutional guardrails that would force the government to commit to the rule when it binds. We suppose that, at the beginning of each period, the government can choose to deviate from the rule. Once the government deviates—either by issuing more debt than the rule allows or by defaulting—it is absorbed into the benchmark equilibrium with no fiscal rule. Interestingly, the model without commitment features significantly lower default risk, lower spreads, higher capital, and higher consumption, resulting in welfare gains of 1.2 percent, more than double than with commitment. Since defaulting would now imply losing the benefits of having the rule, default becomes costlier than before and the government chooses to avoid it. The prospect of losing the rule provides enough incentives to support it and higher incentives to avoid default, which significantly increases welfare gains.

Finally, we present empirical evidence that supports the main mechanism of the model. While the relationship between fiscal rules and sovereign spreads is well established in the literature, the link between rules and private investment has been less explored.[4] We fill this gap by estimating the long-run and the short-run relationship between debt rules and private investment for a panel of 63 emerging economies. Using a panel regression, we estimate a significant positive relationship between having a debt rule in place and private investment as percentage of GDP. We interpret this result as long-run evidence of higher investment in countries with a debt rule. We then use a local projections framework to estimate changes in investment following the introduction of a fiscal rule and find evidence of a transition path similar to the one predicted by the model: an initial drop in investment shortly followed by an expansion.

Related literature.—We mainly contribute to the quantitative sovereign default literature (Eaton and Gersovitz (1981); Arellano (2008); Aguiar and Gopinath (2006)) with constraints to fiscal policy (Alfaro and Kanczuk (2017); Hatchondo, Martinez, and Roch (2020); Bianchi, Ottonello, and Presno (2023)); Deng and Liu (2023); Azzimonti and Mitra (2023a); Azzimonti and Mitra (2023b)). Our model extends the model in Hatchondo, Martinez, and Sosa-Padilla (2016) to incor-

[4] See Iara and Wolff (2010), Kalan, Popescu, and Reynaud (2018), Davoodi et al. (2022), and Islamaj, Samano, and Sommers (2024)).

porate private capital accumulation as studied by Esquivel (2024) and fiscal rules similar to those in Hatchondo, Martinez, and Roch (2022). Our main contribution is to show how using a fiscal rule to mitigate the dynamic interactions between debt dilution and underinvestment can generate an expansionary fiscal consolidation, especially in economies with substantial default risk.

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. Halac and Yared (2014), Halac and Yared (2018), and Halac and Yared (2022) study debt limits 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. Debt limits emerge as an efficient mechanism through which citizens provide incentives to the government ex ante. We contribute by showing that with capital accumulation and default risk fiscal rules may be sustained even without a commitment technology to enforce them.

Finally, this paper relates to the literature that studies whether fiscal consolidation is expansionary or contractionary. This literature has focused on a tension between a "Keynesian" argument that states that fiscal consolidation is likely to contract aggregate demand a "Ricardian" one that claims 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. Giavazzi and Pagano (1990) present evidence of large-scale fiscal contractions in Denmark and Ireland associated with a strong output expansion. In a discussion of their work, Blanchard (1990) develops a simple model to reconcile both ideas. Similarly, other theoretical work such as Bertola and Drazen (1993), Bi (2012), and Bi, Leeper, and Leith (2013) has studied mechanisms for such expansions in advanced economies. We present a novel channel through which fiscal consolidation generates an expansion in emerging economies facing high default risk.

Layout.—Section 2 presents the model environment and discusses the main mechanism and trade-offs in detail. Section 3 presents the quantitative analysis and the main results. Section 4 presents the empirical analysis. Section 5 concludes.

2 Model

We develop a sovereign default model with private capital accumulation and fiscal rules. 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 by issuing long-term debt that is purchased by risk-neutral foreign lenders. The government makes lump-sum transfers (or levies lump-sum taxes) to the households and cannot commit to repaying its debt.

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 foreign lenders. 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 $\frac{\phi}{2}\frac{(k_{t+1}-k_t)^2}{k_t}$, where $\phi > 0$. The budget constraint of a representative household is:

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

where $i_{k,t} = k_{t+1} - (1-\delta) k_t$ is investment, Π_t are profits from the firm, and T_t is a lump-sum transfer from the government.

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

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

[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.

$$
\begin{aligned}
\log z_{t+1} &= (1-\rho)\log(\mu_z) + \rho\log(z_t) + \epsilon_t \\
\mathbb{E}[\log z_t] &= \log(\mu_z)
\end{aligned}
$$

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.

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's budget constraint when it is in good financial standing is:

$$T_t + (\gamma + \kappa(1-\gamma))B_t = q_t i_{b,t}, \tag{2}$$

where 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 $z_D(z_t) = z_t - \max\left\{0, \xi_0 z + \xi_1 z^2\right\}$, where $\xi_0 < 0 < \xi_1$.[6] 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 $\mathcal{F}$ that maps the state space of the economy into the power set of government policy instruments. We study debt limits where the fiscal rule is of the form:

$$\mathcal{F}(z_t, K_t, B_t) = \left\{B_{t+1} | B_{t+1} \le \max\left\{\chi_b z_t K_t^{\alpha}, (1-\gamma)B_t\right\}\right\} \tag{3}$$

where $\chi_b \in (0,1)$. This formulation imposes that the debt-to-GDP ratio cannot exceed χ_b. If outstanding debt B_t is already higher than this limit for a given realization of z_t, then it must

[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.

be reduced by at least the fraction γ that matured. This implicitly imposes that when debt is above the limit there cannot be a primary deficit (debt issuance $i_{b,t}$ cannot be positive). We later relax this assumption and allow for positive (but limited) primary deficits when debt is above its limit. An important contribution of our model is that capital accumulation relaxes the fiscal rule in subsequent periods. As we discuss extensively in the following section, this feature increases the value of sustaining higher levels of capital under a fiscal rule.

Timing.—At the beginning of a period, the government observes (z_t, K_t, B_t) and makes its default and borrowing 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. This timing assumptions 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 aggregate state. Let $g = (T, B')$ 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

$$H^P(z,k,x,g) = \max_{c,i,k'} \left\{ u(c) + \beta \mathbb{E}\left[(1-d') H^P \left(z', k', x', g^P \right) \right] \right. \tag{4}$$
$$\left. + \beta \mathbb{E}\left[d' H^D(z', k', K') \right] \right\}$$
$$s.t. \quad c + i + \frac{\phi}{2} \frac{(k'-k)^2}{k} \leq r(z,K)k + \Pi(z,K) + T$$
$$i = k' - (1-\delta)k$$
$$x' = \Gamma_x^P(z,x,g), \quad g^P = \Gamma_g^P(z',x'), \quad d' = \Gamma_d(z',x')$$

where Γ_x^P is the household's belief about the law of motion of the endogenous aggregate state x in repayment, Γ_g^P is the household's belief of fiscal policy in repayment, Γ_d the household's belief about the government's default decisions, the rental rate of capital is $r(z,K) = z\alpha K^{\alpha-1}$, and firm profits are $\Pi(z,K) = z(1-\alpha)K^{\alpha}$. The value of the household when $d = 1$ is

$$H^D(z,k,K) = \max_{c,i,k'} \left\{ u(c) + \beta \mathbb{E}\left[\theta (1-d') H^P \left(z', k', x', g^P \right) \right] \right. \tag{5}$$
$$\left. + \beta \mathbb{E}\left[(1-\theta+\theta d') H^D(z', k', K') \right] \right\}$$
$$s.t. \quad c + i + \frac{\phi}{2} \frac{(k'-k)^2}{k} \leq r(z_D(z),K)k + \Pi(z_D(z),K)$$
$$i = k' - (1-\delta)k$$
$$x' = \Gamma_x^D(z,K), \quad g^P = \Gamma_g^P(z',x'), \quad d' = \Gamma_d(z',x')$$

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

$$V(z,x) = \max_{d\in\{0,1\}} \left\{ dV^D(z,K) + (1-d)V^P(z,x) \right\} \tag{6}$$

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

$$V^P(z,x) = \max_{T,B' \in \mathcal{F}(z,x)} \left\{ u\left(c^P(z,K,x,g)\right) + \beta \mathbb{E}\left[V(z',x')\right] \right\} \tag{7}$$
$$s.t. \quad T + (\gamma + \kappa(1-\gamma)) B = q(z,x')\left[B' - (1-\gamma)B\right]$$
$$K' = k^P(z,K,x,g), \quad g = (T,B')$$

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

$$V^D(z,K) = u\left(c^D(z,K,K)\right) + \beta \mathbb{E}\left[\theta V^D(z',K') + (1-\theta) V(z',x')\right] \tag{8}$$

where $K' = k^D(z,K,K)$, and c^D and k^D are the household's 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 (6) through (8); (ii) given all prices and beliefs, the value and policy functions for the households solve the problems in (4) and (5); (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

$$q(z,x') = \frac{\mathbb{E}\left[(1-d')(\gamma + (1-\gamma)(\kappa + q(z',x'')))\right]}{1+r^*} \tag{9}$$

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

2.2 Debt dilution and underinvestment

Two dynamic frictions arise from the government's inability to commit to future policy: debt dilution from not being able to commit to future debt issuance, and underinvestment from the private sector from not being able to commit to future debt payments.

