Fiscal Rules and Discretion with Risk of Default

Chiara Felli — Sapienza
Facundo Piguillem — EIEF & CEPR
Liyan Shi — CMU & CEPR

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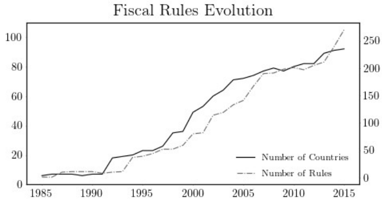

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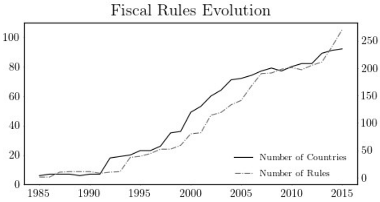

- **Sovereign default is central to discussions about fiscal rules.**
- Rules are usually set by rules of thumb.

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- **Characterization of optimal policies: *spending and default rules*.**
  - Extend previous theoretical results on spending rules.
  - No-default benchmark rule: Amador Werning Angeletos 2006 (AWA).

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Gains of default vs fiscal rules an order of magnitude larger!

A model of present-biased governments

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- $\Rightarrow$ Quasi-hyperbolic preference. Phelps and Pollak 1968. Laibson 1997.

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Definition 1: An allocation specifies spending and default decisions:

$$\mathcal{A} = \left\{ g(\theta, b), \underbrace{\delta(\theta, b)}_{\in\{0,1\}} \right\}_{\theta\in\Theta, b\in\mathbb{R}}$$

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- Debt accumulation:

$$\dot{b}\left(\theta, b\right) = r(b)b + g(\theta, b) - \tau$$

Rules-free equilibrium

Spending and default incentives

- When not in default:

$$\rho w^n(\theta, b) = \underbrace{\max_g \left\{ \theta u(g) + (r(b)b + g - \tau) w_b^n(\theta, b) \right\}}_{\text{spending when in power}}$$

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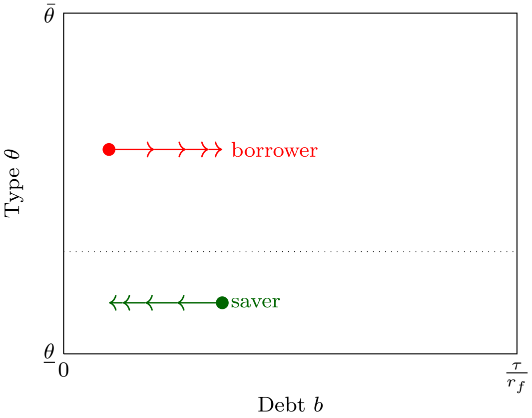

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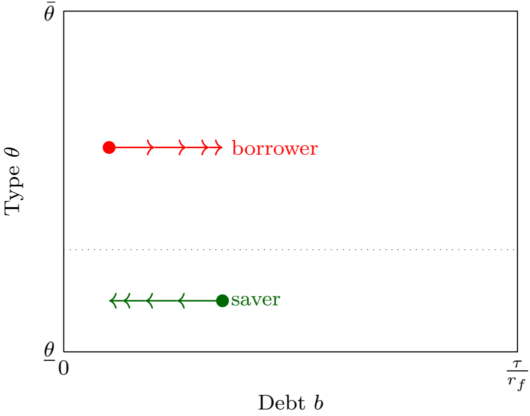

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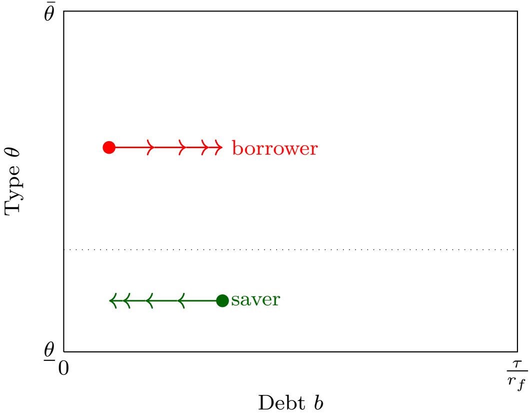

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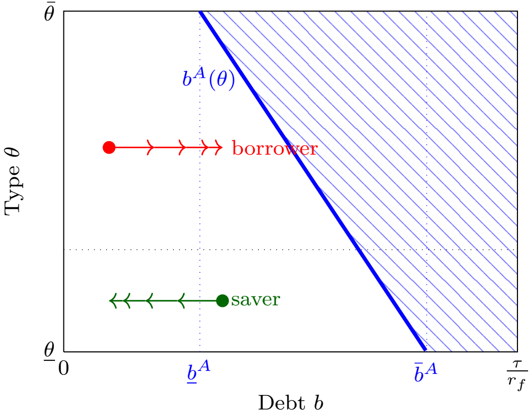

