Fiscal Rules and Sovereign Default

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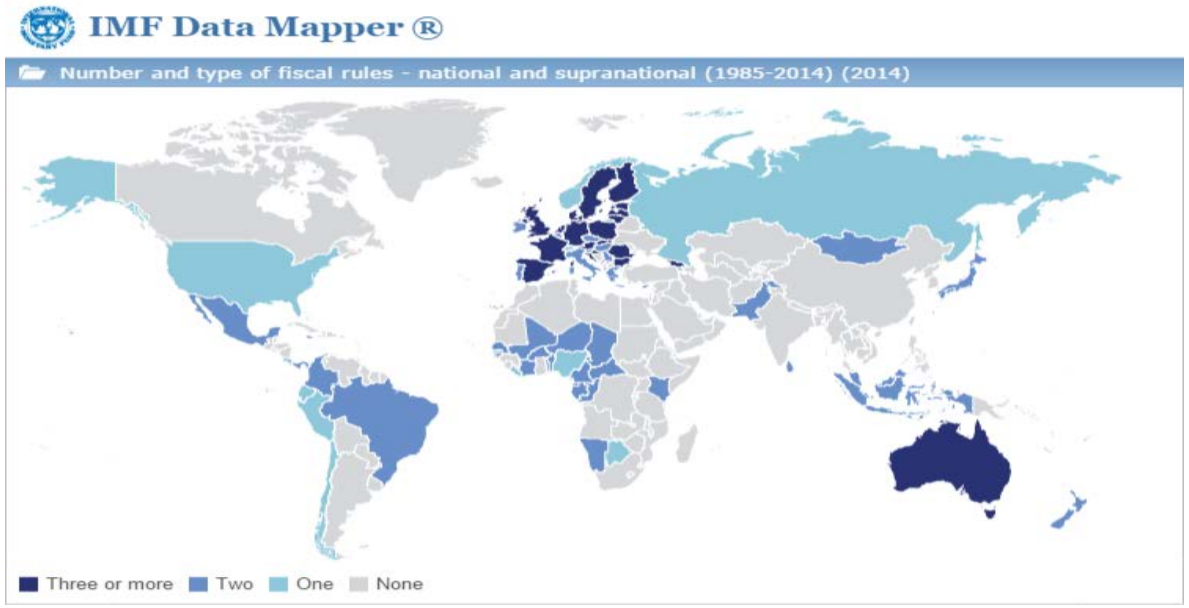
* Paper does not reflect views Ministry of Finance, Brazil.

Countries with Fiscal Rules

"Fiscal Rules at a Glance" (IMF 2015): Only 5 countries in 1985; 89 countries now.

- Different types: Debt, deficit, etc.



- Long term rationale: Debt Sustainability
- Countercyclical fiscal policy (Keynes, Barro, etc.)
  - Emerging follow pro-cyclical policies (Kaminsky, Reinhart and Vegh, 2005; Vegh and Vuletin, 2012).

Fiscal Rules: Specific Questions

Quantitative analysis of fiscal rules in a model of Sovereign Debt Default

- Are optimal fiscal rules quantitatively important (welfare)?
- Should fiscal rules consider the economic cycle (countercyclical)?
- How do simple rules compare with more complex ones?
  - Any difference between debt / deficit rules?

Fiscal Rules: Substantive Questions

- "Rule versus discretion": Why commitment?
  - Is there time-inconsistency problem?
  - Government too impatient (non-benevolent)?
- Is the commitment effective?
  - Simpler rules/more restrictive rules.
- Should Government hold positive amounts of debt?
  - Transfer across generations (old-young)?
  - Front load consumption due to catch-up (Emerging Economies)

Model: Role for Fiscal Rules

- Transform the traditional model of sovereign debt and default by assuming governments' preferences to be time inconsistent:
  - Quasi-hyperbolic consumption model (Laibson, 1997).
- Aggregating the preferences of time consistent citizens naturally results in time inconsistent preferences, Jackson and Yariv (2014, 2015).
  - Even if benevolent ex-ante, the sovereign thus ends up with preferences that display an extra discount parameter that captures the ex-post present-bias.
  - Political Game (Amador and Aguiar, 2010)
- The consequent conflict between today's government and tomorrow's generates a natural role for fiscal rule.