In the presence of long-term debt, the issuance of new debt reduces the value of existing outstanding debt. The government does not internalize this loss in value because outstanding debt is held by foreign lenders. Lenders then offer a lower price for currently issued bonds in anticipation of future borrowing increasing default risk and diluting the future market value of these long-term bonds. Hatchondo, Martinez, and Sosa-Padilla (2016) find that this negative externality from current debt issuance on past governments substantially increases default risk.

Underinvestment arises because households do not internalize how the aggregate capital allocation affects future default incentives. They do respond, however, to default risk because the marginal product of capital is lower in default. The Euler equation of a representative household is

$$u'\left(c_t^P\right) P_{k,t} = \beta \mathbb{E}\left[\left(1-d_{t+1}\right) u'\left(c_{t+1}^P\right) R_t^P + d_t u'\left(c_{t+1}^D\right) R_t^D\right] \tag{10}$$

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

$$R_{t+1}^P = \alpha z_{t+1} A K_{t+1}^{\alpha-1} + (1-\delta) P_{k,t+1} + \frac{\phi}{2}\left(\frac{I_{t+1}}{K_{t+1}}\right)^2 \tag{11}$$

in repayment and

$$R_{t+1}^D = \alpha z_D\left(z_{t+1}\right) A K_{t+1}^{\alpha-1} + (1-\delta) P_{k,t+1} + \frac{\phi}{2}\left(\frac{I_{t+1}}{K_{t+1}}\right)^2 \tag{12}$$

in default. As the probability of default increases, the expected return to capital decreases due to $z_D\left(z_{t+1}\right) \leq z_{t+1}$, which lowers household's incentives to invest. In addition to default risk depressing investment, households do not internalize how their investment decision affects default risk and, thus, the price of newly issued debt. To illustrate this, consider the case in which the government can directly choose the aggregate capital allocation. Then, the Euler equation for capital in repayment would be:

$$u'\left(c_t^P\right)\left[P_{k,t} - \frac{\partial q\left(z_t, x_{t+1}\right)}{\partial K_{t+1}} i_{b,t}\right] = \beta \mathbb{E}\left[\left(1-d_{t+1}\right) u'\left(c_{t+1}^P\right) R_t^P + d_t u'\left(c_{t+1}^D\right) R_t^D\right] \tag{13}$$

where the term $\frac{\partial q(z_t, x_{t+1})}{\partial K_{t+1}} i_{b,t}$ shows that the government understands how its choice of K_{t+1} affects its the borrowing terms and, in turn, the resource constraint in t. Esquivel (2024) shows that under the assumptions we have made for z_D default incentives are decreasing in capital and the derivative $\frac{\partial \hat{q}}{\partial K} \geq 0$.[7] This implies that households underinvest in periods where borrowing needs are positive $i_{b,t} \geq 0$. Moreover, this inefficiency vanishes withouth default risk (q would be constant) and is more severe in states for which q is "steeper", which, as we show in the quantitative analysis in Section (3), is the case in periods of distress.

In summary, government overborrowing due to debt dilution exacerbates default risk, which depresses long-run levels of capital. In addition, underinvestment in periods of distress further increases default risk and the ex ante penalty that forward-looking lenders impose on the price of government debt. Fiscal rules can mitigate the costs from debt dilution (Hatchondo, Martinez, and Roch (2022)) and lower default risk. Moreover, in our environment lower default risk mitigates underinvestment and the economy sustains higher levels of capital, output, and consumption in the long-run. The implementation of a fiscal rule in an economy without one, however, may result in a costly transition by inducing a recession and temporarily lower consumption if debt has to be consolidated to a lower level. In the following section we quantify these trade-offs and characterize the fiscal rule and consolidation plan that maximize welfare gains.

3 Quantitative analysis

We solve numerically for the equilibrium using value function iteration. Following Hatchondo, Martinez, and Sapriza (2010), we compute the limit of the finite-horizon version of the 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 of the government 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.

[7] See Esquivel (2024) 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.

3.1 Calibration

We calibrate the model to Argentina, which is a common reference in the sovereign debt literature and for which the potential gains from fiscal discipline are frequently featured in policy debates.[8] A period in the model is one quarter. Unless specified otherwise, we use data from the fourth quarter of 1993 to the fourth quarter of 2023. There are two sets of parameters: one with values taken from the literature or directly from the data (summarized in Table 1) and another chosen to match some empirical moments in model simulations with no debt limit ($\chi_d = \infty$, Table 2). Most of our externally calibrated parameters rely on Chatterjee and Eyigungor (2012) and Gordon and Guerron-Quintana (2018), who calibrate for Argentina as well.

Table 1: Independent parameters

Parameter		Value	Source
Relative risk aversion	σ	2	Standard value
Risk-free rate	r^*	0.01	Standard value
Discount factor	β	0.95	Standard value for Argentina
Debt duration	γ	0.05	Chatterjee and Eyigungor (2012)
Coupon	κ	0.03	Chatterjee and Eyigungor (2012)
Probability of reentry	θ	0.0625	Gelos, Sahay, and Sandleirs (2011)
Capital share	α	0.33	Standard value
Depreciation rate	δ	0.05	Standard value
Persistence of productivity	ρ	0.95	Gordon and Guerron-Quintana (2018)
St. dev of productivity	σ_z	0.017	Gordon and Guerron-Quintana (2018)

The relative risk aversion parameter is $\sigma = 2$ and the risk-free rate $r^* = 0.01$, which are standard values in the business cycle literature. We set the discount factor of the households (and the benevolent government) to $\beta = 0.95$, which is close to values that have been calibrated to the Argentinean economy in similar models.[9] Following Chatterjee and Eyigungor (2012), we set the debt duration parameter $\gamma = 0.05$ and the coupon rate to $\kappa = 0.03$ to match the maturity and coupon information for Argentina reported in Broner, Lorenzoni, and Schmukler (2013). We set the probability of reentry to financial markets to $\theta = 0.0625$ for an average duration in autarky of 16 quarters, which is the median duration of default events documented by Gelos, Sahay, and Sandleirs (2011). The capital share $\alpha = 0.33$ and the capital depreciation rate $\delta = 0.05$ are standard values. Finally, we

[8] See "Argentine executives pitch fiscal discipline as election hits home stretch." *Reuters*, October 11, 2023. "Javier Milei implements shock therapy in Argentina." *The Economist*, December 13, 2023.

[9] Arellano (2008) chooses 0.953, Chatterjee and Eyigungor (2012) choose 0.954, and Gordon and Guerron-Quintana (2018) choose 0.946.

take the persistence $\rho = 0.95$ and variance $\sigma^2 = 0.017$ of the productivity shock from Gordon and Guerron-Quintana (2018), who calibrate them for Argentina using a similar production technology.

Table 2: Parameters chosen to target simulation moments

Parameter		Value	Target	Data	Model
Capital adjustment cost	ϕ	25.0	σ_i/σ_y	2.65	2.49
Quadratic cost on	ξ_0	-0.6608	$Av(r_t - r^*)$	0.08	0.07
productivity in default	ξ_1	0.8501	$\frac{B}{4*Y}$	0.45	0.45

The moments in the model are calculated using 10,000 samples of 1,000 periods each after dropping the first 1,000. The annualized yield on government bonds is $r_t = ((\gamma + (1-\gamma)(\kappa + q_t))/q_t)^4 - 1$ and the annualized risk-free interest rate is $r^* = 0.04$. Spreads are $r_t - r^*$. Both in the data and the model real GDP and investment are measured with base-period prices, we take the natural logarithm and detrend using an HPfilter with a smoothing parameter of 1600.

Table 2 summarizes the moment-matching exercise. We choose the capital adjustment cost parameter $\phi = 25$ and the two parameters governing the productivity penalty of default $\xi_0 = -0.6608$ and $\xi_1 = 0.8501$ to jointly match: (i) a ratio of investment volatility-to-GDP volatility of 2.65, (ii) an average spread of 0.08, and (iii) an average debt-to-GDP ratio of 0.45. Spreads in the model are calculated as $r_t - r^*$, where $r_t = ((\gamma + (1-\gamma)(\kappa + q_t))/q_t)^4 - 1$ is the annualized yield of government bonds implied by q_t. Spreads in the data are from the Emerging Markets Bond Index, an index composed of U.S. dollar-denominated emerging market bonds. For debt, we use the general government gross debt measured as a percentage of GDP from the IMF. Both in the model and in the data, we only consider periods in good financial standing. Thus, the sample in the data includes the periods 1993-2001 and 2005-2019.