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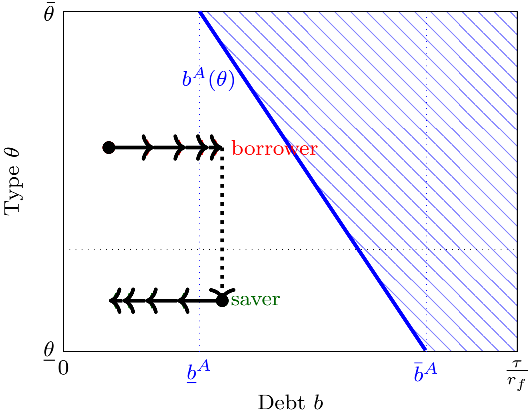

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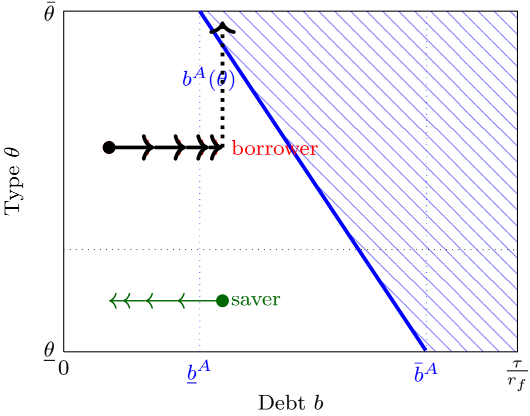

But if re-access is "easy"

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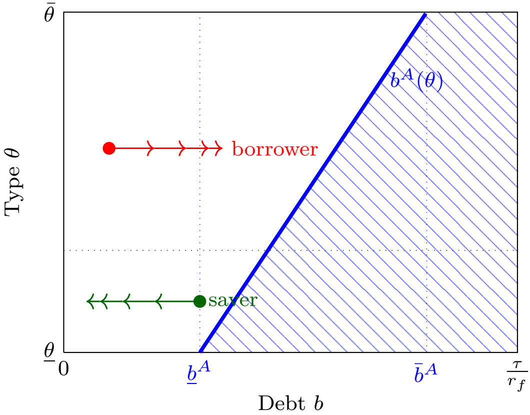

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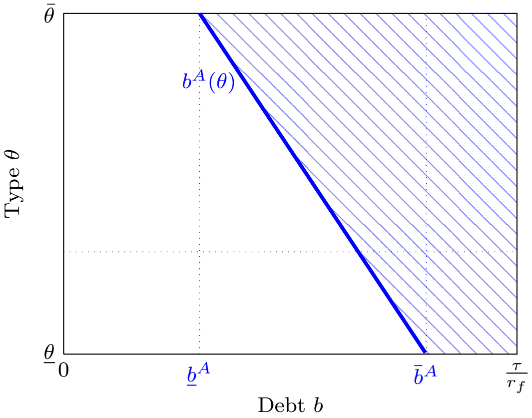

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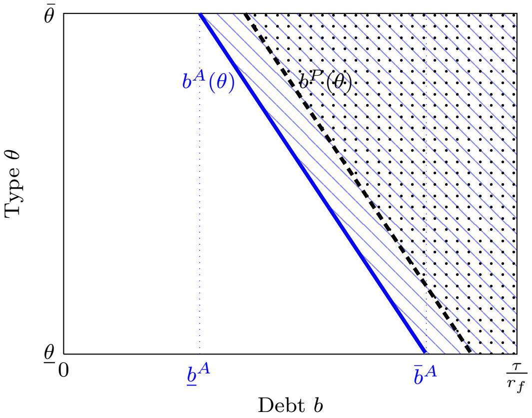

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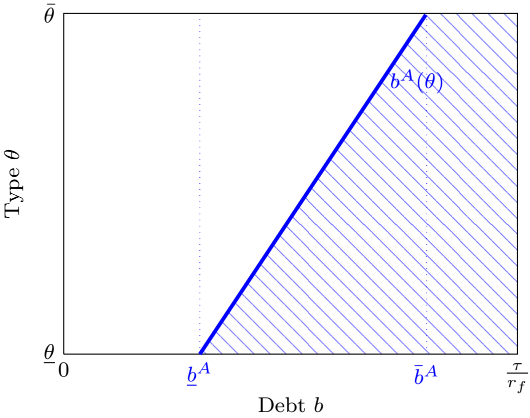

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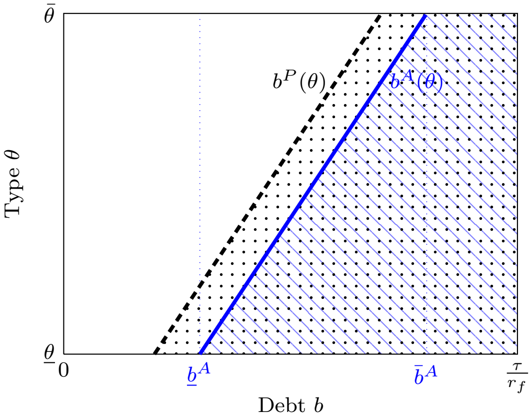

Optimal rules

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$$\text{s.t.} \quad w(\theta, \theta, b; \mathcal{A}) \geq w(\tilde{\theta}, \theta, b; \mathcal{A}), \quad \forall \theta, \tilde{\theta} \in \Theta \qquad \text{(IC)}$$

Report

market interest rate $r\,(b; \mathcal{A})$

Information and welfare

- Principal (planner, rule-writer): government type θ is noncontractible.

