Policy Rules and Large Crises in Emerging Countries

Emilio Espino
UTDT

Julian Kozlowski
FRB St. Louis

Fernando M. Martin
FRB St. Louis

Juan M. Sánchez
FRB St. Louis

The 5th TWID International Finance Conference

August 6–7, 2024
Tokyo, Japan

Motivation

Emerging countries have increasingly adopted **government policy rules**.

- Fiscal policy: debt ceilings, balanced budget, etc.
- Monetary policy: inflation targeting, money growth targets, etc.

But **large crises** generate discussions about suspensions of rules and escape clauses.

This paper

Evaluates the gains of adopting rules and the benefits of flexibility in large crises using a sovereign default model with fiscal and monetary policies.

What we do

Introduce policy rules in a sovereign default model with fiscal and monetary policy.

Calibrate the model with no shocks to the long-run average of Latin American countries.

Show that there are welfare gains associated with introducing rules.

Calibrate an unexpected shock to reproduce the impact of COVID-19.

Study potential gains of flexibility in rules after a large crisis.

Related literature

Sovereign default

Eaton and Gersovitz (1981); Aguiar and Gopinath (2006); Arellano (2008); Hatchondo and Martinez (2009); Chatterjee and Eyigungor (2012).

Sovereign default + fiscal policy

Cuadra, Sánchez, and Sapriza (2010); Bianchi, Ottonello, and Presno (2023).

Sovereign default + monetary policy

Na, Schmitt-Grohé, Uribe, and Yue (2018); Arellano, Bai, and Mihalache (2020); Espino, Kozlowski, Martin, and Sánchez (2024).

Sovereign default + policy rules

Bianchi and Mondragon (2021); Hatchondo, Roch, and Martinez (2022).

Model

Framework

Small open economy tradable-nontradable model (TNT as in Uribe and Schmitt-Grohé, 2017, §8) with production, money and sovereign default.

There are three private goods and one public good:

1. Non-tradable good, consumed (c^N) and produced (y^N) domestically.
2. Imported good, consumed (c^T) domestically but not produced.
3. Exported good, produced (y^T) domestically but not consumed.
4. Public good (g), transformed one-to-one from non-tradable output.

Money is motivated by a cash-in-advance constraint on non-tradables.

The firm's problem

Parameters that change in the crisis

A representative firm maximizes profits:

$$\max_{y^N, y^T, h} \; p^N y^N + e(1-\phi) y^T - wh$$

subject to $A(I)F(y^N, y^T) - h \leq 0$.

From the FOCs, we obtain two equations:

$$w = \frac{\theta}{A(I) F_N c^N},$$

$$e = \frac{\theta F_T}{(1-\phi) F_N c^N},$$

The household's problem

Parameters that change in the crisis

Policy variables

The problem of the household is

$$V(m, B, l) = \max_{c^N, c^T, m', h} u(c^N, c^T) + v(1-h) + \vartheta(g) + \beta \mathbb{E}[V(m', B', l')|B, l]$$

subject to $p^N c^N + e(1+\phi)c^T + m'(1+\mu) \leq (1-\tau)wh + m + p^N \gamma$

$$p^N c^N \leq \theta m$$

From the FOCs, we obtain two equations:

- household intra-temporal condition with wedge $(1-\tau)$.
- Household inter-temporal condition with wedge $(1+\mu)$.

Government and the rest of the world

Bonds are long-term and denominated in foreign currency. The government may default on its debt. International risk-neutral lenders price debt.

Expenditure consists of public good g and (exogenous) transfers γ, while revenue comes from taxing labor τ, seigniorage μ, and borrowing B'.

