Monetary Policy and Sovereign Debt Sustainability

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How does monetary policy affect sovereign debt sustainability?

- Large public debt levels after Covid-19. Inflation has risen in most advanced economies.
  - Is the ability to inflate debt away welfare-enhancing?
- A gov't that cannot commit to repay its debt presumably cannot commit not to inflate it away
  - Effect of (expected) inflation on nominal yields
- **This paper**: analyze trade-offs between price stability and sovereign debt sustainability...
  - ... when government cannot make credible commitments

What we do: analyze optimal fiscal-monetary policy in a model of strategic default

- Small open endowment economy, continuous-time
- Benevolent government sells nominal bonds to foreign investors
- Government may partially default on its real debt...
  - through (discrete) outright repudiation: exclusion from capital markets + output loss
  - through (continuous) inflation: utility costs
- Government chooses fiscal (primary deficit) and monetary policy (inflation) under discretion

What we find: discretionary inflation is welfare improving with high debt levels

- Optimal inflation properties:
  1. Inflationary bias: If there is debt outstanding $\rightarrow$ incentive to inflate it away.
  2. Inflation increases with the welfare gain from a marginal reduction in the real value of debt
- Analyze the impact of optimal inflation policy on sovereign debt sustainability.
  - Inflation provides extra state-contingent tool (more powerful with $\uparrow$ debt) $\rightarrow$ better consumption smoothing $\rightarrow$ less incentive to default
- Is it better to commit ex-ante to never inflate ex-post? (real debt, central bank mandate...)
  - No, except for very low initial debt levels
- The model helps to interpret Brazilian 2002-2003 crisis (and to evaluate counterfactual without nominal debt)

Model

Model: output and prices

- Single consumption good with int'l price = 1. Exogenous output endowment, $z_t = \log(y_t)$

$$dz_t = -\mu z_t dt + \sigma dW_t,$$

- Local currency price,

$$dP_t = \pi_t P_t dt.$$

Assets

- Long-term bond issued at time t pays stream of geometrically-decaying *nominal* coupons $\left\{(\delta+\lambda)\, e^{-\delta(s-t)}\right\}_{s\geq t}$
- Sovereign debt,
$$dB_t = B_t^{new}dt - \lambda dt B_t.$$
λ : amortization rate; fully held by foreign investors
- Government's flow of funds
$$Q_t B_t^{new} = (\lambda+\delta)\, B_t + P_t\,(c_t - y_t)\,.$$
δ : coupon rate, Q_t bond price, $c_t - y_t$ primary deficit
- Define real debt in face value terms as $b_t \equiv B_t/P_t$
$$db_t = s\,(b, z, c, \pi)dt = [\frac{(\lambda+\delta)\, b_t + c_t - y_t}{Q_t} - (\lambda+\pi_t)\, b_t]dt.$$

Preferences

- Household preferences,

$$U_0 \equiv \mathbb{E}_0 \left[\int_0^\infty e^{-\rho t} u(c_t) - x(\pi_t, y_t) dt \right]$$

where

$$u(c) = \begin{cases} \log(c), & \text{if } \gamma = 1 \\ \frac{c^{1-\gamma}-1}{1-\gamma}, & \text{f } \gamma \neq 1 \end{cases}, \quad x(\pi, y) = \frac{\psi(y)}{2}\pi^2, \;\; \psi(y) = \psi y^{\zeta}.$$

- Inflation costs can be justified by quadratic price adjustment costs à la Rotemberg (1982)

Fiscal and monetary policy

- At each point in time, benevolent gov't chooses
  - default or continue repaying debt
  - consumption (c_t), inflation rate (π_t)

  under discretion (take investor's pricing scheme $Q(b, z)$ as given)

Default

- Default implies
- exclusion from capital markets; random duration $\tau \sim \exp(1/\chi)$
- contraction in output endowment $y_t - \epsilon(y_t)$
- After exclusion, gov't reenters markets with debt ratio θb

Value function

Repayment region: "HJB Variational Inequality"

$$0 = \max \left\{ V_{def}(b,z) - V(b,z), \max_{c,\pi} u(c) - x(\pi, e^z) + s(b,z,c,\pi) \frac{\partial V}{\partial b} - \mu z \frac{\partial V}{\partial z} + \frac{\sigma^2}{2} \frac{\partial^2 V}{\partial z^2} - \rho V(b,z) \right\}$$