Principal chooses allocation $\mathcal{A} = \{g(\theta, b), \delta(\theta, b)\}_{\theta \in \Theta, b \in \mathbb{R}}$:

$$\max_{\mathcal{A}} \int_{\underline{\theta}}^{\bar{\theta}} v(\theta, b; \mathcal{A}) dF(\theta)$$

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Report

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- Mechanism is *static*. *Sequentially Optimal* (no commitment required).

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Report

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Lemma 4: interest-rate externaltiy

Constrained efficiency

Proposition 3. *There exists upper and lower bounds of debt*

$$0 \leq \underline{b} \leq \bar{b} < \frac{\tau}{r_f}$$

and a debt-dependent spending threshold

$$\theta^s(b) \in \Theta, \forall b \leq \bar{b}$$

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I) Spending rule: agents with low needs have **discretion to spend**.

$$g(\theta, b) = \begin{cases} g^A(\theta, b), & \forall \theta \leq \theta^s(b) \\ g^A(\theta^s(b), b), & \forall \theta \geq \theta^s(b); \end{cases}$$

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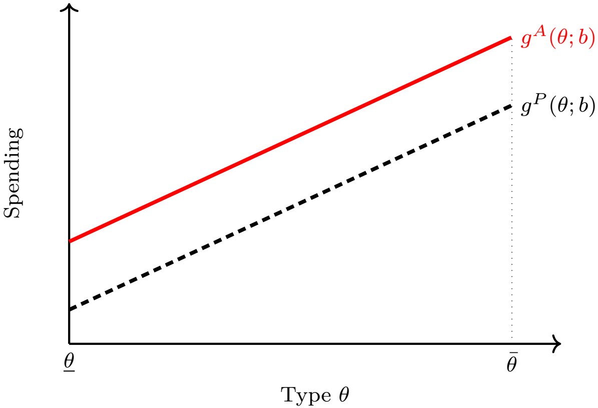
II) Default rule: for intermediate debt levels, **full discretion to default**.

$$\delta(\theta, b) = \begin{cases} 0, & \forall b \leq \underline{b} \\ \delta^A(\theta, b), & \forall b \in (\underline{b}, \bar{b}] \\ 1, & \forall b > \bar{b}, \end{cases}$$

How to fix overspending bias?



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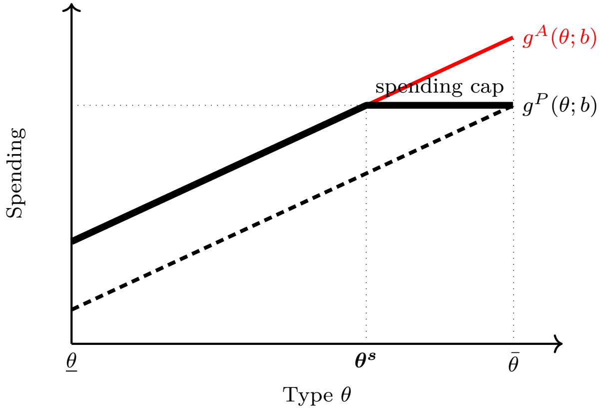
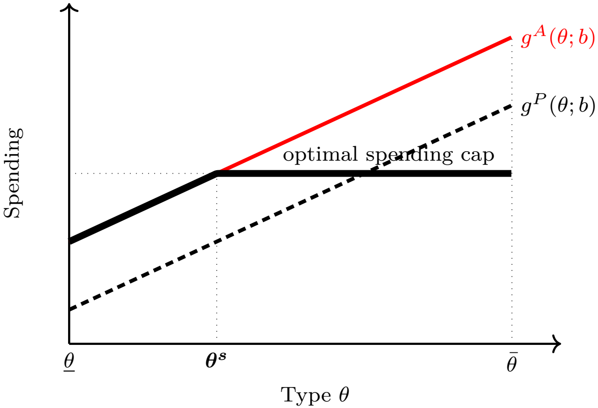


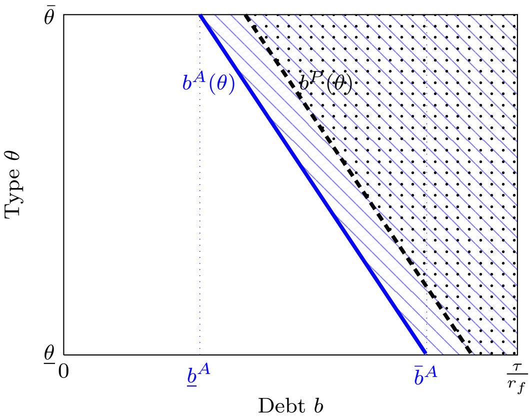
▸ Lemma 5 (No-default benchmark: AWA rule)

How to fix overspending bias?