Government budget constraint in units of domestic currency:

$$p^N(g+\gamma) + e\delta B = \tau wh + \mu + eQ(B')[B' - (1-\delta)B]$$

Parameters that change in the crisis

Balance of payments, expressed in foreign currency:

$$(1-\phi)y^T - (1+\phi)c^T = \delta B - Q(B')[B' - (1-\delta)B]$$

Policy variables

Government optimization

Conditional on repayment, the problem of the government maximizes

$$V^P(B) \equiv \max_{B', c^N, c^T, y^T, \mu, \tau, g} u(c^N, c^T) + v(1-h) + \vartheta(g) + \beta \mathcal{V}(B')$$

Parameters that change in the crisis

Policy variables

subject to

1. government budget constraint
2. balance of payment constraint
3. households and firms making optimal decisions
4. equilibrium conditions: $c^N + g = y^N, \;\; A(I)F(y^N, y^T) = h, \;\; p^N = \frac{\theta}{c^N}$
5. constraints imposed by rules (if they apply):
   - Monetary policy: $\mu = \mu^*$
   - Fiscal policy: $B' < B^*$

Government optimization

Conditional on default, the problem of the government maximizes

$$V^D \equiv \max_{c^N, c^T, y^T, \mu, \tau, g} u(c^N, c^T) + v(1-h) + \vartheta(g) + \beta \mathbb{E}[\underbrace{\pi}_{\text{re-entry prob}} \mathcal{V}(0) + (1-\pi)V^D]$$

Parameters that change in the crisis

Policy variables

subject to

1. government budget constraint
2. balance of payment constraint
3. households and firms making optimal decisions
4. equilibrium conditions: $c^N + g = y^N$, $A^D(I)F(y^N, y^T) = h$, $p^N = \frac{\theta}{c^N}$

Note rules do not apply in default.

Repayment vs Default

Defaulting leads to temporary exclusion from credit markets and lower productivity.

At the beginning of period, government chooses between pay (P) and default (D)

$$\hat{\mathcal{V}}(B, \varepsilon) = \max\{V^P(B) + \varepsilon, V^D\}$$

where ε is iid, drawn from a logistic distribution with mean zero and variance ζ.

Probability of repayment: $\mathcal{P}(B) = \Pr[V^P(B) - V^D \geq -\varepsilon]$

Implies continuation value: $\mathcal{V}(B) = E_\varepsilon[\hat{\mathcal{V}}(B, \varepsilon)]$

The price of external debt satisfies zero profits for international risk-neutral lenders:

$$Q(B') = \frac{1}{1+r}\left[\mathcal{P}\left(B'\right)\left(\delta + (1-\delta)Q\left(\mathcal{B}(B')\right)\right)\right]$$

Extreme value shocks imply analytical expressions

Repay/default problem:

$$\hat{\mathcal{V}}(B, \varepsilon) = \max\{V^P(B) + \varepsilon, V^D\}$$

Expectation of the value function with respect to utility shocks:

$$\mathcal{V}(B) = \mathbb{E}_\varepsilon[\hat{\mathcal{V}}(B, \varepsilon)] = \zeta \ln \left\{\exp[V^P(B)/\zeta] + \exp[V^D/\zeta]\right\}$$

Probability of repayment, $\mathcal{P}(B) \equiv \Pr[V^P(B) - V^D \geq -\varepsilon]$:

$$\mathcal{P}(B) = \frac{\exp[V^P(B)/\zeta]}{\exp[V^P(B)/\zeta] + \exp[V^D/\zeta]}$$

Calibration

Quantitative analysis

Calibration matches long-run averages for seven Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru and Uruguay) from 1980 to 2018.

EKMS (2024) studies the case with stochastic term-of-trade and TFP.