First order conditions

$$u'(c(b,y)) = -\frac{\partial V}{\partial b} \frac{1}{Q(b,z)},$$

$$\pi(b,z) = -\frac{1}{\psi(e^z)} b \frac{\partial V}{\partial b} > 0.$$

Default

$$\rho V_{def}(b,z) = \max_{\pi} u_{def}(z) - x(\pi, e^z - \epsilon(e^z)) - \pi b \frac{\partial V_{def}}{\partial b} - \mu z \frac{\partial V_{def}}{\partial z} + \frac{\sigma^2}{2} \frac{\partial^2 V_{def}}{\partial z^2} + \chi (V(\theta b, z) - V$$

International investors (bond pricing)

- Risk-neutral investors can invest elsewhere at riskless real rate $\bar{r}$
- Unit price of the nominal non-contingent bond

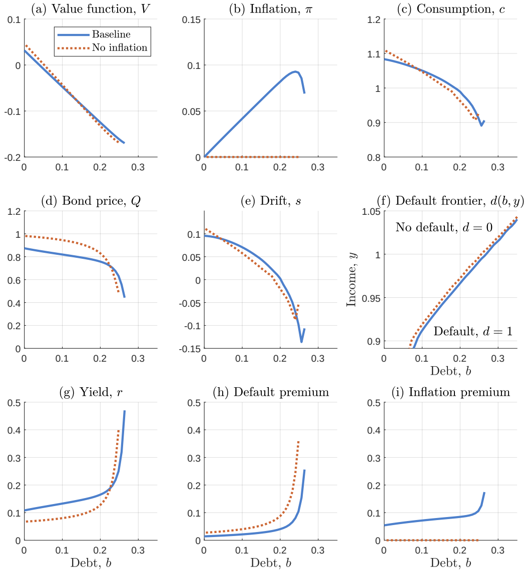
$$
\begin{aligned}
\left(\bar{r}+\pi(b,z)+\lambda\right)Q(b,z) &= (\lambda+\delta)+s\,(b,z)\,\frac{\partial Q}{\partial b}-\mu z\frac{\partial Q}{\partial z}+\frac{\sigma^2}{2}\frac{\partial^2 Q}{\partial z^2},\ \text{ if } d(b,z)=0,\\
Q(b,z) &= Q_{def}(b,z),\ \text{ if } d(b,z)=1,\\
\left(\bar{r}+\pi(b,z)\right)Q_{def}(b,z) &= -\pi b\frac{\partial Q_{def}}{\partial b}-\mu z\frac{\partial Q_{def}}{\partial z}+\frac{\sigma^2}{2}\frac{\partial^2 Q_{def}}{\partial z^2}+\chi\left[\theta Q\left(\theta b,z\right)-Q_{def}(b,z)\right],
\end{aligned}
$$

Quantitative Analysis

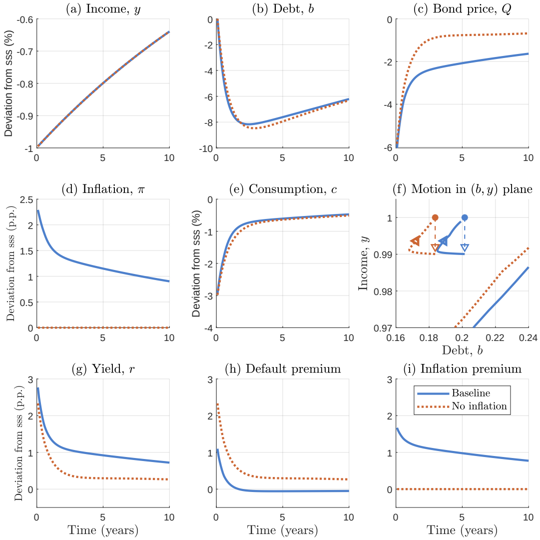
Calibration: Brazil

Parameter	Value	Description	Source / target
μ	0.045	Driftparameteroutput	Persistence Brazilian GDP
σ	0.027	Diffusionparameter output	Volatility Brazilian GDP
λ	0.264	Bondamortizationrate	Macaulay duration 2.3 years
δ	0.061	Bondcouponrate	Average coupon payment
γ	1	1/IES	Log-utility
χ	0.1538	Reentry rate	Chatterjee and Eyigungor (2012)
$\bar{r}$	0.04	Risk-free real interest rate	Chatterjee and Eyigungor (2012)
θ	0.5	Fraction of debt after default	Benjamin and Wright (2013)
ρ	0.129	Household discount factor	(1) Sample average, (2) trough-to-peak increase in 2002-03 and (3) peak level in 2002-03 crisis of (i) inflation, (ii) sovereign spread and (iii) default premium
d_0	-0.323	Default cost parameter	
d_1	0.361	Default cost parameter	
ψ	1.87	Scale of inflation costs	
ζ	27.8	Procyclicality inf. costs	