Lemma 5 (No-default benchmark: AWA rule)

How to fix default bias?
Over-default



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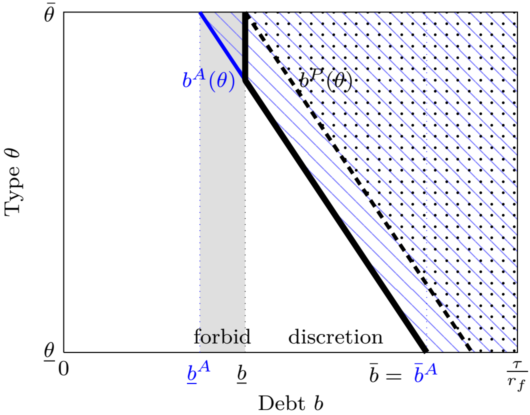

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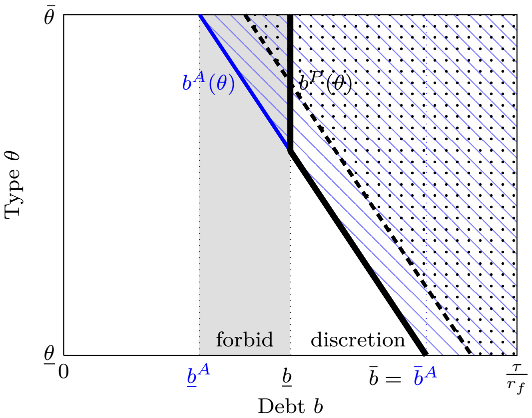
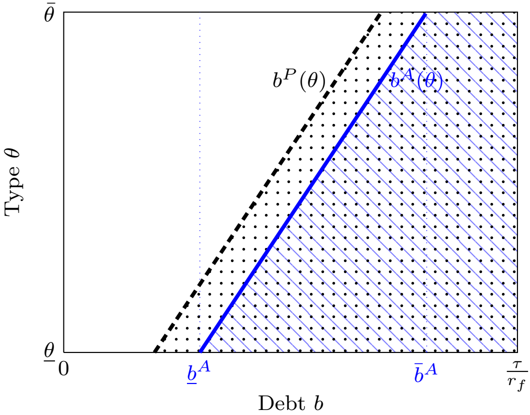
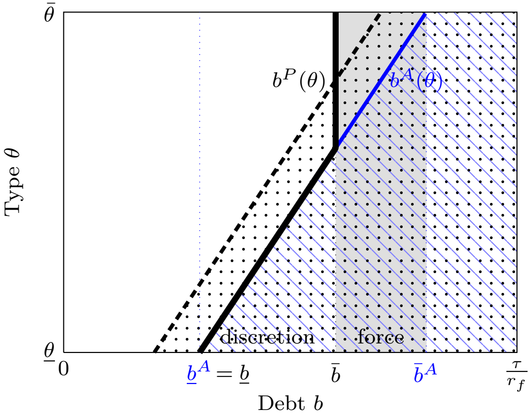


How to fix default bias? Under-default



▸ Proposition 5 (Forbid or force default?)

How to fix default bias? Under-default



Proposition 5 (Forbid or force default?)

Implementation

- Implement the spending rule with a debt-dependent deficit limit.
  - European Fiscal Compact: if debt>60% GDP, a "debt-brake-rule" is triggered, deficit limit changes from 3% of GDP to 1% surplus.

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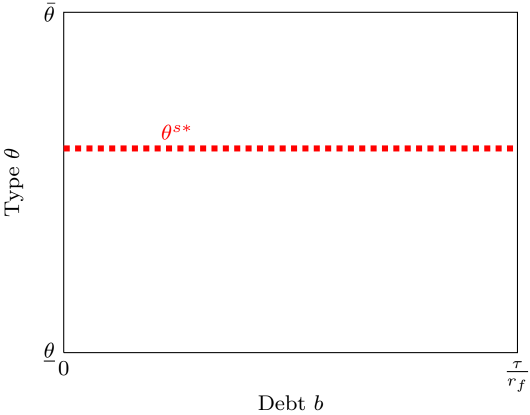
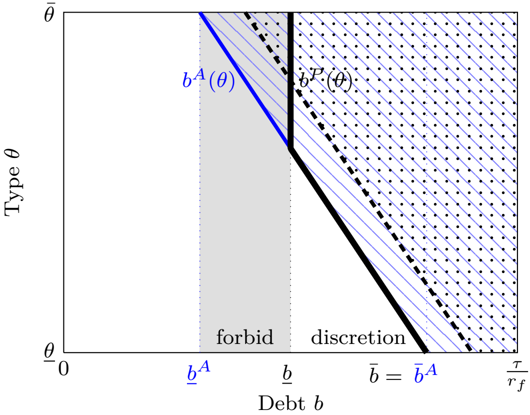
  - Bulgaria's Public Finance Act: *"any interest and principle payables related to government debt shall constitute a priority liability for the state budget."*

- To *force default*: **debt limit**. But *debt over the limit must be defaulted.*
  - Ex. Special law stating debt above the limit is not recognized as a legitimate obligation.