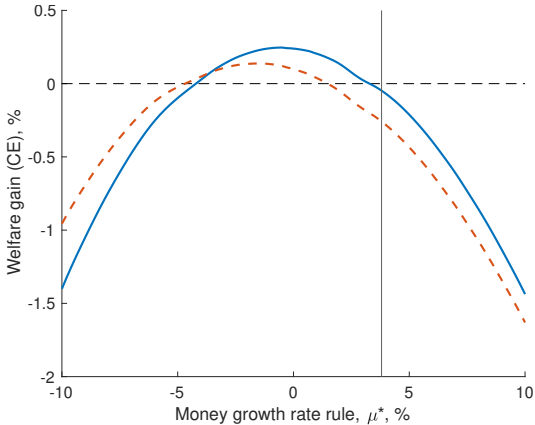
Roadmap:

- Derive optimal monetary and fiscal rules in normal times. welfarewelfare
- Use COVID-19 to simulate a large, unexpected crisis: {TFP, γ, ϕ, θ}.
- Benchmark: optimal rules are imposed prior to crisis and suspended during.
- Run counterfactuals to study rules vs flexibility.

Policy Rules

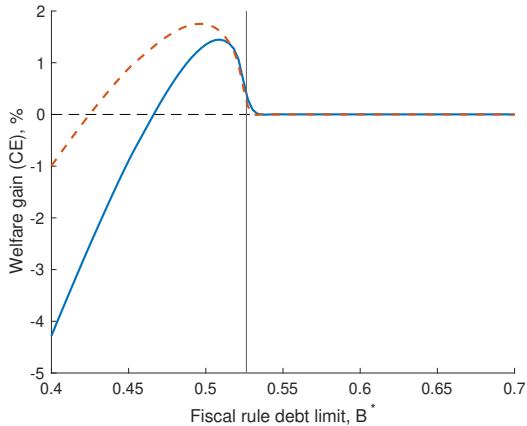
Monetary policy rule: $\mu = \mu^*$

Welfare gains (% of nontradable consumption) as a function of money target



Fiscal policy rule: $B' \leq B^*$

Welfare gains (% of nontradable consumption) as a function of debt limit



Long-run implications of policy rules

Rules vs. discretion—long-run statistics

	Discretion	Money growth $\mu^* = -0.50\%$	Debt ceiling $B^* = 0.51$	Both $\mu^* = -0.80\%$ $B^* = 0.51$
Debt / GDP	0.365	0.363	0.351	0.347
Inflation	0.038	-0.005	0.036	-0.008
Tax rate	0.240	0.269	0.238	0.268
Expenditure / GDP	0.250	0.251	0.250	0.251
Real GDP	1.000	0.993	1.000	0.992
Employment	0.587	0.586	0.587	0.586
Exports / GDP	0.209	0.200	0.207	0.197
Default probability	0.020	0.021	0.010	0.010
Welfare gains, %	—	0.250	1.450	1.978

Robustness

Compensating transfers to international investors

- Differences in welfare gains, but similar optimal targets

Short-term debt

- Larger gains from monetary rule; no gains from fiscal rule

No time-consistency problem due to money demand

- No gains from monetary rule; optimal debt limit increases

Large Crises

The impact of large crises: response to COVID-19 shock

Optimal monetary and fiscal rules imposed prior to shock, suspended during crisis, reimposed afterwards

Targeted

	Data	Model
Δ Real GDP, %	-9.5	-9.5
Δ Expenditure / GDP, pp	4.1	4.1
Δ Imports, %	-15.4	-15.4
Δ Inflation, pp	-0.2	-0.2
Δ Credit spreads, bps	96.2	96.3

Non-Targeted

	Data	Model
Δ GDP USD, %	-18.6	-21.9
Δ Employment, pp	-7.3	-2.9
Δ Exports, %	-13.2	-13.9
Δ Debt / GDP, pp	5.2	12.7
Δ Tax rate, pp	-0.8	-9.9
Δ Money growth rate, pp	28.9	15.8
Δ Depreciation, pp	8.2	13.0
Δ Inflation in 2021, pp	6.3	18.0
Welfare gain of shock, %		-13.1

