Expansionary Fiscal Rules Under Sovereign Risk

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XXIII Banca d'Italia Public Finance Workshop
September 4, 2025

[1]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. All errors are our own.

Motivation

- Emerging markets: challenge of fiscal consolidation without sacrificing economic activity
  - Fiscal consolidation $\longrightarrow$ contraction in the short-run
  - Healthy public finances $\longrightarrow$ higher income in the long-run
- Could fiscal rules contribute to achieving an expansionary fiscal consolidation?
- **This paper**: Theory of fiscal rules and capital accumulation under default risk:
  - short-run: contraction due to fiscal adjustment
  - long-run: lower spreads, higher investment

This paper

- Sovereign default model:
  - private capital accumulation
  - long-term debt
  - fiscal rules (debt limits, deficit limits, and a dual rule)
- Why fiscal rules? They help to "kill two birds with one stone"
  - As a commitment devise, they limit debt dilution
  - This lowers default risk, which in turn mitigates underinvestment
- We find that under optimal fiscal rules the economy transitions to a distribution with:
  - lower debt-to-GDP, sovereign risk, and spreads
  - higher capital stock, output, and consumption

Model

Environment

- Small-open economy: continuum of households, competitive firm, benevolent government
- Households: identical with preferences

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_t) \right]$$

with $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$, $\beta \in (0,1)$

- Households own firm and capital, make investment decisions, cannot borrow from abroad
- Government borrows on behalf of the households, can default on debt
- Firm rents capital, produce output with technology

$$Y_t = z_t K_t^{\alpha}$$

where $\log z_t = \rho \log z_{t-1} + \epsilon_t$ with $\rho \in (0,1)$ and $\epsilon_t \sim N\left(0, \sigma_z^2\right)$ iid $\forall t$

Government borrowing

- Long-term debt, matures at rate γ, pays coupon κ on remaining $(1-\gamma)$, law of motion:

$$B_{t+1} = i_{b,t} + (1-\gamma)\, B_t$$

where $i_{b,t}$ is debt issuance

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

where T_t is a lump-sum transfer (or tax if $T_t < 0$)

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- Fiscal rule: debt limit

$$\mathcal{F}(B_t, K_t, z_t) = \{B_{t+1} | B_{t+1} \leq \max\{\chi_b Y_t, (1-\gamma) B_t\}\}$$

where $\chi_b \in (0,1)$

Government default

- The government can default at the beginning of each period $d_t = 1$
  - Government's budget constraint is:
$$T_t = 0$$
  - productivity is $z_D(z_t) = z_t - \max\left\{0, \xi_0 z_t + \xi_1 z_t^2\right\}$ with $\xi_0 < 0 < \xi_1$
  - excluded from financial markets, readmission with probability θ and $B_t = 0$

Timing

- Timing within a period:

  1. Government observes state, decides to default or repay, and chooses $g_t = (B_{t+1}, T_t)$ (with commitment within the period)
  2. Households observe g_t and make consumption and investment decisions
  3. Lenders observe g_t and aggregate investment, and price the debt

An equilibrium is (i) value, policy, and beliefs functions for the household, (ii) value and fiscal policy functions for the government, and (iii) a price schedule q such that:

1. Given q, the government's policy functions, and household's beliefs, the value and policy functions of the household solve its dynamic programs
2. Given q and the household's policy functions, the value and policy functions of the government solve its dynamic programs
3. Beliefs are consistent with policy functions
4. Lenders break even in expectation

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

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

Mechanism

Underinvestment and debt dilution

Welfare gains from debt rules come from how lowering default risk ameliorates two distortions:

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  - present planner/government wants to borrow more than past selves

Underinvestment and debt dilution

Welfare gains from debt rules come from how lowering default risk ameliorates two distortions:

- **Debt dilution** (Hatchondo, Martinez, Sosa-Padilla (2016)):
  - present planner/government wants to borrow more than past selves
- **Underinvestment** (Esquivel (2024)):
  - default risk lowers expected capital returns
  - households underinvest when borrowing needs are positive
  - lower investment increases default risk