Calibration: Technical Motivation

- Emerging countries accumulate debt levels close to 60% of GDP (Reinhart and Rogoff, 2009)
- Intertemporal discount parameter ("beta"): calibrated to extremely low numbers to match debt/default.
  - Aguiar and Gopinath (2006), Alfaro and Kanczuk (2005, 2009), and Arellano (2008): annual beta 0.4 – 0.8
  - Values much lower than would be obtained if calibration were to local interest rates.
- The use of time inconsistent government preferences removes this calibration restriction allowing the household impatience parameter to be calibrated to the interest rate.

Overview of Findings

Calibrating the model to the Brazilian economy + hyperbolic preferences parameter (Angeletos et al., 2001):

- Brazilian level of debt and frequency of default (household impatience parameter calibrated to interest rates).
- Adoption of the optimal fiscal rule implies substantive welfare gains relative to the absence of a rule.
  - Optimal fiscal rule does not entail a countercyclical fiscal policy.
  - Under the optimal fiscal rule, the country would never opt to default.
- A debt rule that sets the maximum amount of debt and the optimal fiscal rule: similar welfare gains to optimal rule.
- A deficit rule that sets the maximum amount of deficit per period incurs welfare losses.

Relation to the Literature

- Sovereign debt and default (Amador and Aguiar, 2015).
- Hatchondo et al. (2015) study the role of sovereign default and fiscal rules limiting the maximum sovereign premium the government can pay when it increases its debt level.
  - Differently from their work, in our model government preferences display a present bias, which creates a natural role for fiscal rules.
- Recent literature on rules versus discretion (Amador, Werning and Angeletos, 2006; Halac and Yared, 2014, 2015).
  - We explicitly consider the possibility of default + also assume the private sector to know as much as the government about the state of the economy

Overview

- Introduction
- Model
- Calibration
- Simulation Results
  - No Rule
  - Optimal Fiscal Rule
  - Debt Rules
  - Deficit Rules
- Robustness and Discussions
  - Risk Aversion, Discretionary Taxes, and Counter-Cyclical policies.
  - Private Information
  - Self Interested Government
- Conclusions

The Model: Standard Sovereign Default Model

- Benevolent government/sovereign borrows funds from a continuum of risk-neutral investors.
- Government taxes a (stochastic) output at constant rate (τ); chooses expenditure (g), debt (d), and whether to default;
- If defaults: temporarily excluded from borrowing in markets and incurs additional output loss (ϕ)

$$g_t=\tau\exp(z_t)-d_t + q_t d_{t+1} \qquad \text{if repays debt}$$

$$g_t=\tau(1-\phi)\exp(z_t) \qquad \text{if chooses to default}$$

  - z_t technology state; d_t *total*, domestic and international, government debt;

- Risk neutral investors, choose the debt price q_t f(perceived default likelihood); ψ_t default probability f(government incentive to repay debt); ρ risk-free rate;.

$$q_t = \frac{(1-\psi_t)}{(1+\rho)}$$

The Model: Hyperbolic Utility Function

$$U_t = E_t\left[u(g_t) + \beta\sum_{\tau=1}^{\infty}\delta^{\tau}u(g_{t+\tau})\right]$$

- Hyperbolic Utility function discount over time: $\{1, \beta\delta, \beta\delta^2, \beta\delta^3, ...\}$
- Time inconsistent preferences: preferences at t are inconsistent with preferences at date t+1
  - β is the present bias
  - Natural rationale for fiscal rules
- We assume perfect information about state of the economy (z).

Timing and Equilibrium

- Government begins each period with debt level d_t and receives the endowment's tax revenue, $\tau \exp(z_t)$.
- Taking the bond price schedule $q(s_t, d_{t+1})$ as given, the government faces two decisions:
  - (i) whether to default, and
  - (ii) if it decides not to default, the next level of debt, d_{t+1}.
- Stochastic dynamic game played by a large agent (the government) against many small agents (the continuum of investors).
- Markov perfect equilibria: define states of the economy in which there is default, determine prices (investors); solve sovereign problem, determining default, use in the next iteration.