Spending rule: no-default AWA rule



Spending rule: with default risk



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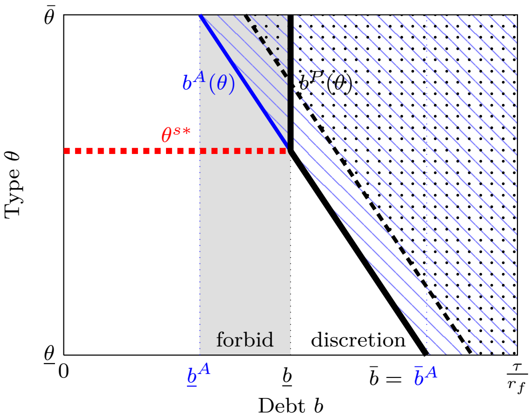

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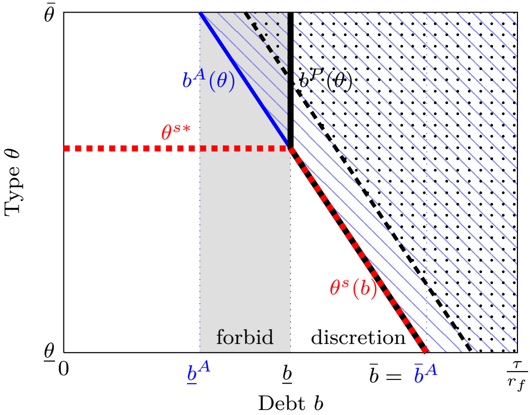
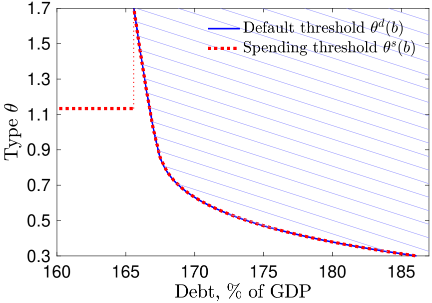


Quantitative: dominant insurance externality

(a) Spending rules only



No spending rules in default-risk region.

- Default manipulation: disincentive default.

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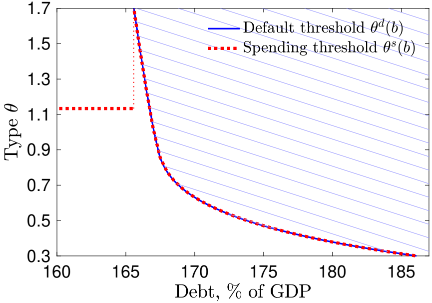

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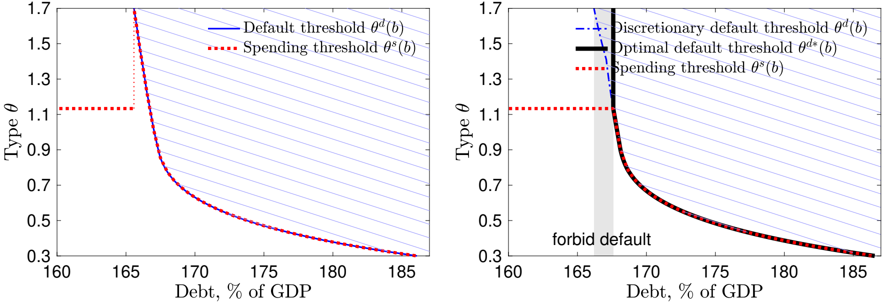

No spending rules in default-risk region.

- Default manipulation: disincentive default. ***Forbid default*** if possible!

Quantitative: dominant clean-slate externality

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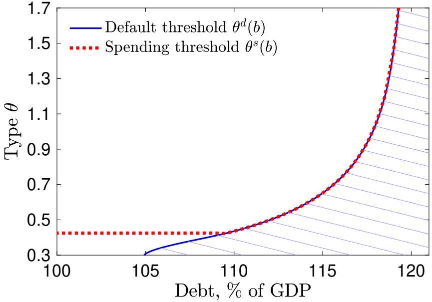

No discretionary spending in high default-risk area.

Quantitative: dominant clean-slate externality

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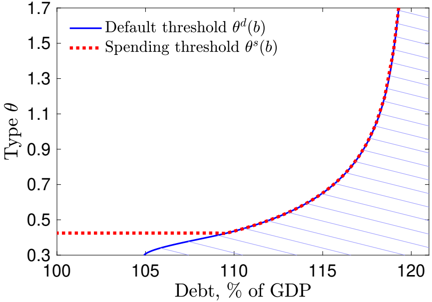

No discretionary spending in high default-risk area.