Quantitative analysis

Calibration

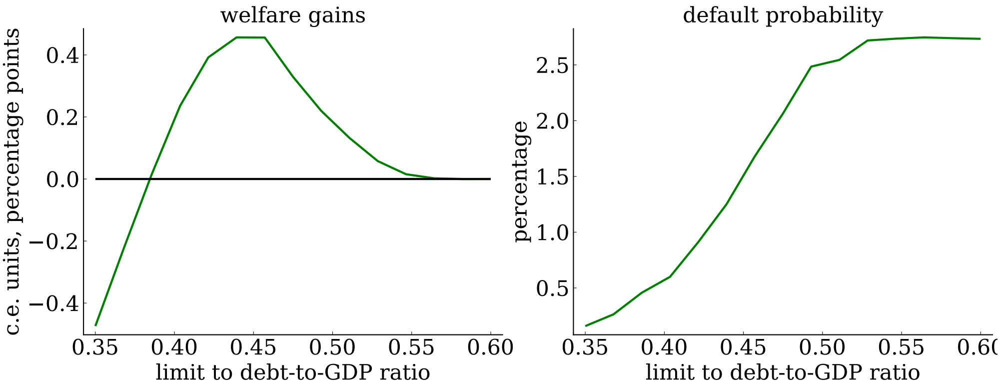
Argentina (1993Q4-2023Q4)					
Independent parameters, **no debt limit**					
Parameter	Value	Parameter	Value	Parameter	Value
σ	2	r^*	0.01	δ	0.05
γ	0.05	κ	0.03	θ	0.0625
β	0.95	ρ	0.95	σ_z	0.017
Parameters to target moments from data					
Parameter	Value	Target	Data	Model	
ϕ	25.0	$\frac{\sigma_i}{\sigma_y}$	2.65	2.49	
ξ_0	-0.661	$Av\,(r - r^*)$	0.08	0.07	
ξ_1	0.850	$\frac{B}{GDP}$	0.45	0.45	

Non-targeted moments

Moment	Data	Model
default frequency	0.03	0.03
σ_{r-r^*}	0.04	0.04
σ_c/σ_y	1.1	1.7
σ_y	4.8	3.5
$\sigma_{\frac{TB}{y}}$	2.3	6.2
$Corr\,(r - r^*, y)$	-0.79	-0.32
$Corr\left(\frac{TB}{y}, y\right)$	-0.68	-0.46

Optimal debt limit

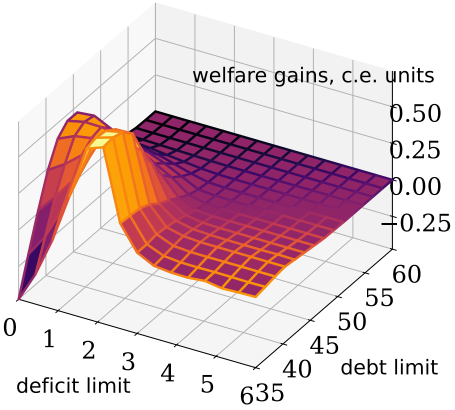
- Recall $\mathcal{F}(z_t, K_t, B_t) = \{B_{t+1} | B_{t+1} \leq \max\{\chi_b z_t K_t^{\alpha}, (1-\gamma) B_t\}\}$



- Optimal debt limit is $\chi_b = 0.44$ and generates $wg = 0.46\%$

Optimal dual rule

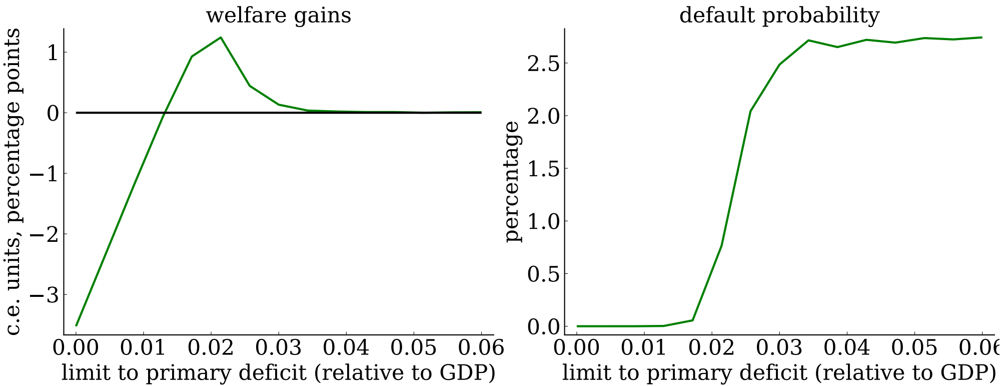
- Recall $\mathcal{F}(z_t, K_t, B_t) = \{B_{t+1} | B_{t+1} \leq \max\{\chi_b z_t K_t^\alpha, (1-\gamma) B_t + \chi_d z_t K_t^\alpha\}\}$