Table 3: Non-targeted moments

Moment	Data	Model
default frequency	0.03	0.03
σ_{r-r^*}	0.05	0.04
σ_c/σ_y	1.2	1.7
σ_y	4.8	3.5
$\sigma_{tb/y}$	2.3	6.2
$Cor(r - r^*, y)$	-0.79	-0.32
$Cor(tb/y, y)$	-0.68	-0.46

The moments in the model are calculated using 10,000 samples of 1,000 periods each after dropping the first 1,000. The annualized yield on government bonds is $r_t = ((\gamma + (1-\gamma)(\kappa + q_t))/q_t)^4 - 1$ and the annualized risk-free interest rate is $r^* = 0.04$. Spreads are $r_t - r^*$. Both in the data and the model real GDP and consumption are measured with base-period prices, we take the natural logarithm and detrend using an HPfilter with a smoothing parameter of 1600.

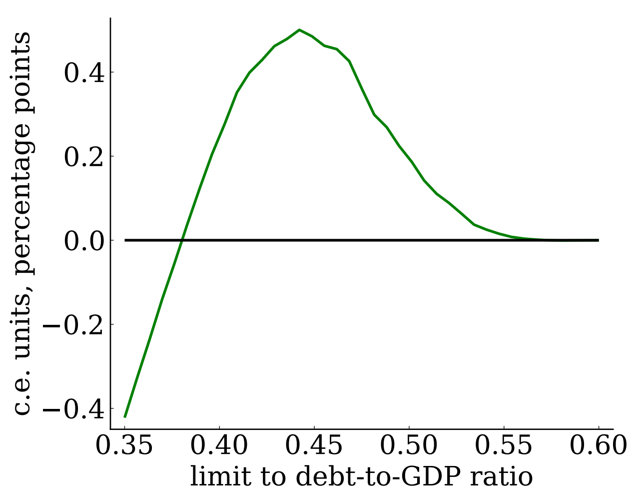
Table 3 reports other business cycle moments not targeted in the calibration. The model generates an annual default frequency of three defaults per century, as reported in other studies. The model also does a good job on the volatility of spreads and in generating countercyclical spreads and trade balances, which is an important feature of business cycles in emerging market economies that has been highlighted in the literature. Consumption is more volatile than GDP, as in the data, but this ratio of volatilities is slightly larger. The volatility of output is close to that of the data, but not the volatility of the trade balance, which is much larger.

3.2 Optimal debt limit

As mentioned before, our benchmark calibration considers an economy that does not adhere to any limits to its debt level or issuance other than those imposed by the market. We now compute the optimal debt limit as the parameter χ_b that maximizes the average welfare gains of implementing the fiscal rule (3) in the ergodic distribution.

Let $\lambda(s_t, x_t; \chi_b)$ be the welfare gains of implementing χ_b when the state is (s_t, x_t) expressed in consumption equivalent units. Also, let $\bar{\lambda}(\chi_b)$ be the average of λ in the ergodic distribution. Figure 1 shows $\bar{\lambda}$ for different values of χ_b, calculated as the average of 10,000 random draws of $\lambda(s_t, x_t; \chi_b)$.[10]

Figure 1: Welfare gains of implementing debt limits



For each value of the limit to the debt-to-GDP ratio χ_b the graph depicts average welfare gains $\bar{\lambda}(\chi_b)$ expressed in consumption equivalent units. Each $\bar{\lambda}(\chi_b)$ is the average welfare gains $\lambda(s_t, x_t; \chi_b)$ of 10,000 draws of (s_t, x_t) from the ergodic distribution in the benchmark economy without fiscal rules.

Note that if the debt limit is too high then welfare gains are zero because the fiscal rule is so relaxed that it has no effect on the government's incentives and, thus, no effect on prices or

[10] We pick each (s_t, x_t) as the last element from a simulation of 1,001 periods in the benchmark economy.

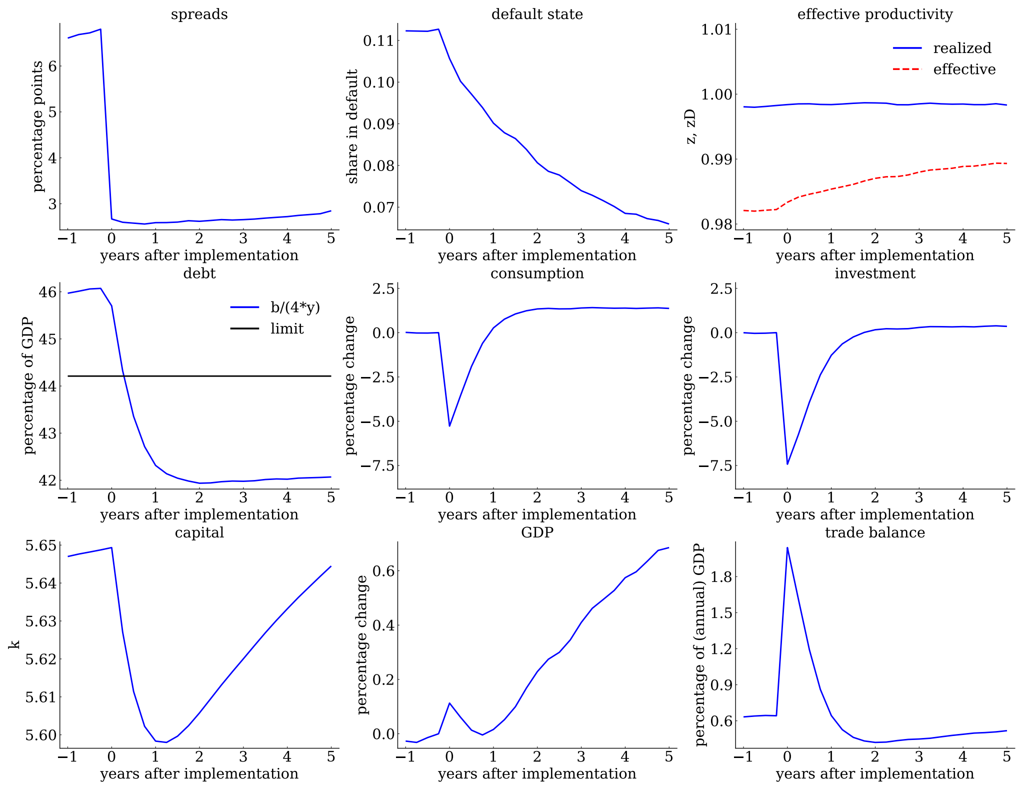
investment. On the other hand, if the debt limit is too strict then there are welfare losses from implementing the fiscal rule and the reason is twofold. First, because the implementation would require a lengthy and costly adjustment period during which consumption and investment are depressed in order to comply with the rule. Second, because the economy's ability to borrow in the long-run would be too restricted.

The highest welfare gains of 0.5 percent are achieved with a debt limit of $\chi_b^* = 0.442$, which is close to the average debt-to-GDP ratio in the benchmark economy of 0.45. In the long-run, however, the government in the economy with this fiscal rule chooses a debt level that is well below this limit. The following subsection analyzes the drivers of these welfare gains and presents the main result of the paper: after implementing the optimal debt limit the economy transitions to a distribution with higher capital stock, higher output, higher consumption, lower debt-to-GDP ratio, and lower sovereign spreads and default risk.

3.3 Expansionary fiscal consolidation

Figure 2 shows the average of 10,000 paths following the implementation of the optimal fiscal rule in period $t = 0$. All initial periods are drawn from the ergodic distribution and each period is one quarter (the plot shows the units in years for clarity of the exposition). When the fiscal rule is first implemented, investment and consumption drop to finance a large debt reduction. Spreads sharply drop on impact and remain low, reflecting both lower default risk and less future debt dilution. Interestingly, GDP increases on impact because fewer economies default in that period, as can be seen in the top middle panel where the share of economies in default drops in $t = 0$. Effective TFP, net of the default penalty, is then higher in each of these economies that would have defaulted otherwise, which is reflected in a higher average GDP in $t = 0$. These economies can avoid defaulting in $t = 0$ thanks to lower sovereign spreads.

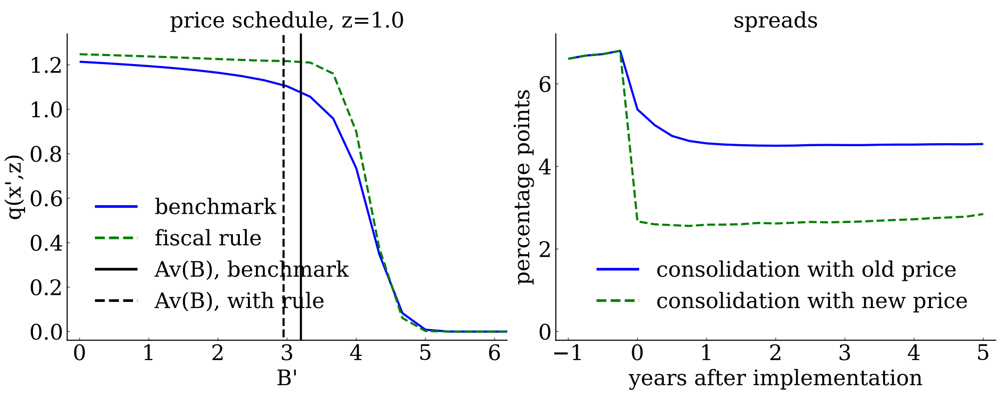
Figure 2: Expansionary fiscal consolidation



Each panel shows the average of 10,000 time series that start at one draw from the ergodic distribution in the benchmark economy without fiscal rules and implement the optimal fiscal rule in year $t = 0$. For each path, the initial state is the end-state of a simulation of 1,001 periods. For spreads we only consider paths with no default. For debt we set $B_t = B_{t-1}$ if $dt = 1$ and $B_t = 0$ when the economy is readmitted to financial markets.

