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Debt Sustainability, Confidence Risk and International Reserves

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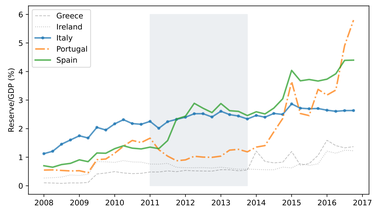
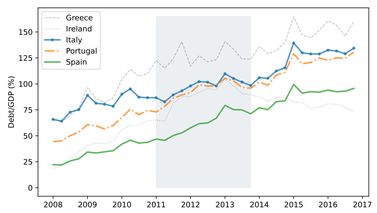
Motivation

- Governments have positive amounts of reserves and debt
- Puzzle: why not use reserve to pay down debt?
- Possible explanations:
  - Governments accumulate reserves when bond prices are high and use them when prices are low [1]
- Not useful to explain the behavior of some European countries during recent crises





Can governments accumulate reserves to reduce confidence risk on sovereign debt?

What do we do?

Build a three-period model based on Lorenzoni and Werning(2019) [2]

- Exogenous surplus/deficit
- Default when repayment is not feasible
- Level of reserves is the only choice

For some level of deficit,

- Portfolio without reserves is subject to multiple equilibria
- Portfolio with reserves and more debt leads to a unique equilibrium
- Unique equilibrium has a lower expected prob. of default

Main Result: Government should accumulate reserves to reduce the risk of a self-fulfilling crisis

Model: Three-period

Stochastic Process

- **Period Zero and One:** constant deficit z_0, z_1
  - prob. π, $\omega_t = 0$, bad sunspot
- **Period Two:** surplus z_2
  - $z_2 \sim F(z_2)$ with support $[\underline{Z}, \overline{Z}]$

Government

- **Period Zero**
  - Two-period bond b_1 with coupons $\{\kappa_1, (1-\delta)\kappa_2\}$
  - One-period risk-free reserve a_1 that pays one
- **Period One**
  - One-period bond b_2 that promises to pay κ_2
- $d_t = 1$ **if default**
  - Recovery value $\nu_t = \max\{\phi z_t, 0\}$ with $\phi \in [0,1]$
- **Absent default, budget constraints are**

$$z_0 + q_0(s_0)(b_1(s_0)) = q_a a_1(s_0),$$
$$z_1 + q_1(s_1)(b_2(s_1) - (1-\delta)b_1(s_0)) + a_1(s_0) = \kappa_1 b_1(s_0),$$
$$z_2 \geq \kappa_2 b_2(s_1)$$

International investors

- **Risk-neutral, discount factor** β
- **Non-arbitrage condition:**

$$q_t = \beta \mathbb{E}\left[(1-d_{t+1})(\kappa_{t+1} + (1-\delta)q_{t+1}) + d_{t+1}\frac{\nu_{t+1}}{b_{t+1}} | s_t\right]$$

Competitive Equilibrium

A competitive equilibrium consists of a sequence of prices $\{q_0, q_1\}$; debt issuance $\{b_1, b_2\}$; reserves $\{a_1\}$; and default rules $\{d_t\}_{t=1,2}$, such that:

1. Given prices; debt issuance, reserves, and default rules are consistent with the government's budget constraints.
2. Given debt, reserves and default rules; the non-arbitrage condition of international investors holds.

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Equilibrium

Period Two

- Budget constraint is $z_2 \geq \kappa_2 b_2$
  - If $z_2 \geq \kappa_2 b_2$, repays
  - Otherwise, defaults, and each bondholder receives