Instruments to Affect Consumption: Default and Borrowing

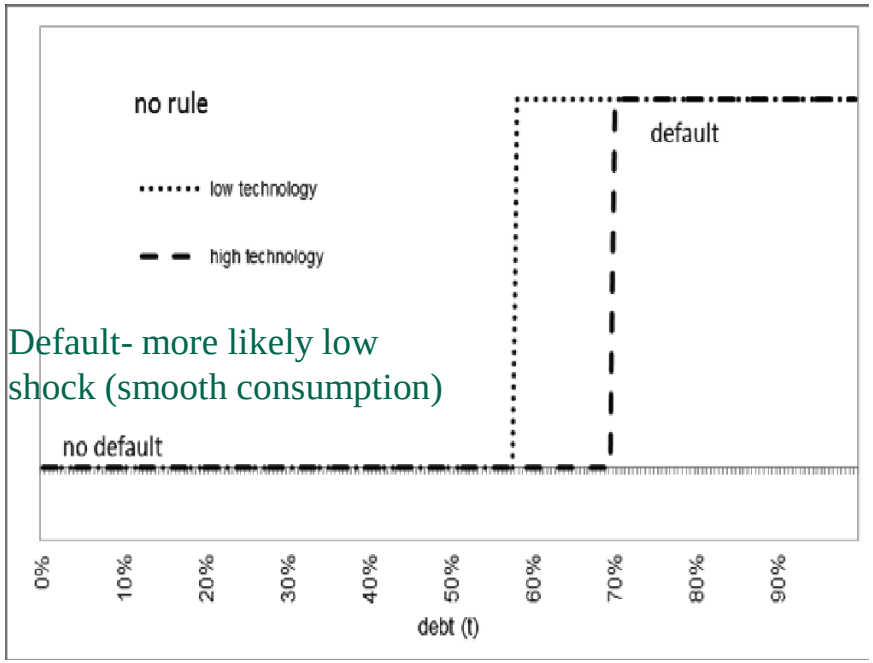
- Default: opt for a higher level of consumption in exchange for being temporarily excluded from capital markets + output costs.
  - Escape from high indebtedness and low technology shock: extremely low consumption levels.
- Debt: smooth income fluctuations (as default) + tilt the consumption profile towards the present (impatience country > investors).
  - Front loading consumption is easier during high income shocks when debt is cheaper and borrowing limits looser (lower probability of default).
- The two objectives of the debt instrument conflict:
  - Good technology shock-cheaper to frontload consumption but also makes sense to save for rainy days (opposite for bad technology shock).
  - The policy rule obtained by solving the calibrated model reflects which objective**, to smooth consumption or frontload its profile, is quantitatively more important.**