- Optimal dual rule is $(\chi_b = 0.37, \chi_d = 0.021)$ and generates $wg = 0.74\%$

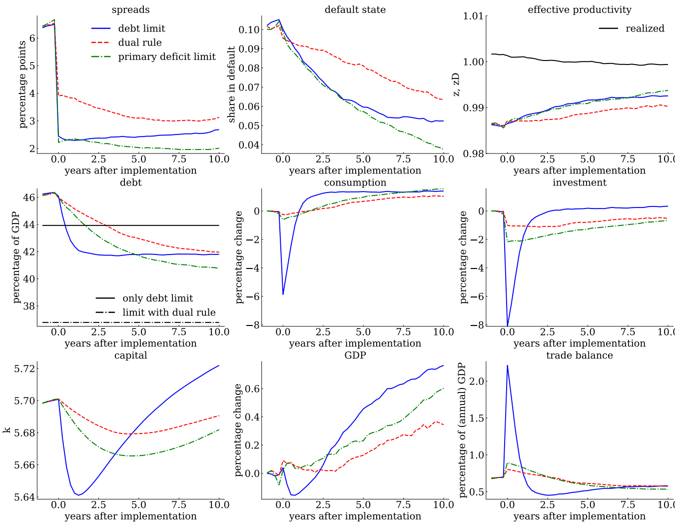
Optimal deficit limit

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

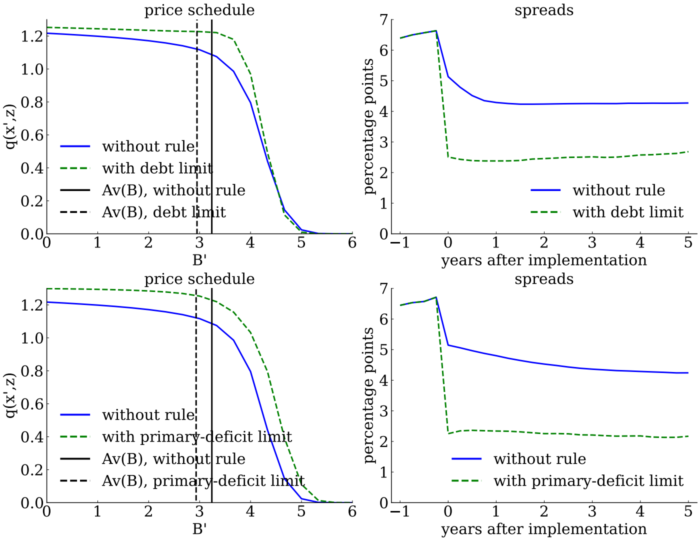


- Optimal deficit limit is $\chi_d = 0.021$ and generates $wg = 1.24\%$

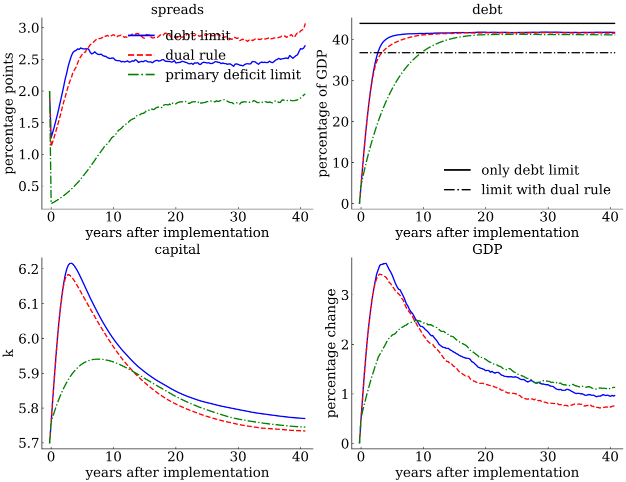
Transition paths following rules adoption long-run