The left panel of Figure 3 shows the price schedule of debt evaluated at the average capital stock in the benchmark economy and at the average shock. The solid blue line corresponds to the price schedule with no fiscal rule and the dotted green line to the price schedule with the optimal fiscal rule. The announcement of the fiscal rule shifts the price schedule upward, which immediately lowers borrowing costs. An aggressive debt-repayment plan, such as the one following the rule, would also lower spreads but this reduction would not be as significant absent the commitment not to dilute the debt with future issuance. The right panel of Figure 3 compares the observed path of spreads following the implementation of the rule (dotted green line) with a hypothetical path in which the government implemented the same debt reduction but facing the price schedule without a fiscal rule. Spreads would drop but only by half of what they do with the fiscal rule. In addition, note that the price with the fiscal rule is “flatter” for low debt levels and steeper for higher levels. The former is because the fiscal rule limits future debt dilution, so for low debt levels a marginal increase has a small negative effect on its price. The latter is because closer to the debt limit default is more attractive with the rule since it prevents new debt issuance. This change in shape gives the government additional incentives to reduce the debt to avoid being too close to the steep region of the price schedule. This lowers the probability of sudden sharp increase in spreads due to a low realization of the shock and allows room for higher borrowing at low costs when needed.

Figure 3: Spreads and the price of debt



The left panel shows the price schedule of debt evaluated at the average capital stock in the benchmark economy and at the average shock. The solid-blue line corresponds to the price schedule with no fiscal rule and the dotted-green line to the price schedule with the optimal fiscal rule. The right panel shows the time series of spreads following the average path of debt and capital computed using the price schedule in the benchmark economy (solid-blue line) and the one in the economy with the fiscal rule (dotted-green line).

After increasing on impact, average GDP drops during the first year following the implementation of the rule but then starts growing after the fifth quarter as investment and consumption recover. GDP growth and trade surpluses drive the reduction of the debt-to-GDP ratio to an average of 0.42, well below the 0.442 imposed by the rule. This is because having the rule bind is costly, which makes default more attractive in those states. The government ex ante chooses to avoid these occurrences by issuing lower levels of debt. In the benchmark economy with no fiscal rule the optimal debt limit would bind 78 percent of the time in the ergodic distribution, compared to the limit actually binding only 7.4 percent of the time when the fiscal rule is in effect. In the long-run, lower default risk and the implied higher expected marginal product of capital drive an increase in investment and the economy converges to a new ergodic distribution with higher average consumption and output, as can be seen in Figure 6 in the Appendix.

Average consumption converges to a level that is 1.35 percent higher in the economy with a fiscal rule. Welfare gains of implementing the rule are only 0.5 percent because the economy goes through a painful transition in which consumption is lower during the first four quarters and higher afterward. The sizable welfare gains are mostly explained by higher consumption possibilities due to a higher capital stock, which is sustained because the limit to debt dilution lowers default risk.

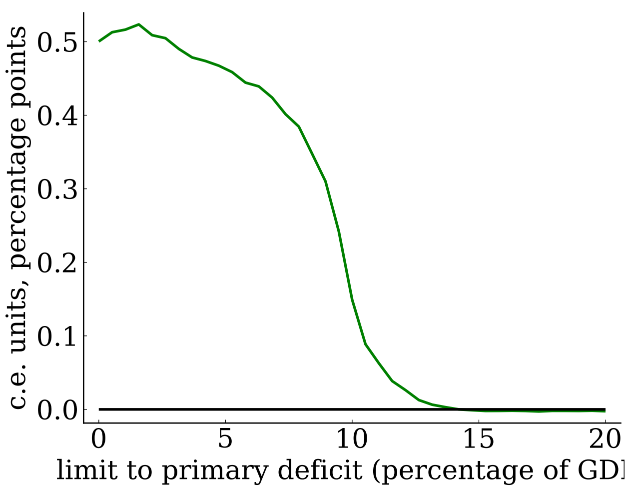
3.4 Fiscal consolidation plan

Recall that our formulation imposes a balanced budget when the debt limit binds. As mentioned before, debt is above the limit implied by the optimal rule 78 percent of the time in the economy with no rule, which partly explains the costly average transition. We now explore fiscal consolidation plans that would allow positive, but limited, primary deficits when the rule binds. These plans pose a trade-off between flexibility during the transition and undermining the benefits of the debt limit in the long-run. Specifically, we now consider fiscal rules of the form

$$\mathcal{F}\left(z_t, K_t, B_t\right) = \left\{B_{t+1} | B_{t+1} \leq \max\left\{\chi_b^* z_t K_t^\alpha, (1-\gamma) B_t + \chi_d z_t K_t^\alpha\right\}\right\},$$

where $\chi_b^* = 0.442$ is the optimal debt limit and $\chi_d > 0$ allows for a positive primary deficit when the rule binds. Figure 4 shows the welfare gains of implementing the optimal fiscal rule χ_b^* with different values for χ_d.

Figure 4: Welfare gains of deficit limits



For each value of the limit to the deficit-to-GDP ratio i_b the graph depicts average welfare gains $\bar{\lambda}\left(\chi_b\right)$ expressed in consumption equivalent units. Each $\bar{\lambda}\left(\chi_b\right)$ is the average welfare gains $\lambda\left(s_t, x_t; \chi_b^*, \chi_b\right)$ of 10,000 draws of $\left(s_t, x_t\right)$ from the ergodic distribution in the benchmark economy without fiscal rules.

If χ_d is high enough it completely undermines the debt limit, since the government is allowed to issue more debt than it would want to regardless. The optimal $\chi_d^* = 0.0158$ implies allowing a primary deficit of roughly 1.6 percent of GDP when the debt limit binds. Figure 7 in the Appendix shows that the average transitions with $\chi_d = \chi_d^*$ are very similar to those with with $\chi_d = 0$ discussed above. With χ_d^* the initial drops in consumption and investment are slightly lower—4.8 and 6 percent, respectively—and the convergence to their long-run values is slightly slower. Overall, the transitions are not substantially different and the welfare gains of implementing the optimal debt limit with χ_d^* are 0.52 percent, which implies modest additional gains of attempting a smoother transition.

3.5 Rules without commitment

So far we have assumed that the government can commit to the fiscal rule. We interpret this assumption as reflecting the implementation of institutional guardrails that prevent a government from deviating from the rule with discretion. One example is the case of Chile, where a budget-balance rule allows for deviations that have to be contingent on the price of copper and the business cycle, which are overseen by independent agencies.[11] In this subsection we argue that even in the absence of such commitment technology, a country facing substantial default risk such as Argentina has incentives to abide by a fiscal rule like the one described above. These incentives span from the gains from the rule lowering default risk and boosting capital accumulation.

We modify the model by allowing the government to deviate from the rule at the beginning of every period. We assume that the private sector (both lenders and domestic households) play a grim trigger strategy in which once the government deviates from the rule—either by issuing more debt than what the rule allows or by defaulting—then it can never credibly implement one again. That is, after deviating the government is absorbed into the benchmark equilibrium in which lenders and households behave as if there was no fiscal rule. Table 4 compares long-run statistics for different cases.

[11] Another example is the case of the European Fiscal Compact, which requires its members to commit to a balanced-budget rule and allows temporary deviations in "exceptional circumstances", such as "an unusual event outside the control of the country concerned or a period of severe economic downturn as defined in the preventive arm of the reinforced Stability and Growth Pact" (ECB Monthly Bulletin, March 2012).

Table 4: Long-run moments, different cases

	$Pr(d=1)$	μ_{r-r^*}	σ_{r-r^*}	$\frac{B}{4*Y}$	$\frac{\mu_c}{\mu_c^{\text{no rule}}}$	$\frac{\sigma_c}{\sigma_y}$	w.g.
no fiscal rule	0.027	0.07	0.04	0.44	1.00	1.70	-
with commitment	0.014	0.03	0.03	0.42	1.02	1.73	0.52
without commitment	0.004	0.01	0.01	0.42	1.03	1.70	1.21

The moments in the model are calculated using 10,000 samples of 1,000 periods each after dropping the first 1,000. The annualized yield on government bonds is $r_t = ((\gamma + (1-\gamma)(\kappa + q_t))/q_t)^4 - 1$ and the annualized risk-free interest rate is $r^* = 0.04$. Spreads are $r_t - r^*$. We only consider periods in good financial standing to compute statistics regarding spreads. For GDP and consumption we take the natural logarithm and detrend the series using an HPfilter with a smoothing parameter of 1600.