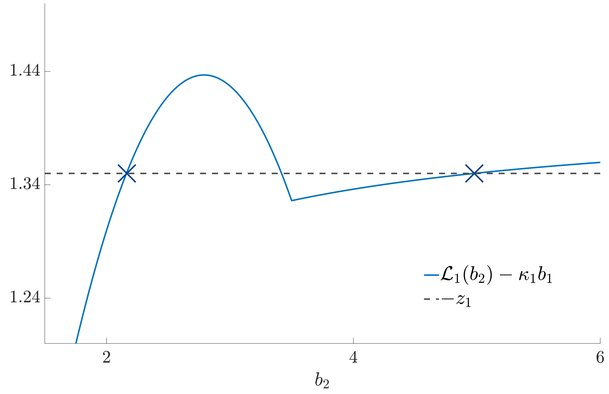
$$\frac{\phi z_2}{b_2} < \kappa_2$$

- Equilibrium bond price function:

$$Q_1(b_2) = \beta\left[(1 - F(\kappa_2 b_2))\,\kappa_2 + \frac{\phi}{b_2}\int_{\underline{Z}}^{\kappa_2 b_2} z_2 dF(z_2)\right]$$

Period One

$$z_1 + Q_1(b_2)(b_2 - (1-\delta)b_1) + a_1 = \kappa_1 b_1$$



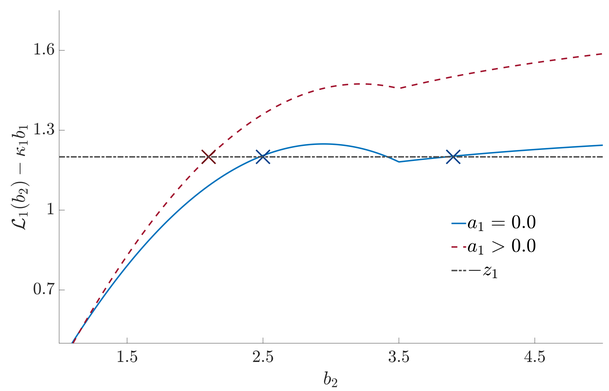
Period Zero

- Equilibrium bond price function:

$$Q_0(b_1, a_1) = \beta(\kappa_1 + (1-\delta)\mathbb{E}\left[Q_1(B_2(b_1, a_1, \omega_1))\right])$$

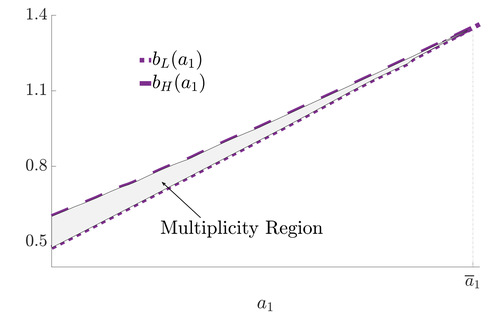
- Budget constraint:

$$z_0 + Q_0(b_1, a_1)(b_1) = q_a a_1$$

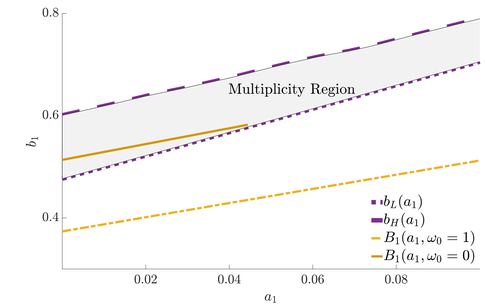


Self-Fulfilling Crises and Reserves

Proposition 1: There exists a level of reserves $\overline{a}_1$ such that $b_L(\overline{a}_1) = b_H(\overline{a}_1)$ and the equilibrium in period one is unique.



Proposition 2: Assume z_0 is such that the economy with $a_1 = 0$ has multiple equilibria. Then there exists a level of reserves a_1^* for which the economy has a unique equilibrium associated with a lower expected b_2.



Conclusion

- Reserves provide insurance against confidence-driven fluctuations in prices
- Accumulating reserves, the government can effectively restore uniqueness in sovereign debt markets
- The government can mitigate confidence risk by accumulating foreign reserves

Reserves can help to eliminate self-fulfilling crises

References

[1] Javier Bianchi, Juan Carlos Hatchondo, and Leonardo Martinez. International reserves and rollover risk. American Economic Review, 108(9):2629–2670, 2018.

[2] Guido Lorenzoni and Ivan Werning. Slow moving debt crises. American Economic Review, 109(9):3229–3263, 2019.