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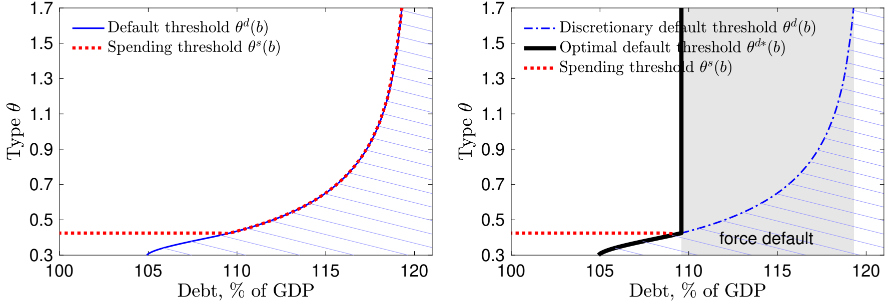
(A) Spending rules only (B) Complemented by default rules

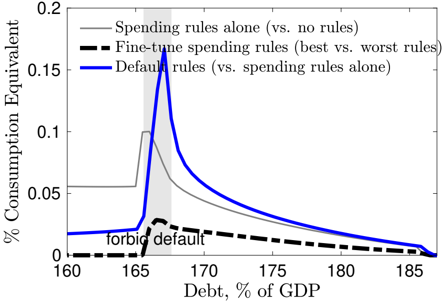


No discretionary spending in high default-risk area.

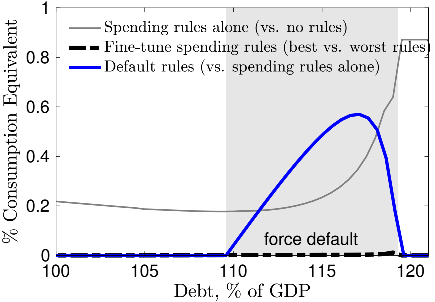
- Default manipulation: incentive default. ***Force default*** if possible!
- Without default rules, impose a draconian spending rule to force default.

Decomposition of welfare gains

(A) Dominant insurance externality



(B) Dominant clean-slate externality



- Gains from **fine-tuning spending rules** are minuscule.
- Gains from **default rules** are orders of magnitude larger.

Conclusion

- Default risk is a key consideration on the debate about fiscal rules.
- Must be studied together, they come hand in hand.
- $\Rightarrow$ Need for debt limits and debt-dependent spending rules.

- Some takeaways:
  - Even with spending rules in place, it could be optimal to forbid default when debt is low.
  - There may be too little default; it could be optimal to force it.

- Default rules are less common but should be considered.
- How? Some rudimentary thoughts on implementation.

Appendix slides

Markov equilibrium ▸ Back

- Due to time inconsistency, a tough cookie!
  - Equilibrium existence? Uniqueness? Continuity?
    - Krusell Smith 2003: when it exists, everything is possible.
    - Harris Laibson 2013: "immediate" gratification, $\lambda \to \infty$.
    - Chatterjee Eyigungor 2016: need lotteries for continuous equilibria.

- Our approach: Piguillem Shi 2024
  - Equivalent to the problem of a ***time-consistent*** agent with a ***distorted "distribution"*** of shocks.
  - Intuition: *myopia* is behavioral equivalent to *optimism* about the future.
  - Use standard tools to characterize the equilibrium.

A USEFUL RELATION ▸ Back

Lemma A1 (Value functions). *The value functions satisfy:*

$$\beta v^{n}\left(\theta, b\right) = w^{n}\left(\theta, b\right) - \left(1-\beta\right)\theta w_{\theta}^{n}\left(\theta, b\right)$$
$$\beta v^{d}\left(\theta\right) = w^{d}\left(\theta\right) - \left(1-\beta\right)\theta w_{\theta}^{d}\left(\theta\right)$$

A USEFUL RELATION ▸ Back

Lemma A1 (Value functions). *The value functions satisfy:*

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$$\beta v^d(\theta) = w^d(\theta) - (1-\beta)\,\theta w^d_\theta(\theta)$$

- Default bias tied to default pattern:

$$\beta\left[v^n\left(\theta, b^A(\theta)\right) - v^d(\theta)\right] = \underbrace{\left[w^n\left(\theta, b^A(\theta)\right) - w^d(\theta)\right]}_{=0} - (1-\beta)\,\theta\underbrace{\left[w^n_\theta\left(\theta, b^A(\theta)\right) - w^d_\theta(\theta)\right]}_{\text{default pattern?}}$$

EQUIVALENCE ▸ BACK

Proposition A1 (Equivalence). *The biased agent's problem can be equivalently represented as the problem of the following agent:* $\forall \theta \in \Theta, b \geq \underline{b}$,

$$(\rho+\lambda)\, w^n(\theta,b) = \max_g \left\{ \theta u\left(g\right) + \left(r(b)b + g - \tau\right) w_b^n(\theta,b) + \lambda \int_{\underline{\theta}}^{\bar{\theta}} w(\theta',b)dG(\theta') \right\}$$

$$(\rho+\lambda+\phi)\, w^d(\theta) = \theta u\left(\kappa\tau\right) + \phi w^n(\theta,0) + \lambda \int_{\underline{\theta}}^{\bar{\theta}} w^d(\theta')dG(\theta'),$$

where the time-consistent agent assigns "expectation" to the taste shocks:

$$G\left(\theta\right) = \begin{cases} F\left(\theta\right) + \left(1-\beta\right)\theta f\left(\theta\right), & \underline{\theta} \leq \theta < \bar{\theta} \\ 1, & \theta = \bar{\theta}. \end{cases}$$

The adjusted distribution imply an average $\int_{\underline{\theta}}^{\bar{\theta}} \theta dG\left(\theta\right) = \beta$.