The impact of large crises under policy rules

Response to crisis—maintaining vs. suspending or abandoning rules

	Both rules are			Monetary rule is		Fiscal rule is	
	Maintained	Suspended	Abandoned	Suspended	Abandoned	Suspended	Abandoned
Δ Real GDP, %	-12.13	-9.49	-9.54	-9.30	-9.41	-11.91	-11.92
Δ Debt / GDP, %	26.95	36.64	36.88	30.90	31.26	33.28	33.42
Δ Money growth rate, pp	0.00	15.81	16.31	17.94	17.90	0.00	0.00
Δ Tax rate, pp	4.73	-9.87	-9.60	-9.16	-9.06	2.40	2.90
Δ Primary deficit / GDP, pp	-0.41	13.92	13.59	12.94	12.85	2.18	1.61
Δ Credit spreads, bps	94.58	96.28	218.57	74.80	95.66	117.94	242.09
Δ Inflation, pp	-1.21	-0.19	0.52	1.72	1.99	-2.99	-2.70
Δ Inflation 2021, pp	1.23	18.01	18.24	15.95	16.99	5.14	3.78
Welfare gains of shocks, %	-13.85	-13.13	-15.10	-13.35	-13.87	-13.51	-15.20
Welfare gains of flexibility, %	—	0.83	-1.42	0.57	-0.02	0.39	-1.54

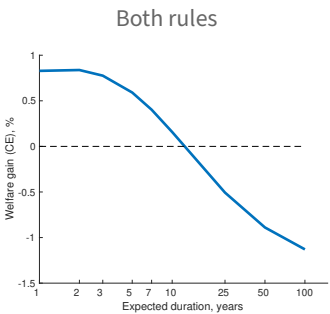
Unpacking the gains from flexibility during large crises

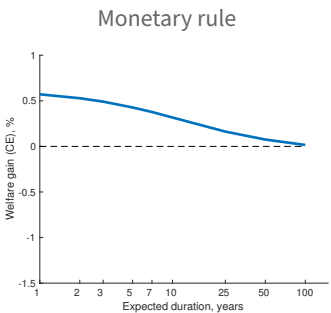
Welfare gains (% of nontradable consumption) from flexibility

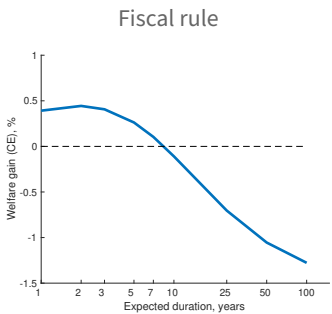
Shocks				Both rules are		Monetary rule is		Fiscal rule is	
TFP	γ	ϕ	θ	Suspended	Abandoned	Suspended	Abandoned	Suspended	Abandoned
$\surd$	$\surd$	$\surd$	$\surd$	0.83	-1.42	0.57	-0.02	0.39	-1.54
$\surd$	$\surd$	$\surd$	$\times$	0.39	-1.72	0.19	-0.35	0.25	-1.58
$\surd$	$\surd$	$\times$	$\surd$	0.49	-1.74	0.40	-0.20	0.17	-1.75
$\surd$	$\times$	$\surd$	$\surd$	0.56	-1.67	0.32	-0.26	0.33	-1.59
$\times$	$\surd$	$\surd$	$\surd$	0.66	-1.54	0.46	-0.12	0.31	-1.58

What if rules remain suspended after crisis ends?