Sovereign spreads and the price of debt



Transition paths, zero initial debt



Conclusion

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- Fiscal rules can generate a long-run economic expansion in the presence of sovereign risk
  - Directly: fiscal rules contain debt dilution
  - Indirectly: fiscal rules mitigate underinvestment
- The desirability of an specific type of rule depends on the initial debt level
  - The deficit limit is optimal when achieving fiscal consolidation
  - The dual rule is preferred at lower levels of indebtedness
- Exciting avenues for future research:
  - Empirically: how does corporate investment respond to the adoption of fiscal rules?
  - Quantitatively: how would the results change with endogenous debt maturity or private over-borrowing?

Appendix

Recursive formulation, households in repayment back

Aggregate state is (z, x), with $x = (B, K)$

- The value of a household when the government is in good standing $(d = 0)$ is

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

$$s.t. \qquad c + i + \frac{\phi}{2} \frac{(i)^2}{k} \leq r(K, z, 0)\, k + \Pi(K, z, 0) + T$$

where $r(K, z, 0) = \alpha z K^{\alpha - 1}, \quad \Pi(K, z, 0) = (1 - \alpha) z K^{\alpha}$

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- $c^P(g, x, k, z)$, $i^P(g, x, k, z)$, and $k^P(g, x, k, z)$ are the policy functions

Recursive formulation, households in default back

Aggregate state is (z, x), with $x = (K, B)$

- The value of a household when the government is in default $(d = 1)$ is

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

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

where $r(K, z, 1) = \alpha z_D(z) K^{\alpha - 1}$, $\Pi(K, z, 1) = (1 - \alpha) z_D(z) K^{\alpha}$

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Recursive formulation, government

back

- The value of the government in good standing is

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

- The value of default is

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

- The value of repayment is

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

denote the policy for debt as $B(x,z)$

Benevolent planner back

- The value of a benevolent social planner is:

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

- The value of default is

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

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

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

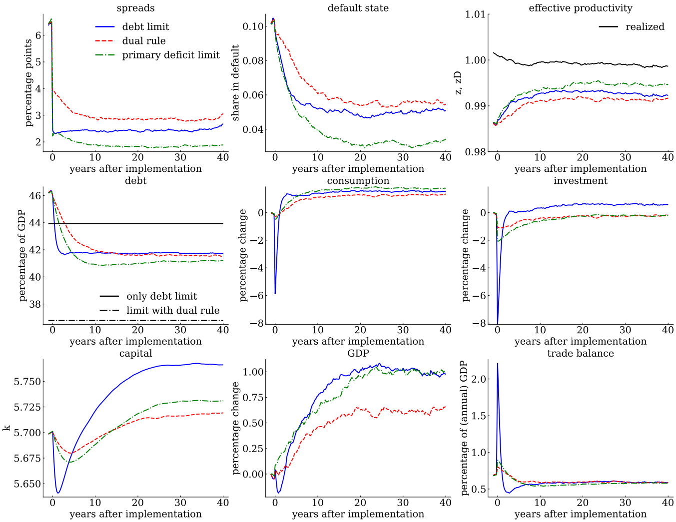
- The value of repayment is

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

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

$$K' = I + (1-\delta)K, B' \in \mathcal{F}(x,z)$$

Transition paths, long run back



Regression Analysis: Equation

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

where:

- $(I/y)_{i,t}$ denotes private investment, normalized by GDP for country i at t
- $d_{i,t}$ is a dummy variable that assigns 1 if there is a debt rule in the country i at period t
- $r^s_{i,t}$ denotes 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
- $\hat{y}_{i,t}$ is the cyclical component of GDP for country i at period t
- $\varepsilon_{i,t}$ denotes the regression residuals

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

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