The first two rows in Table 4 correspond, respectively, to the benchmark model with no fiscal rule and to the model with commitment to the rule analyzed above with values of $\chi_b = 0.442$ for the debt limit and $\chi_d = 0.0158$ for the deficit limit when the debt limit binds. The third row corresponds to the model with the same rule without commitment. Interestingly, the case without commitment features significantly lower default risk, and lower and less volatile spreads. With lower default risk households hold larger stocks of capital and sustain larger and less volatile consumption. Thus, the average welfare gains of implementing the rule without commitment more than double those of implementing it with commitment. [12]

In the previous subsection, a more generous price schedule for government debt is an important component behind the gains from the rule. This is because commitment to future fiscal discipline that prevents debt dilution is priced in, which generates lower default risk and higher capital accumulation. Without a technology to commit to the rule the government will only abide by it if it has incentives to do so, which is also priced in. The prospect of no longer being able to credibly implement the rule after deviating provides enough incentives for the government to avoid states in which it would be tempted to do so. This is because of the large dynamic gains, due to the interaction between lower spreads and larger capital accumulation, that it would forgo. Moreover, default is now much costlier in every state because it would imply losing these benefits of having the rule once the default episode ends. This change in behavior further increases the dynamic gains of the fiscal rule, which compound into stronger incentives to keep it. In a nutshell, the government

[12]Figure 8 in the Appendix compares the average transition paths of implementing the rule with and without commitment. Consistent with the long-run statistics above, the fraction of economies in default drops significantly more. This generates lower spreads and a larger and quicker GDP expansion. The initial drops in consumption and investment are similar, which suggest that most of the increase in welfare gains spans from the significantly lower default risk in the long-run.

does not need a commitment technology to abide by the rule because it is too good to let go of.

4 Supportive evidence

A central prediction of the theory presented above is that countries with debt rules tend to face lower sovereign spreads and accumulate more capital than countries without rules. Although the link between fiscal rules and sovereign spreads is well-established in the literature, the relationship between rules and investment remains unexplored.[13] To fill this gap, we study both the long-run and short-run relation between debt rules and private investment using data from 2000 to 2019 for a sample of 63 emerging market economies, which are commonly used in the literature.[14]

4.1 Long-run evidence

In this subsection, 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 for private investment, J.P. Morgan EMBI for sovereign spreads, and IMF World Economic Outlook for public debt and GDP to estimate the following panel fixed-effect regression:

$$(I/y)_{i,t} = \alpha_i + \beta d_{i,t-1} + \gamma_1 r^s_{i,t-1} + \gamma_2 (B/y)_{i,t-1} + \gamma_3 \hat{y}_{i,t-1} + \varepsilon_{i,t}$$

where $(I/y)_{i,t}$ denotes private investment, normalized by GDP for country i at time t; $d_{i,t}$ is a dummy variable that assigns 1 if there is a debt rule in country i at period t and 0 otherwise; $r^s_{i,t}$ denotes EMBI sovereign spreads in basis points for country i at period t; $(B/y)_{i,t}$ denotes the level of public debt normalized by GDP for country i at period t; and $\hat{y}_{i,t}$ is the cyclical component of GDP for country i at period t. All regressors are lagged one period to control for endogeneity. The term $\varepsilon_{i,t}$ denotes the regression residuals.

[13] See for example, Iara and Wolff (2010), Kalan, Popescu, and Reynaud (2018), Davoodi et al. (2022), and Islamaj, Samano, and Sommers (2024).

[14] The countries in our panel include Angola, Argentina, Armenia, Azerbaijan, Belize, Bolivia, Brazil, Bulgaria, Cameroon, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Gabon, Georgia, Ghana, Guatemala, Honduras, Hungary, India, Indonesia, Iraq, Jordan, Kazakhstan, Kenya, Latvia, Lebanon, Lithuania, Malaysia, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Romania, Russia, Senegal, Serbia, Slovak Republic, South Africa, Sri Lanka, Thailand, Tunisia, Turkiye, Ukraine, Uruguay, Venezuela, Vietnam, and Zambia.

Table 5 shows that, other things equal, having a debt rule in place is positive correlated with higher private investment. The coefficient on the debt-rule dummy is positive and statistically significant, and this result is robust to various controls and specifications. Specification (1) presents the unconditional correlation between debt rules and private investment. Specification (2) controls for sovereign spreads, specification (3) controls for spreads and public debt, and specification (4) presents the baseline specification controlling for spreads, debt, and the cyclical component of GDP, which are the main macro variables driving the dynamics of private investment in our quantitative model. The estimate in column (4) suggests that private investment in countries with a debt rule in place is, on average, 1.4 percentage points of GDP higher than in countries without a debt rule. In the Appendix, Table 6 presents an alternative specification using country fixed effects, and Table 7 presents similar results using logs for private investment, sovereign spreads, and public debt. Overall, the positive correlation between debt rules and private investment holds.

Table 5: Panel Regressions: Debt Rules and Private Investment

	Dependent variable: (I/y)			
	(1)	(2)	(3)	(4)
DebtRule	**1.272***	**1.245***	**1.322****	**1.386****
	(0.754)	**(0.713)**	**(0.665)**	**(0.673)**
Sovereign Spreads		-0.00173^{**}	-0.00126^{**}	-0.00128^{**}
		(0.000675)	(0.000508)	(0.000529)
Public Debt			-0.0376^{**}	-0.0258
			(0.0170)	(0.0216)
Cyclical GDP				8.057**
				(3.413)
Observations	782	782	782	782
Number of countries	63	63	63	63

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

Importantly, the rest of independent variables have the expected sign and most of them are statistically significant. On one hand, the coefficient associated with sovereign spreads is negative and significant, suggesting, as expected, that a decrease in sovereign risk is associated to higher investment. On the other hand, the coefficient associated with public debt is negative, which is consistent with the findings in the debt overhang literature regarding the negative effects of debt levels on investment. However, our estimate in the baseline specification is not statistically significant. Finally, 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).

4.2 Short-run evidence

To estimate changes in private investment following the implementation of debt rules, we present an empirical analysis using the local projections method (LP) proposed by Jorda (2005).[15] The benchmark specification for different horizons $h = 0, \ldots, 5$ in years is given by:

$$(I/y)_{i,t+h} - (I/y)_{i,t-1} = \beta_h D_{i,t} + \gamma_1 r^s_{i,t-1} + \gamma_2 (B/y)_{i,t-1} + \gamma_3 \hat{y}_{i,t-1} + \delta X_{i,t} + \varepsilon_{i,t+h} \quad (14)$$

where $(I/y)_{i,t+h}$ denotes private investment, normalized by GDP, for country i at time $t+h$; $D_{i,t}$ is a dummy variable that equals 1 if a debt rule was implemented in period t and 0 otherwise; h denotes the time horizon considered after the debt rule implementation; r^s are the EMBI sovereign spreads in basis points; $\left(B/y_{i,t-1}\right)$ is the level of public debt normalized by GDP; and $\hat{y}_{i,t-1}$ is the cyclical component of GDP. All control variables are lagged one period to control for endogeneity. X_{it} denotes a vector which contains two lags of annual private investment, normalized by GDP. The term $\varepsilon_{i,t+h}$ denotes the regression residuals.

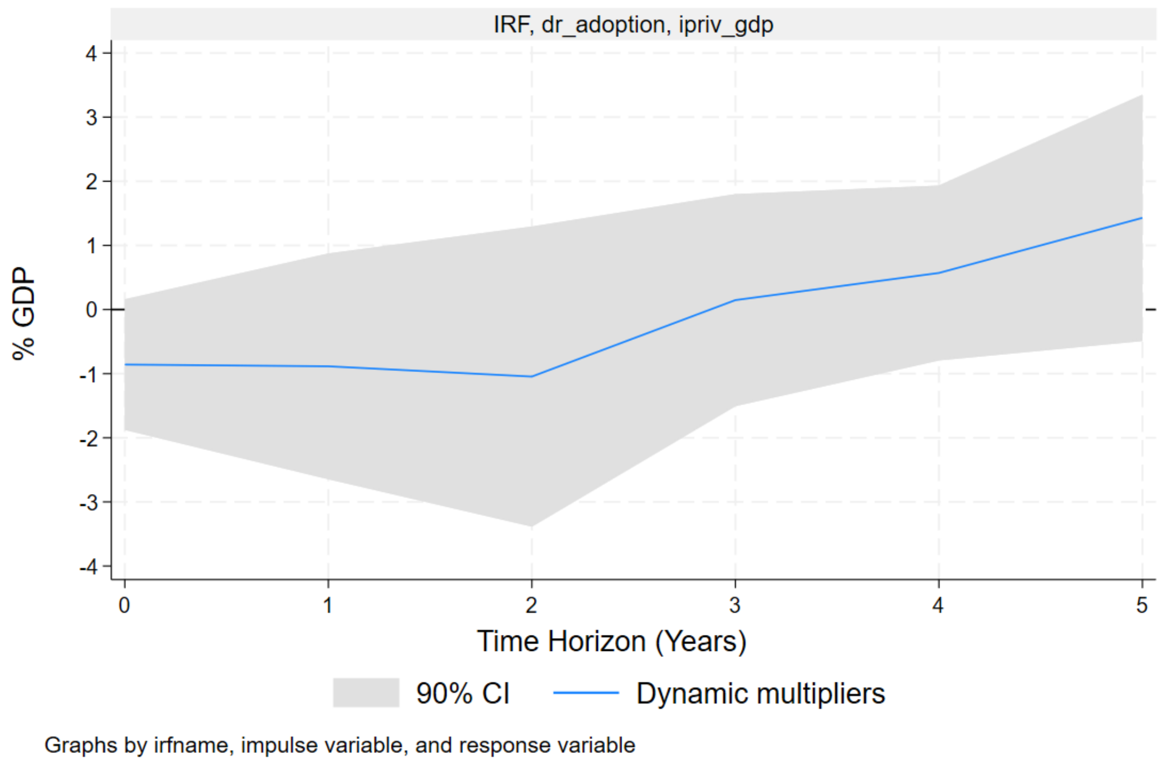
Figure 5 reports the impulse response function derived from equation 14. The shaded regions represent 90 percent confidence intervals, with standard errors adjusted for heteroskedasticity.[16] The figure shows the cumulative change in private investment, normalized by GDP, after an implementation of a debt rule. We observe a decline in private investment during the first two years after the rule is introduced, followed by a recovery and increase starting in the third year. By the fifth year, the cumulative effect of the debt rule implementation on private investment is around