Welfare gains of flexibility and duration of suspension







The role of persistence

Rules vs. flexibility when the crisis is expected to last for two years

	Both rules are			Monetary rule is		Fiscal rule is	
	Suspended	Maintained	Abandoned	Suspended	Abandoned	Suspended	Abandoned
Δ Real GDP, %	-8.57	-11.35	-8.61	-8.57	-8.62	-11.35	-11.44
Δ Debt / GDP, %	27.01	21.90	26.30	27.01	26.79	21.90	21.35
Δ Tax rate, pp	-9.15	6.12	-8.87	-9.15	-9.04	6.12	6.63
Δ Primary deficit / GDP, pp	12.64	-2.12	12.29	12.64	12.51	-2.12	-2.68
Δ Money growth rate, pp	19.84	0.00	20.44	19.84	20.01	0.00	0.00
Δ Credit spreads, bps	497.58	647.62	752.54	497.57	562.59	647.48	916.19
Δ Default probability, pp	13.62	17.20	18.78	13.61	15.21	17.19	22.09
Δ Inflation, pp	1.80	-1.94	2.63	1.80	2.13	-1.94	-1.42
Δ Inflation 2021, pp	16.80	1.11	17.33	16.80	17.65	1.11	0.33
Welfare gains of shocks, %	-22.53	-23.08	-24.29	-22.53	-23.00	-23.08	-24.60
Welfare gains of flexibility, %	0.66	—	-1.46	0.66	0.10	0.00	-1.84

Conclusions

Monetary and fiscal rules in emerging countries

In normal times:

- rules mitigate time-consistency problems in debt choice
- debt limit particularly beneficial as the debt-dilution problem is severe
- monetary and fiscal rules are complementary

During times of crisis:

- flexibility might we warranted to implement a better policy response
- prolonged suspension of debt limits beyond crisis may lead to large welfare losses
- persistence of crisis interacts with the value of flexibility

Appendix

Functional forms

Preferences:

$$u(c^N, c^T) = \alpha^N \frac{\left(c^N\right)^{1-\sigma}}{1-\sigma} + \alpha^T \frac{\left(c^T\right)^{1-\sigma}}{1-\sigma}, \quad v(\ell) = \alpha^H \frac{\ell^{1-\varphi}}{1-\varphi}.$$

Labor requirement for production:

$$F(y^N, y^T) = \left[\left(y^N\right)^\rho + \left(y^T\right)^\rho\right]^{1/\rho}$$

Cost of default:

$$A(P) = \omega_0{}^{-1}, \qquad A(D) = (\omega_0 - \omega_1)^{-1}$$

Welfare gains

Value in the repayment and default states, given compensation Δ:

$$V^P(B, \Delta) = u\left((1+\Delta)c^N, c^T\right) + v(1-h) + \vartheta(g) + \beta\mathcal{V}\left(B'\right)$$
$$V^D(\Delta) = u\left((1+\Delta)c^N, c^T\right) + v(1-h) + \vartheta(g) + \beta\delta\mathcal{V}(0) + \beta(1-\delta)V^D$$

Ex ante value (before the extreme value shock is realized) is given by

$$\mathcal{V}(B, \Delta) = \zeta \log\left[exp\left(\frac{V^P(B, \Delta)}{\zeta}\right) + exp\left(\frac{V^D(\Delta)}{\zeta}\right)\right]$$

Let $\mathcal{V}^R(B)$ be the corresponding value function under policy rule $R = \{\mu^*, B^*\}$. For a given debt level B, the welfare measure Δ solves:

$$\mathcal{V}(B, \Delta) = \mathcal{V}^R(B)$$

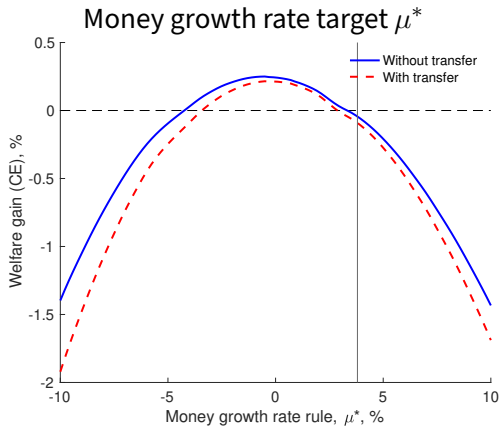
Impact of rules on the economy

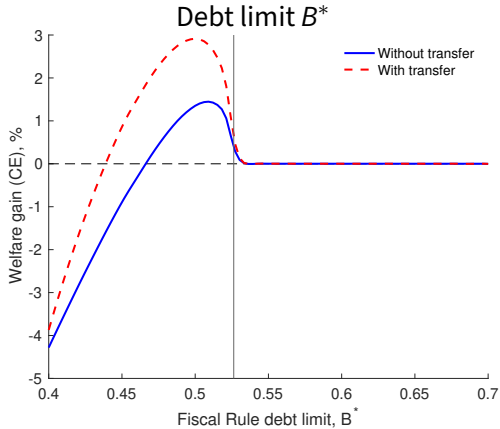
	No Rules	Money growth, $\mu^* = -0.5\%$			Debt ceiling, $B^* = 0.51$			Money growth, $\mu^* = -0.80\%$ Debt ceiling, $B^* = 0.51$		
		Always	Suspend	Abandon	Always	Suspend	Abandon	Always	Suspend	Abandon
Δ Real GDP, %	-9.5	-11.8	-8.9	-9.1	-9.4	-9.6	-9.5	-11.9	-9.0	-9.1
Δ GDP USD, %	-20.8	-19.2	-21.8	-22.1	-21.6	-20.2	-20.4	-20.1	-21.0	-21.6
Δ Employment, pp	-3.2	-4.5	-3.0	-3.0	-3.2	-3.2	-3.1	-4.6	-3.0	-3.0
Δ Imports, %	-15.6	-23.9	-12.8	-12.9	-17.9	-13.3	-14.4	-27.3	-9.9	-11.3
Δ Exports, %	-10.7	-20.2	-7.5	-7.3	-9.0	-12.3	-11.7	-18.8	-9.4	-8.4
Δ Debt / GDP, pp	11.2	10.5	11.6	11.6	9.7	11.6	11.6	8.8	12.0	12.1
Δ Tax rate, pp	-6.3	4.2	-9.3	-9.1	-6.0	-6.6	-6.5	5.3	-9.7	-9.4
Δ Expenditure / GDP, pp	4.6	5.1	4.5	4.5	4.4	4.7	4.6	5.0	4.6	4.6
Δ Primary deficit / GDP, pp	10.9	0.9	13.7	13.6	10.4	11.3	11.1	-0.4	14.3	14.0
Δ Money growth rate, pp	13.2	0.0	17.7	17.8	14.1	12.2	12.6	0.0	16.6	17.1
Δ Credit spreads, bps	96.2	135.2	96.3	104.7	31.5	54.7	140.5	39.7	51.0	151.0
Δ Default probability, pp	2.5	3.5	2.6	3.0	1.3	1.2	1.7	1.7	1.0	1.9
Δ Inflation, pp	-0.2	-2.5	0.6	0.9	0.7	-1.1	-0.8	-1.7	-0.4	0.2
Δ Inflation 2021, pp	14.4	3.4	17.7	18.9	13.4	15.6	14.6	1.7	19.0	19.3
Δ Depreciation, pp	12.2	4.5	14.8	15.4	14.4	10.2	10.9	6.4	12.3	13.9
Δ Depreciation 2021, pp	2.6	-2.7	3.8	6.7	-0.2	6.3	3.6	-6.0	7.5	7.9