- Plus transversality condition $\Rightarrow$ Viscosity solution.

Rules-free equilibrium: spending ▸ Back

Lemma 1 (Spending pattern). *Suppose CRRA with risk aversion γ. When not in default, the spending growth rate is*

$$\frac{\dot{g}^A(\theta,b)}{g^A(\theta,b)} = \frac{1}{\gamma}\left(\frac{\partial(r(b)\,b)}{\partial b} - \rho - \lambda + \lambda\beta\frac{-\frac{\partial}{\partial b}\mathbb{E}\left[v(\theta',b)\right]}{\theta u'\left(g^A(\theta,b)\right)}\right)$$

- Present bias leads to overspending and debt overaccumulation.

Default pattern

Back

Lemma 3 (High types default first). *If permanent exclusion* $\phi = 0$,

- Default threshold $b^A(\theta)$ is decreasing in θ: $\frac{\partial b^A(\theta)}{\partial \theta} \leq 0$.
- If there exists savers, the threshold is strictly decreasing: $\frac{\partial b^A(\theta)}{\partial \theta} < 0$, $\forall \theta$.

Report ▸ Back

- If type θ reports $\tilde{\theta}$, follow allocation $\left\{g\left(\tilde{\theta},b\right),\delta\left(\tilde{\theta},b\right)\right\}$ and obtain payoff:

$$w(\tilde{\theta},\theta,b;\mathcal{A})=\left(1-\delta\left(\tilde{\theta},b\right)\right)w^{n}(\tilde{\theta},\theta,b;\mathcal{A})+\delta\left(\tilde{\theta},b\right)w^{d}(\tilde{\theta},\theta;\mathcal{A}),$$

where

$$(\rho+\lambda)\,w^{n}(\tilde{\theta},\theta,b;\mathcal{A})=\theta u\left(g\left(\tilde{\theta},b\right)\right)+\dot{b}\left(\tilde{\theta},b\right)w_{b}^{n}(\tilde{\theta},\theta,b;\mathcal{A})+\lambda\beta\mathbb{E}[v(\theta',b;\mathcal{A})]$$

$$(\rho+\lambda+\phi)\,w^{d}(\tilde{\theta},\theta;\mathcal{A})=\theta u\left(\kappa\tau\right)+\phi w^{n}(\tilde{\theta},\theta,0;\mathcal{A})+\lambda\beta\mathbb{E}[v^{d}(\theta';\mathcal{A})]$$

Assumption ▸ Back

Assumption 1 (Type distribution). *$F(\theta)$ admits a differentiable density $f(\theta)$:*

$$\frac{\theta f'(\theta)}{f(\theta)} \geq -\frac{2-\beta}{1-\beta}; \quad \forall \theta \in \Theta$$

- Similiar to Amador Werning Angeletos 2006.
- Ensures $G(\theta) = F(\theta) + (1-\beta)\,\theta f(\theta)$ non-decreasing in $[\underline{\theta}, \bar{\theta})$

Interest rate externality

Back

Lemma 4 (Interest rate externality). *If the principal had perfect information, it would default when debt exceeds $b^P(\theta)$, which satisfies:*

$$v^n(\theta, b^P(\theta)) = v^d(\theta) + \lambda \mathbb{E}\left[\frac{\partial v^n(\theta', b^P(\theta))}{\partial r(b^P(\theta))}\left(1 - \delta^P(\theta', b^P(\theta))\right)\right]$$

Default rules ▸ Back

Proposition 5 (Forbid or force default?). *Suppose* $\beta \in (0,1)$,

(i) If discretionary default $b^A(\theta)$ is monotone decreasing, the debt bounds:

$$\underline{b} > \underline{b}^A \quad \textit{and} \quad \bar{b} = \bar{b}^A.$$

$\forall b \in [\underline{b}^A, \underline{b})$, discretionary default $\mathbb{E}\left[v(\theta,b)\right] < \mathbb{E}\left[v^n(\theta,b)\right] \Rightarrow$ forbid default.

(ii) If discretionary default $b^A(\theta)$ is monotone increasing, the debt bounds:

$$\underline{b} = \underline{b}^A \quad \textit{and} \quad \bar{b} < \bar{b}^A.$$

$\forall b \in (\bar{b}, \bar{b}^A]$, discretionary default $\mathbb{E}\left[v(\theta,b)\right] < \mathbb{E}\left[v^d(\theta)\right] \Rightarrow$ force default.

No-default benchmark: AWA rule

▸ Back

Lemma 5 (No default). *When default is not possible, for all debt levels $b < \frac{\tau}{r_f}$, a debt-independent spending threshold θ^{s*}:*

(i) (Severe present bias) If $\beta \leq \underline{\theta}$, all discretion is taken away.