[15] The LP framework is flexible enough to accommodate a panel structure and does not constrain the shape of the impulse response functions, which makes it less sensitive to mispecification when compared to a traditional VAR model. Previous studies that use local projections to analyze the effects of fiscal policy on output include Auerbach and Gorodnichenko (2013), Jorda and Taylor (2016), Ramey and Zubairy (2018), and Born, Muller, and Pfeifer (2020).

[16] See the discussion in Montiel Olea and Plagborg-Moller (2021).

1.5 percent of GDP, which is consistent with the long-run estimated presented in the previous subsection. Overall, the estimated trajectory of private investment after the implementation of a debt rule is consistent with the transition from our quantitative model, providing empirical support to the expansionary effect of fiscal rules in emerging economies.[17]

Figure 5: Impulse Response Function of Private Investment to Debt Rule Adoption



The impulse response function is constructed based on the estimated β_h coefficients at each horizon, which is denoted by the solid line. The shaded region represents 90 percent confidence intervals based on the respective estimated standard errors.

In a nutshell, the long-run and short-run relation between debt rules and investment is consistent with the predictions of our model.

[17] In the Appendix, Figure 9, 10, 11, and 12 show that our results are robust to different time horizons as well as different measures of investment such as total investment, normalized by GDP.

5 Conclusion

We presented a novel mechanism through which fiscal consolidations can be expansionary in the presence of default risk. When debt reduction happens in the context of the introduction of a fiscal rule default risk substantially decreases, which generates an increase in private capital accumulation. In the long-run, the economy sustains higher levels of capital in an environment with lower default risk, allowing for higher consumption and GDP. Empirically, we showed evidence for a panel of emerging economies that supports the main mechanism of the model: economies with a fiscal rule in place invest relatively more in the long-run.

Importantly, we also showed that when there is no technology to commit to the fiscal rule the government in the model would still choose to abide by it under the threat of never being able to credibly implement it again after deviating. This threat provides enough incentives for the government to avoid the temptation to default or deviate due to the significant gains of facing lower sovereign spreads and higher capital accumulation under the fiscal rule. The government does not need a commitment technology to abide by the rule because it is too valuable to lose.

This latter finding raises the question of why would a government like the one we study not implement a fiscal rule in the first place. Answering this question is beyond the scope of this paper and could benefit from the growing literature at the intersection of political economy, fiscal policy, and default risk. We leave this exciting avenue for future research.

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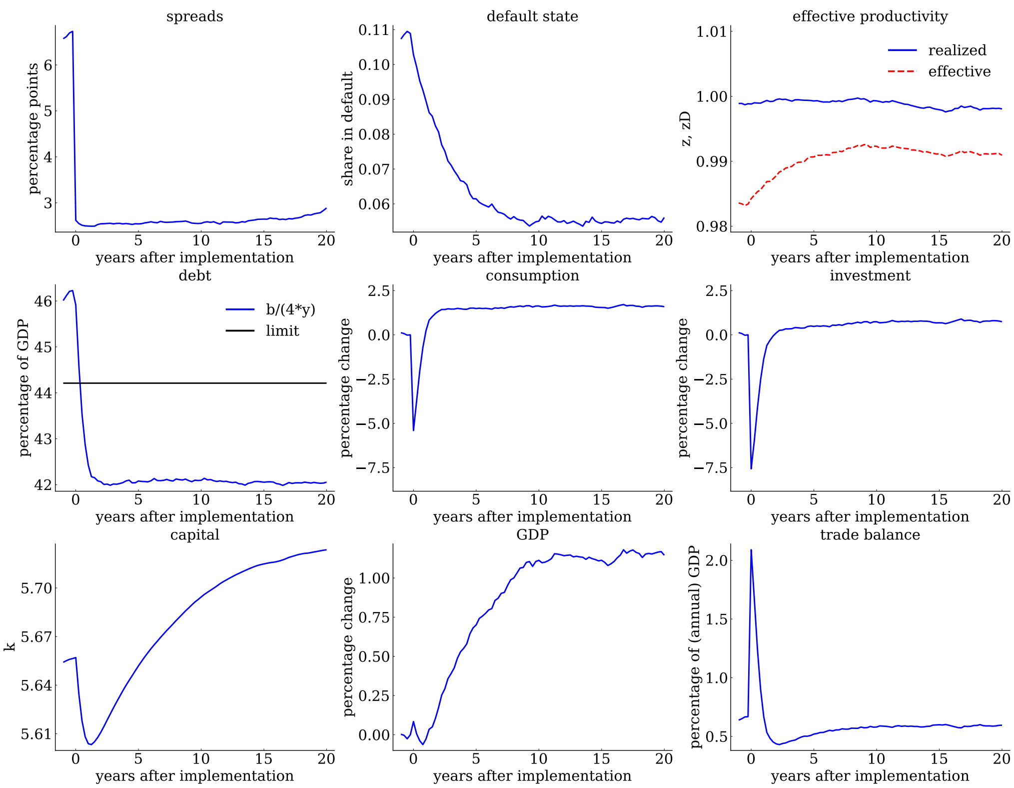
Appendix