Impact of rules on the economy when crisis lasts 2 years

	No Rules	Money growth, $\mu^* = -0.5\%$			Debt ceiling, $B^* = 0.51$			Money growth, $\mu^* = -0.80\%$ Debt ceiling, $B^* = 0.51$		
		Always	Suspend	Abandon	Always	Suspend	Abandon	Always	Suspend	Abandon
Δ Real GDP, %	-8.6	-11.1	-8.1	-8.2	-8.7	-8.7	-8.6	-10.9	-8.2	-8.2
Δ GDP USD, %	-21.4	-19.5	-22.4	-22.6	-20.6	-20.6	-20.9	-18.3	-21.5	-22.1
Δ Employment, pp	-2.7	-4.0	-2.5	-2.6	-2.7	-2.7	-2.7	-3.9	-2.5	-2.6
Δ Imports, %	-20.8	-32.1	-18.0	-18.2	-18.7	-18.7	-19.7	-29.0	-15.4	-16.8
Δ Exports, %	-7.3	-17.9	-4.0	-3.7	-9.0	-9.1	-8.2	-19.5	-6.1	-4.8
Δ Debt / GDP, pp	8.6	7.3	9.1	9.0	9.1	9.1	9.0	7.8	9.7	9.5
Δ Tax rate, pp	-6.1	6.4	-9.1	-9.0	-6.5	-6.5	-6.3	5.4	-9.6	-9.3
Δ Expenditure / GDP, pp	4.2	4.7	4.1	4.1	4.3	4.3	4.2	4.8	4.2	4.2
Δ Primary deficit / GDP, pp	10.3	-1.8	13.1	13.1	10.8	10.8	10.6	-0.6	13.8	13.4
Δ Money growth rate, pp	15.9	0.0	20.3	20.4	14.8	14.8	15.2	0.0	19.1	19.7
Δ Credit spreads, bps	267.4	390.9	277.3	300.2	154.1	155.0	242.1	185.5	145.8	255.6
Δ Default probability, pp	8.0	11.2	8.4	9.2	3.9	3.9	5.1	4.6	3.5	5.4
Δ Inflation, pp	0.4	-2.7	1.2	1.5	-0.7	-0.8	-0.3	-3.8	-0.1	0.7
Δ Depreciation, pp	14.7	5.4	17.4	17.9	12.2	12.2	13.3	3.1	14.4	16.2
Welfare gain of shocks, %	-21.2	-21.7	-21.1	-21.4	-21.0	-21.0	-22.4	-21.4	-20.9	-22.8
Welfare gain of flexibility, %			0.7	0.4		0.0	-1.7		0.7	-1.6

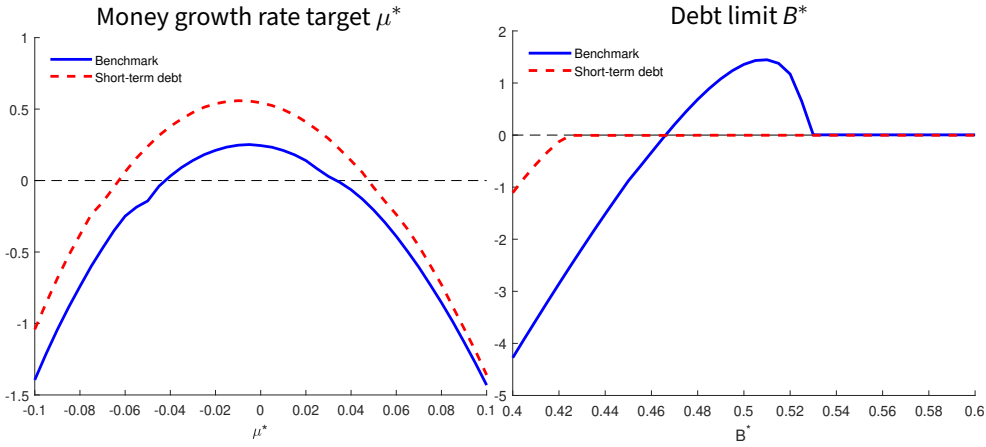
Alternative welfare measure





Note: Debt is at the steady state value, $B = B^{ss}$. The vertical line corresponds to the policy's value in a steady state without rules.