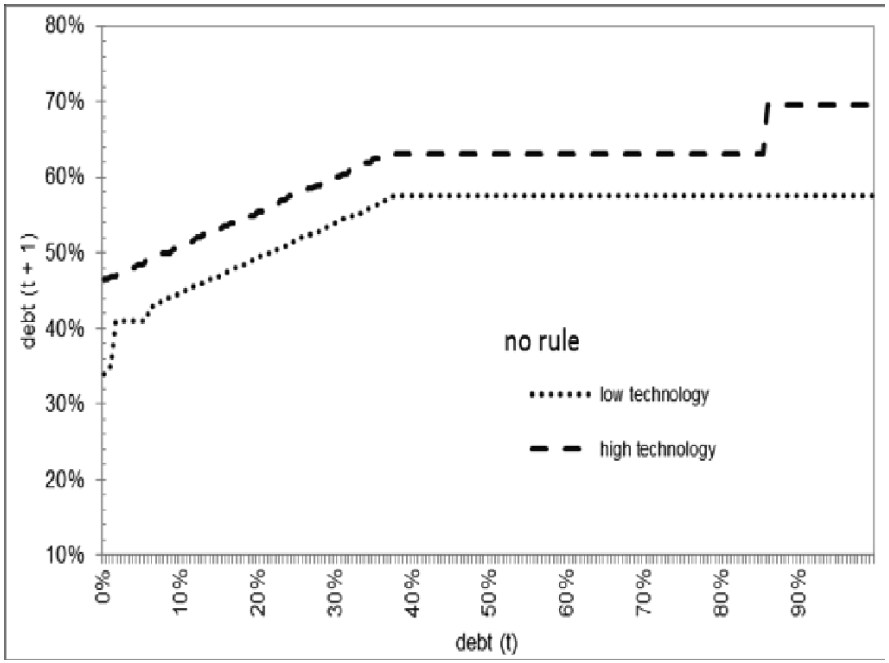
Calibration
Brazil: Annual Data

Technology autocorrelation	$\alpha = 0.85$
Technology standard deviation	$\sigma = 0.044$
Probability of redemption	$\theta = 0.20$
Output costs	$\phi = 0.10$
Risk aversion	$\sigma = 2$
Risk free interest rate	$\rho = 0.04$
Tax rate	$\tau = 0.30$
Discount factor	$\boldsymbol{\delta = 0.90}$
Hyperbolic discount factor	$\boldsymbol{\beta = 0.70}$

No Rule

Policy Functions: Default and Debt





Invariant Distribution

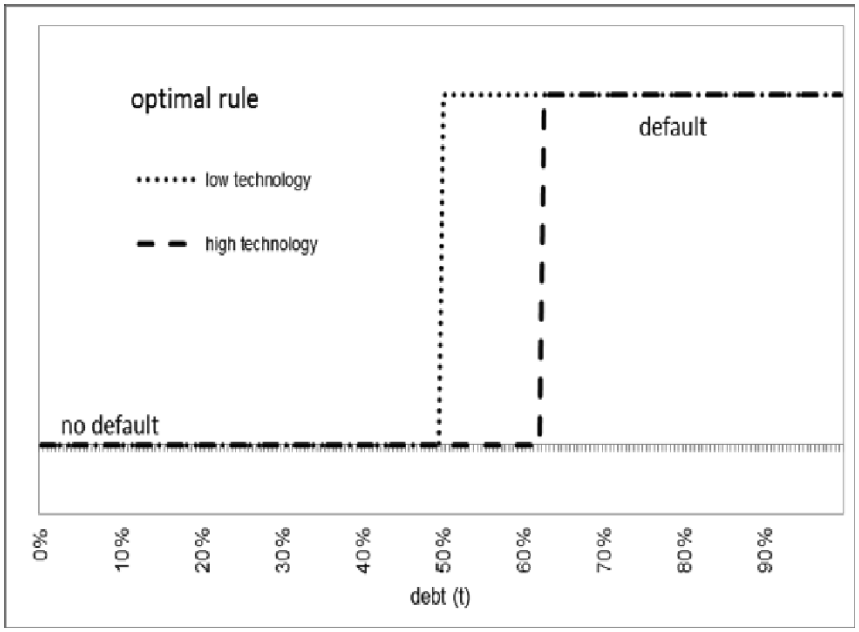
- Exclusion from market = 3.2% of time
- Average Debt (if not excluded) = **60.1% GDP**
- Welfare = 0 (normalization)