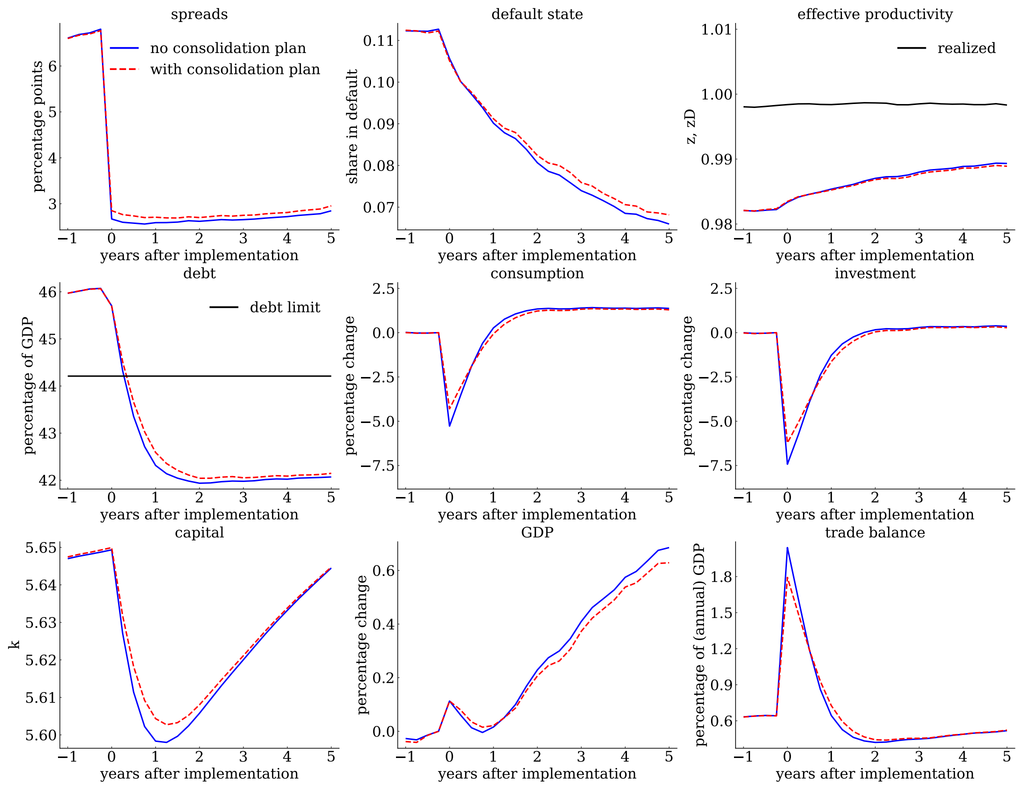
A Fiscal consolidation paths

Figure 6: Expansionary fiscal consolidation, long-run



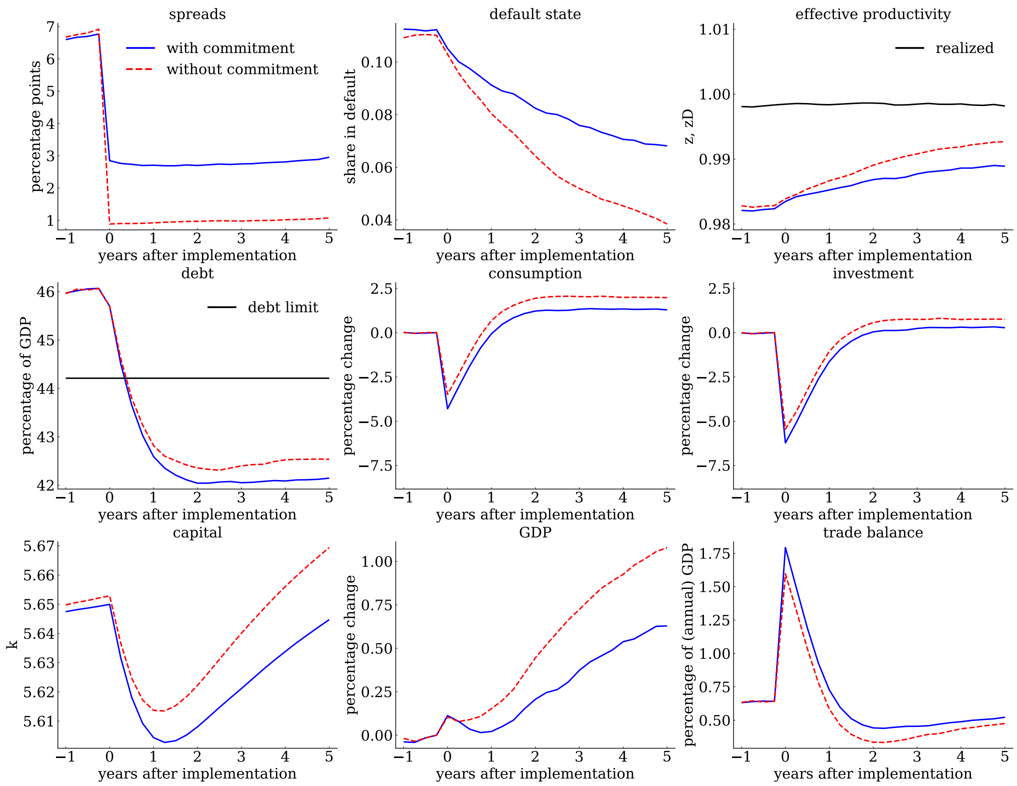
Each panel shows the average of 10,000 time series that start at one draw from the ergodic distribution in the benchmark economy without fiscal rules and implement the optimal fiscal rule in year $t = 0$. For each path, the initial state is the end-state of a simulation of 1,001 periods. For spreads we only consider paths with no default. For debt we set $B_t = B_{t-1}$ if $dt = 1$ and $B_t = 0$ when the economy is readmitted to financial markets.

Figure 7: Expansionary fiscal consolidation with different consolidation plans



Each panel shows the average of 10,000 time series that start at one draw from the ergodic distribution in the benchmark economy without fiscal rules and implement the optimal fiscal rule in year $t = 0$ with two different values for χ_d. For each path, the initial state is the end-state of a simulation of 1,001 periods. For spreads we only consider paths with no default. For debt we set $B_t = B_{t-1}$ if $dt = 1$ and $B_t = 0$ when the economy is readmitted to financial markets.

Figure 8: Expansionary fiscal consolidation with and without commitment



Each panel shows the average of 10,000 time series that start at one draw from the ergodic distribution in the benchmark economy without fiscal rules and implement the optimal fiscal rule in year $t = 0$ with two different values for χ_d. For each path, the initial state is the end-state of a simulation of 1,001 periods. For spreads we only consider paths with no default. For debt we set $B_t = B_{t-1}$ if $dt = 1$ and $B_t = 0$ when the economy is readmitted to financial markets.

B Supportive Empirical Evidence

Table 6: Debt Rules and Private Investment (Country Fixed-Effects)

	Dependent variable: (I/y)			
	(1)	(2)	(3)	(4)
DebtRule	**1.355***	**1.338***	**1.446****	**1.496****
	(**0.803**)	(**0.755**)	(**0.698**)	(**0.708**)
Sovereign Spreads		-0.00172^{**}	-0.00119^{**}	-0.00121^{**}
		(0.000691)	(0.000510)	(0.000529)
Public Debt			-0.0426^{**}	-0.0308
			(0.0182)	(0.0229)
Cyclical GDP				7.568^{**}
				(3.434)
Observations	782	782	782	782
Number of countries	63	63	63	63

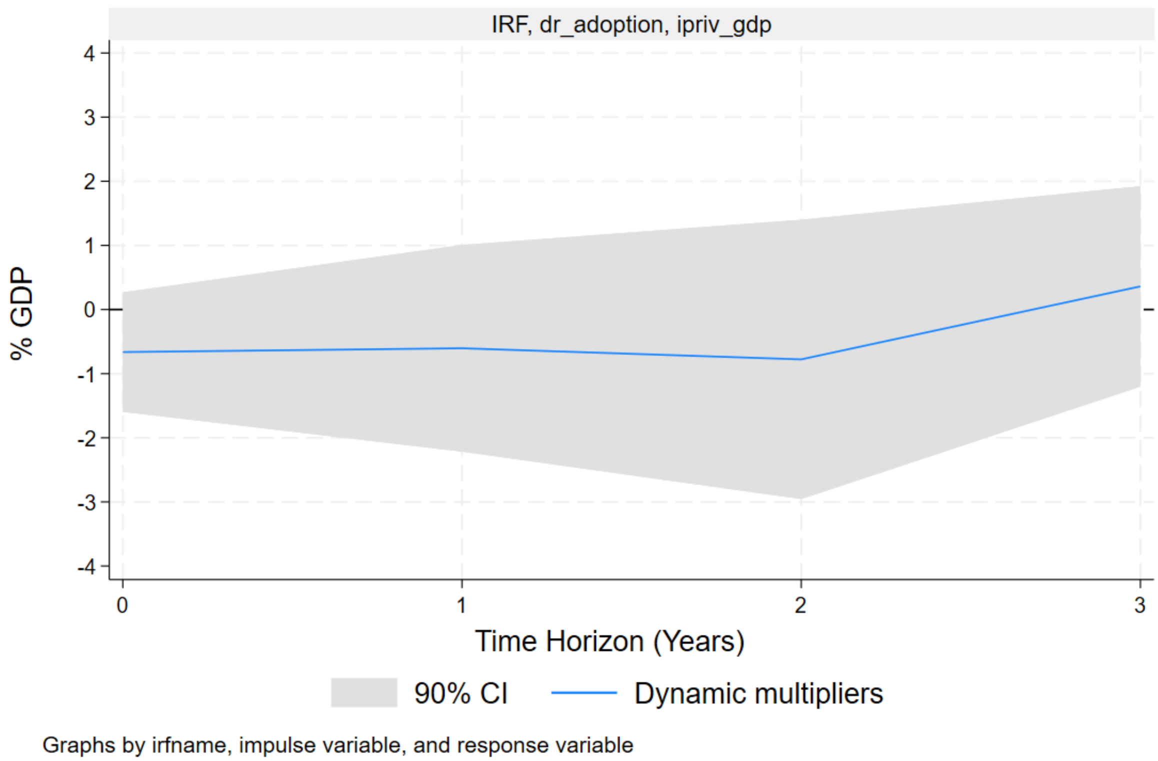
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 7: Debt Rules and Private Investment (Logs)

	Dependent variable: $log(I/y)$			
	(1)	(2)	(3)	(4)
log(DebtRule)	**0.0881***	**0.0717**	**0.0847***	**0.0907****
	(**0.0510**)	(**0.0438**)	(**0.0437**)	(**0.0439**)
log(Sovereign Spreads)		-0.145^{***}	-0.121^{***}	-0.123^{***}
		(0.0415)	(0.0285)	(0.0299)
log(Public Debt)			-0.156^{*}	-0.0915
			(0.0804)	(0.0819)
Cyclical GDP				0.914^{***}
				(0.216)
Observations	782	780	780	780
Number of countries	63	63	63	63