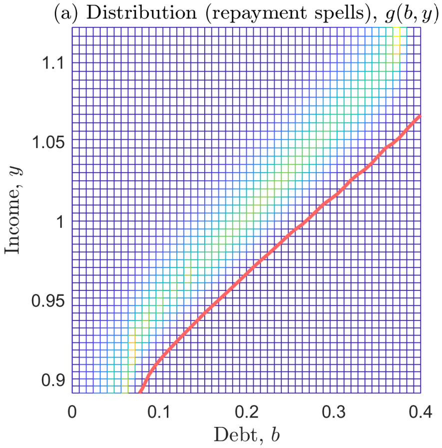
Equilibrium objects

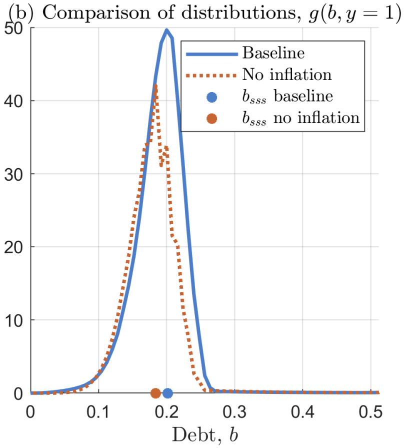


Comparative dynamics: impulse-responses



Average behavior





Welfare analysis

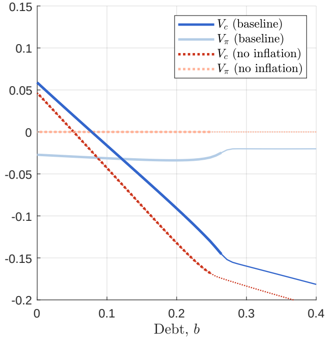


Figure: Welfare decomposition. The figure shows the value functions V_c and V_π in the repayment (thick line) and default (thin line) segments of debt with $y = 1$.

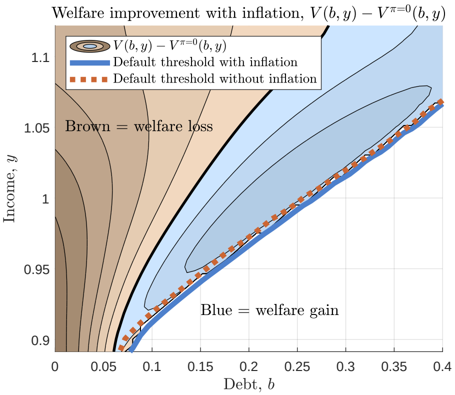


Figure: **Isowelfare curves and default frontier.** The blue region displays the isowelfare curves (b^{κ}, y^{κ}) such that $V(b^{\kappa}, y^{\kappa}) - V^{\pi=0}(b^{\kappa}, y^{\kappa}) = \kappa$. The blue region comprises the states in which $V(b,y) > V^{\pi=0}(b,y)$ and the red region $V(b,y) < V^{\pi=0}(b,y)$. The black line is the isowelfare with $\kappa = 0$. The solid blue line is the default frontier for the baseline regime and the dashed red line the default frontier for the no-inflation regime.

Sensitivity analysis

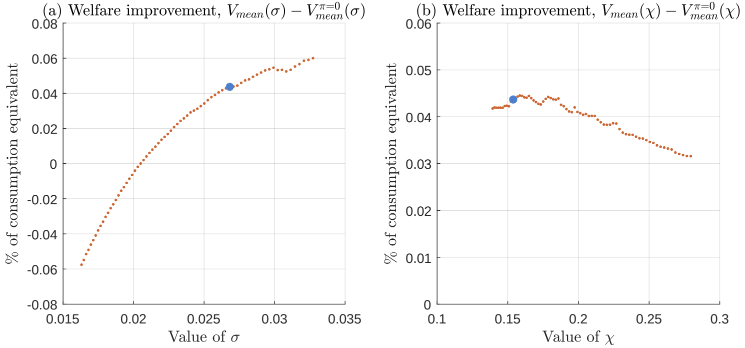


Figure: Average welfare difference between regimes as a function of parameters σ and χ. The welfare improvement $V_{mean}(\cdot) - V^{\pi=0}_{mean}(\cdot) = \int \left[V(b,y) - V^{\pi=0}(b,y) \right] g(b,y)\, dbdy$ is computed for different values of the parameters.

The Brazilian sovereign debt crisis of 2002-2003

In a counterfactual no-inflation scenario, the Brazilian government would have actually *defaulted* in early 2003

Variable	units	Data	Baseline
GDP	%	-2.6	-2.6
inflation, π	pp	9.8	6.5
debt-to-GDP, b	pp	-1.7	-6.0
spread, $r - \bar{r}$	pp	15.7	26.2
inflation premium	pp	7.5	14.4
default premium	pp	11.8	11.8