(ii) (Mild present bias) If $\beta > \underline{\theta}$, the spending threshold:

$$\theta^{s*} = \beta \mathbb{E}\left[\theta | \theta \geq \theta^{s*}\right].$$

Differentiability, jumps & kinks

▸ Back

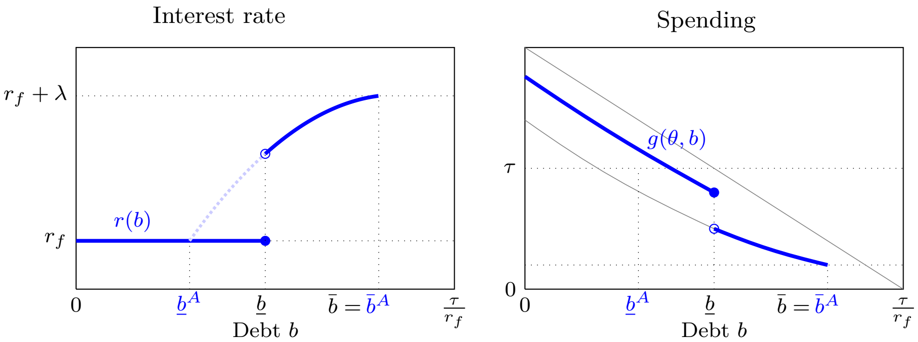
Lemma A4. *If the rule forbids default, i.e., $\underline{b}^A < \underline{b} < \bar{b}$, when debt surpasses $\underline{b}$:*

(i) Interest rate $r(b)$ jumps upward: $r(\underline{b}) < \lim_{b \downarrow \underline{b}} r(b)$.

(ii) Discretionary spending $g(\theta, b)$ jumps downward: $g(\theta, \underline{b}) > \lim_{b \downarrow \underline{b}} g(\theta, b)$.

(iii) Value functions display a kink and are piecewise differentiable:

$$w_b^n(\theta, \underline{b}) > \lim_{b \downarrow \underline{b}} w_b^n(\theta, b) \quad \text{and} \quad v_b^n(\theta, \underline{b}) > \lim_{b \downarrow \underline{b}} v_b^n(\theta, b).$$



Extension: business cycles

BACK

- Revenue τ is observable and contractible and follows:

$$d\log(\tau) = \nu \log\left(\frac{\bar{\tau}}{\tau}\right) dt + \sigma_\tau dW$$

- Allocation: $\{g(\theta, b, \tau), \delta(\theta, b, \tau)\}$. Interest rate:

$$r\left(b, \tau\right) = r_f + \lambda \mathbb{E}\left[\delta\left(\theta, b, \tau\right)\right]$$

Extension: business cycles

BACK

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$$r(b, \tau) = r_f + \lambda \mathbb{E}\left[\delta(\theta, b, \tau)\right]$$

Proposition B1. *There exist* ***state-dependent*** *bounds of debt*

$$0 \leq \underline{b}(\tau) < \bar{b}(\tau)$$

and a ***state-dependent*** *spending threshold*

$$\theta^s(b, \tau) \in \Theta, \;\; \forall b \leq \bar{b}(\tau)$$

i) Types $\theta \leq \theta^s(b, \tau)$ have discretion to spend; above abide by the rule.

ii) If $b \leq \underline{b}(\tau)$, forbid default; if $b > \bar{b}(\tau)$, force default; in between, discretion.

Extension: business cycles

BACK

- When not in default, value functions satisfy:

$$(\rho+\lambda)w^n(\theta,b,\tau) = \max_g \{\theta u(g) + (r(b,\tau)b + g - \tau)w^n_b(\theta,b,\tau)\} + \lambda\beta\mathbb{E}[v(\theta',b,\tau)] + \nu\log\left(\frac{\bar{\tau}}{\tau}\right)\tau w^n_\tau(\theta,b,\tau) + \frac{1}{2}\sigma_\tau^2\tau^2 w^n_{\tau\tau}(\theta,b,\tau)$$

$$(\rho+\lambda)v^n(\theta,b,\tau) = \theta u(g^*) + (r(b,\tau)b + g^* - \tau)v^n_b(\theta,b,\tau) + \lambda\mathbb{E}[v(\theta',b,\tau)] + \nu\log\left(\frac{\bar{\tau}}{\tau}\right)\tau v^n_\tau(\theta,b,\tau) + \frac{1}{2}\sigma_\tau^2\tau^2 v^n_{\tau\tau}(\theta,b,\tau)$$

- When in default, value functions satisfy:

$$(\rho+\lambda+\phi)w^d(\theta,\tau) = \theta u(\kappa\tau) + \phi w^n(\theta,0,\tau) + \lambda\beta\mathbb{E}[v^d(\theta',\tau)] + \nu\log\left(\frac{\bar{\tau}}{\tau}\right)\tau w^d_\tau(\theta,\tau) + \frac{1}{2}\sigma_\tau^2\tau^2 w^d_{\tau\tau}(\theta,\tau)$$

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