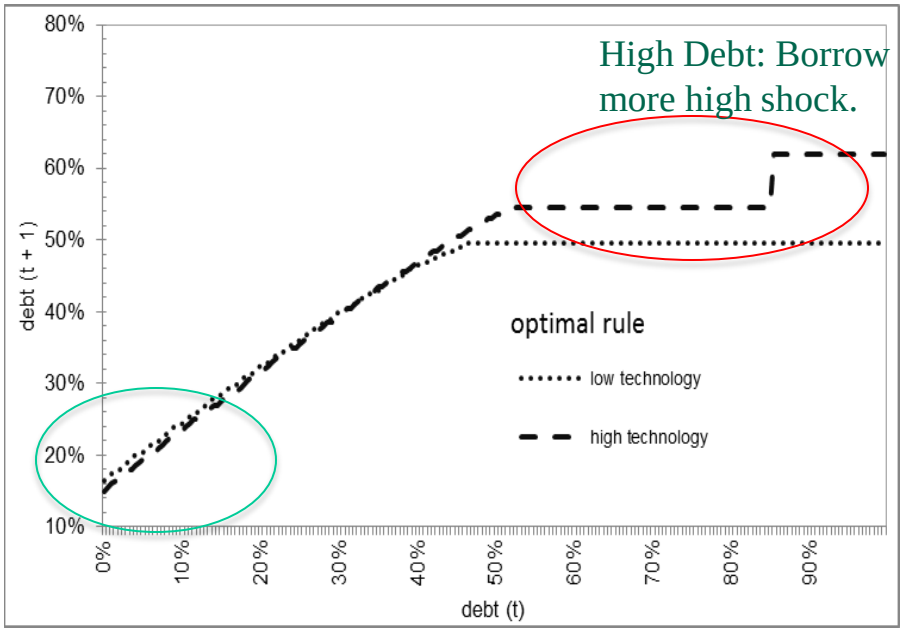
Invariant Distributions: No Rule

Model Specification	*Exclusion from Market (% time)*	*Debt if not excluded (% GDP)*	*Welfare (% GDP)*
No Rule	3.2	60.1	0

Optimal Rule
"First-Best Allocation"

Policy Functions: Default and Debt





Invariant Distribution

- **Exclusion from market = 0% of time**
- Debt (if not excluded) = 50.2% GDP
- Welfare = 0.277 (% of GDP)

Why not countercyclical ?

- Would like to borrow more in bad times, but contracts too expensive.

Invariant Distributions
Optima Rule versus No Rule

Model Specification	*Exclusion from Market (% time)*	*Debt if not excluded (% GDP)*	*Welfare (% GDP)*
No Rule	3.2	60.1	0
Optimal Rule	0	50.2	0.277

The government present bias is responsible for debt over-accumulation of about 10% of GDP and the occurrence of default episodes.

Debt Rule---Debt Level< Threshold

Model Specification	*Exclusion from Market (% time)*	*Debt if not excluded (% GDP)*	*Welfare (% GDP)*
No Rule	3.2	60.1	0
Optimal Rule	0	50.2	0.277
Rule $d \leq 65\%$	3.2	59.8	-0.214
Rule $d \leq 60\%$	3.2	57.8	-0.163
Rule $d \leq 55\%$	1.9	55.0	0.259
Rule $d \leq 50\%$	0.0	50.0	0.276
Rule $d \leq 45\%$	0	45.0	0.275
Rule $d \leq 40\%$	0	40.0	0.212
Rule $d \leq 35\%$	0	35.0	0.129
Rule $d \leq 30\%$	0	30.0	0.024
Rule $d \leq 20\%$	0	20.0	-0.257
Rule $d \leq 10\%$	0	10.0	-0.656
Rule $d \leq 0$	0	0	-1.141

Not binding, with default

No default

Can't front load consumption

Deficit Rules, $\Delta d \equiv d_{t+1} - d_t$

Model Specification	*Exclusion from Market (% time)*	*Debt if not excluded (% GDP)*	*Welfare (% GDP)*
No Rule	3.2	60.1	0
Rule $\Delta d \leq 20\%$	3.2	56.8	-0.184
Rule $\Delta d \leq 10\%$	3.2	57.4	-0.511
Rule $\Delta d \leq 5\%$	3.2	61.3	-0.946
Rule $\Delta d \leq 4\%$	3.2	63.5	-1.049
Rule $\Delta d \leq 3\%$	0.7	74.3	-1.056
Rule $\Delta d \leq 2\%$	0	75.0	-1.097
Rule $\Delta d \leq 1\%$	0	75.0	-1.135