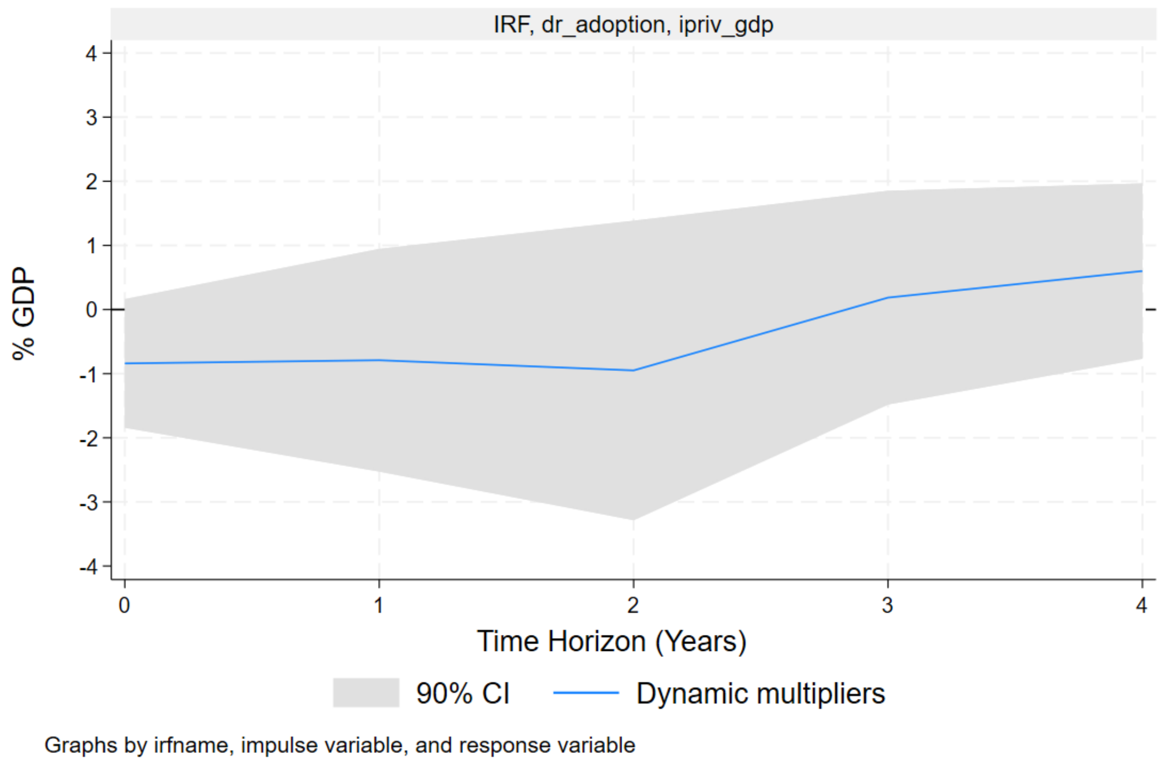
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Figure 9: IRF of Private Investment to Debt Rule Adoption ($h = 0, \ldots, 3$)



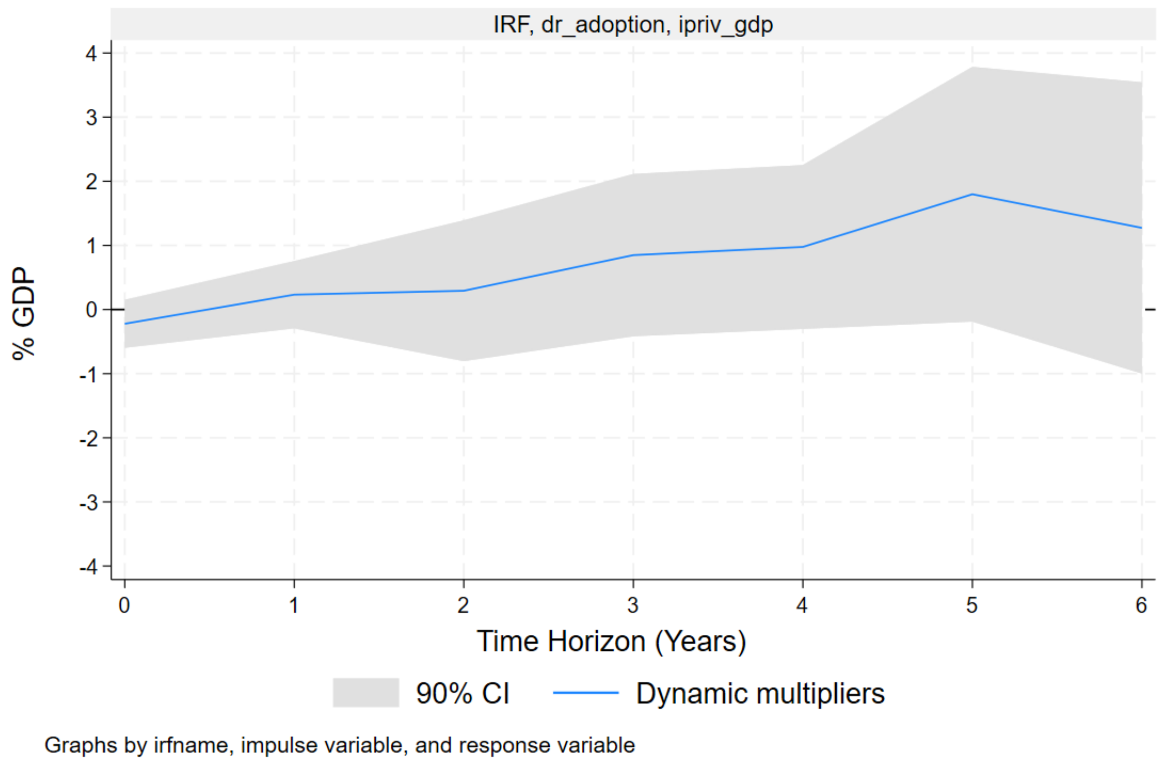
The impulse response function is constructed based on the estimated β_h coefficients at each horizon, which is denoted by the solid line. The shaded region represents 90 percent confidence intervals based on the respective estimated standard errors.

Figure 10: IRF of Private Investment to Debt Rule Adoption ($h = 0, \ldots, 4$)



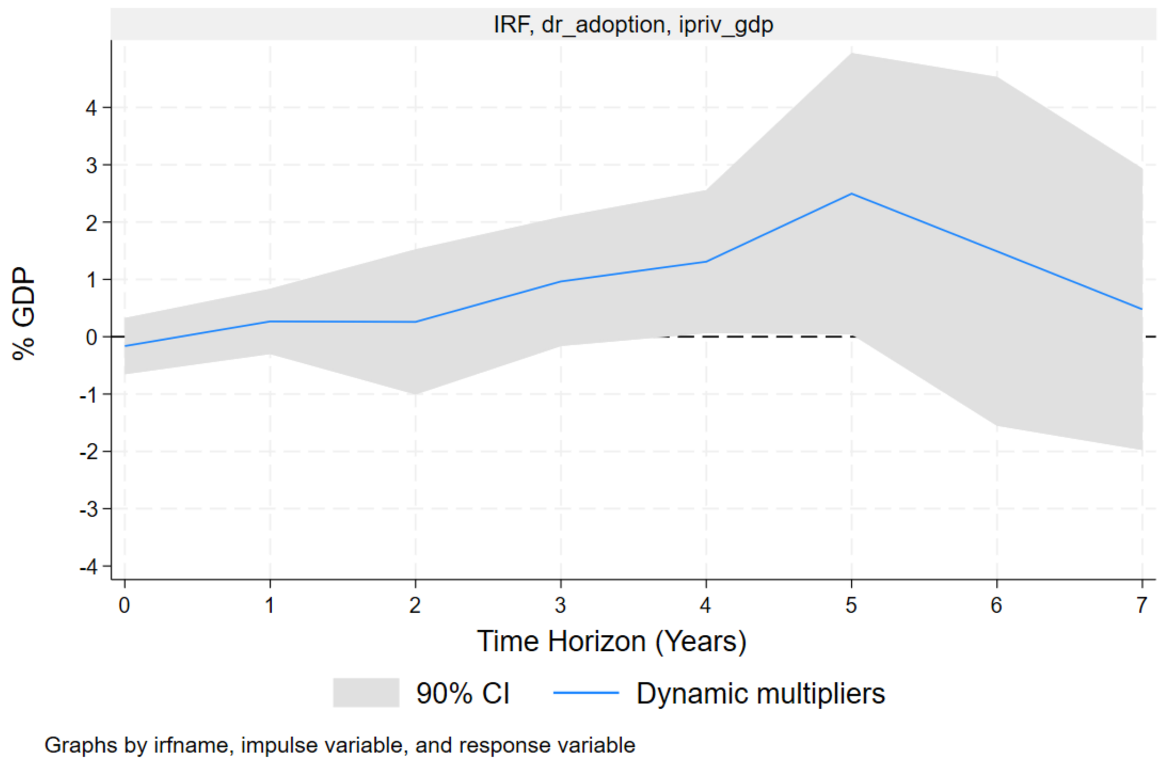
The impulse response function is constructed based on the estimated β_h coefficients at each horizon, which is denoted by the solid line. The shaded region represents 90 percent confidence intervals based on the respective estimated standard errors.

Figure 11: IRF of Private Investment to Debt Rule Adoption ($h = 0, \ldots, 6$)



The impulse response function is constructed based on the estimated β_h coefficients at each horizon, which is denoted by the solid line. The shaded region represents 90 percent confidence intervals based on the respective estimated standard errors.

Figure 12: IRF of Private Investment to Debt Rule Adoption ($h = 0, \ldots, 7$)



The impulse response function is constructed based on the estimated β_h coefficients at each horizon, which is denoted by the solid line. The shaded region represents 90 percent confidence intervals based on the respective estimated standard errors.