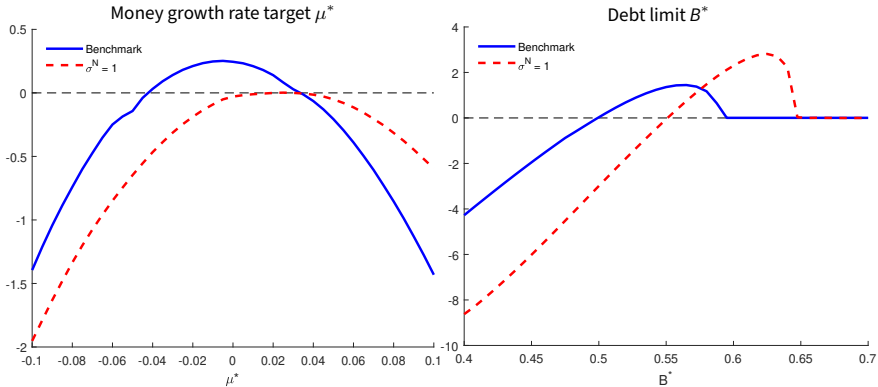
Short-term debt



Note: Debt is at the steady state value, $B = B^{ss}$.

Money demand

With $\sigma^N = 1$, the intertemporal distortion in debt choice, which stems from a time-consistency problem due to the demand for money, disappears.



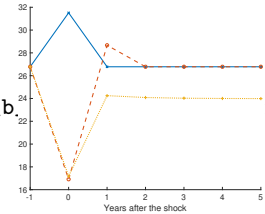
Note: Debt is at the steady state value, $B = B^{ss}$.

Dynamics of a large crisis

Debt/GDP$_{-1}$, %

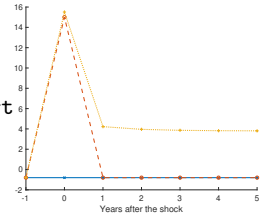
results_2024/fig_ir_b

Tax rate, %



rt

Money growth rate, %



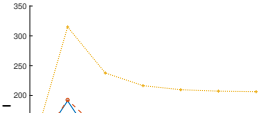
Real GDP

results_2024/fig_ir_g

Inflation, %

s-

Credit spreads, bps



References

Aguiar, M. and Gopinath, G. Defaultable debt, interest rates and the current account. *Journal of International Economics*, 69, 2006.

Arellano, C. Default Risk and Income Fluctuations in Emerging Economies. *American Economic Review*, 98(3), 2008.

Arellano, C., Bai, Y., and Mihalache, G. P. Monetary policy and sovereign risk in emerging economies (nk-default). Technical Report 26671, National Bureau of Economic Research, 2020.

Bianchi, J. and Mondragon, J. Monetary Independence and Rollover Crises. *The Quarterly Journal of Economics*, 137(1), 2021.

Bianchi, J., Ottonello, P., and Presno, I. Fiscal Stimulus under Sovereign Risk. *Journal of Political Economy*, 131(9):2328–2369, 2023.

Chatterjee, S. and Eyigungor, B. Maturity, indebtedness and default risk. *American Economic Review*, 102(6), 2012.

Cuadra, G., Sánchez, J., and Sapriza, H. Fiscal Policy and Default Risk in Emerging Markets. *Review of Economic Dynamics*, 13(2), 2010.

Eaton, J. and Gersovitz, M. Debt with potential repudiation: theoretical and empirical analysis. *Review of Economic Studies*, 48, 1981.

Espino, E., Kozlowski, J., Martin, F. M., and Sánchez, J. M. Domestic Policies and Sovereign Default. *American Economic Journals: Macroeconomics*, forthcoming, 2024.

Hatchondo, J. C. and Martinez, L. Long-duration bonds and sovereign defaults. *Journal of International Economics*, 79, 2009.

Hatchondo, J. C., Roch, F., and Martinez, L. Fiscal rules and the sovereign default premium. *American Economic Journal: Macroeconomics*, 14(4), 2022.

Na, S., Schmitt-Grohé, S., Uribe, M., and Yue, V. The Twin Ds: Optimal Default and Devaluation. *American Economic Review*, 108(7), 2018.

Uribe, M. and Schmitt-Grohé, S. *Open economy macroeconomics*. Princeton University Press, 2017.