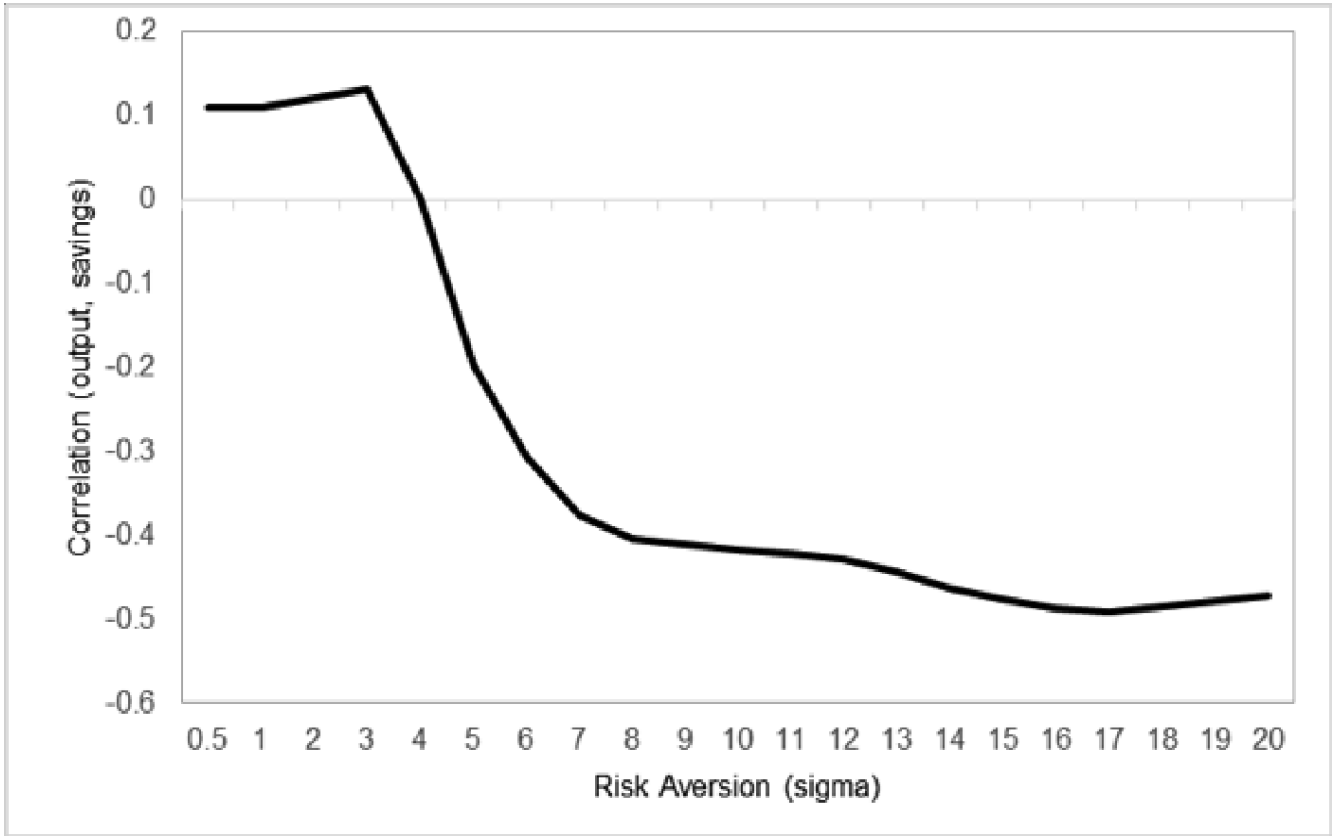
Defaulting is not great if can't frontload consumption

Risk Aversion, Countercyclical Policy, Distortionary Taxes

- A surprising result of our simulations is that optimal fiscal policy is not countercyclical.
  - Tax distortion costs are convex, debt should fluctuate in order to keep tax rates constant. (Barro, 1979).
- In principle, our simple economy has the ingredients that should make countercyclical fiscal policy optimal.
  - Even if the model contemplated production and tax distortions, it would not achieve any more tax smoothing than it already does by assumption.
  - Preferences are concave in consumption, the government has incentives to use debt to smooth consumption.
- Our results indicate that this motive is dominated:
  - Use debt to frontload rather than smooth consumption.

Robustness

- Higher risk aversion → can get counter-cyclicality



Conclusions

1. Welfare gains of fiscal rules are quantitatively important (avoid default)

2. Optimal fiscal rule is not countercyclical
   (For reasonable parameters front loading dominates consumption smoothing.)

3. Simple debt rules can generate virtually same welfare as optimal rule

4. Deficit rules do not allow consumption front loading

- Do we really believe Government should have debt?
  (Front loading government consumption versus other motivations.)