

Discussion of  
**Multiple Equilibria in Open Economy Models with  
Collateral Constraints: Overborrowing Revisited**

by S. Schmitt-Grohe & M. Uribe

Ambrogio Cesa-Bianchi (BoE and CfM)<sup>1</sup>

Workshop on International Business Cycles  
Banque de France  
June 2016

---

<sup>1</sup>The views expressed here are solely those of the author and should not be taken to represent those of the Bank of England.

# This paper

- ▶ Studies open economy models in which external borrowing is limited by collateral
- ▶ Known features of this class of models
  - Amplification  
[Fisher (1933), Mendoza (2002)]
  - Pecuniary externality  
[Jeanne and Korinek (2010a); Bianchi (2011); Benigno et al (2013)]
  - Multiplicity of equilibria  
[Jeanne and Korinek (2010a, 2010b)]
- ▶ This paper focuses on the (often disregarded) existence of **multiple equilibria** and its implications for positive and normative analysis

# This paper – Contribution & Main results

- ▶ Characterize multiple equilibria analytically (perfect foresight)
- ▶ Revisit the scope for policy intervention stemming from the pecuniary externality  $\Rightarrow$  Economy displays **underborrowing**
- ▶ Derive a class of capital control policies that implement the Ramsey optimal allocation
- ▶ Provide an algorithm for solution and simulation of models with occasionally binding collateral constraint and multiple equilibria (available on website!)

# My discussion

- ▶ Can't do justice to the paper in 10 minutes...
- ▶ Plan
  1. Brief summary
  2. Generality of the analytical results
  3. Some comments on quantitative results
  4. Implications for macro-prudential policy

# Environment

- ▶ Household budget/collateral constraints

$$c_t^T + p_t c_t^N + d_t = y_t^T + p_t y_t^N + \frac{d_{t+1}}{1+r_t}$$
$$d_{t+1} \leq \kappa (y_t^T + p_t y_t^N)$$

- ▶ Market incompleteness

- *Limited asset menu*: one internationally traded bond ( $d_{t+1}$ ) denominated in terms of tradable goods
- *Limited access to finance*: quantity of borrowing is limited by a fraction ( $\kappa$ ) of income (flow collateral constraint)

# Pecuniary externality

- ▶ The price of pledgeable collateral ( $p_t$ ) is endogenous to the model but exogenous to individual agents
- ▶ That is: agents internalize the collateral constraint

$$\left( \frac{1}{1+r_t} - \mu_t \right) \lambda_t = \beta \mathbb{E} [\lambda_{t+1}]$$

- ▶ However they do not internalize that in the aggregate their borrowing (consumption) decisions are a key determinant of the asset price that enters collateral constraint

$$p_t = \frac{1-a}{a} \left( \frac{c_t^T}{c_t^N} \right)^{\frac{1}{\xi}}$$

# Multiple equilibria

- ▶ Rewrite the collateral constraint using equilibrium conditions<sup>2</sup>

$$d_{t+1} \leq \kappa \left( y_t^T + \left( y_t^T + \frac{d_{t+1}}{1+r_t} - d_t \right)^2 \right) \equiv RHS$$

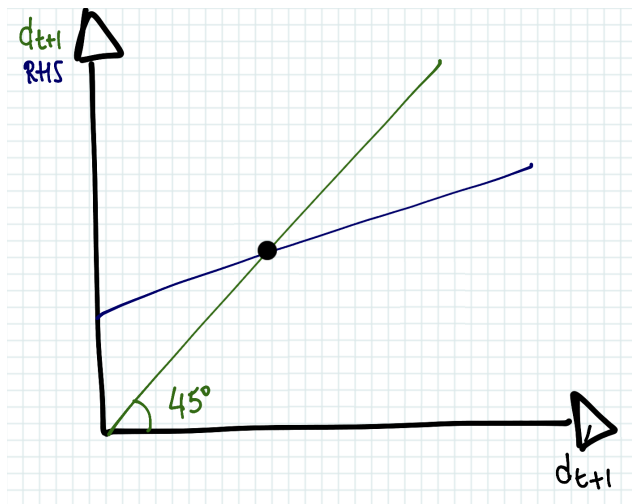
- ▶ Collateral is increasing in the level of debt  $d_{t+1}$  (financial accelerator)
- ▶ But if slope of  $RHS$  is greater than 1 we get a “perverse” relation
  - For a 1 additional unit of debt, leverage falls  $\Rightarrow$  Constraint becomes looser
- ▶ Multiplicity arises when the slope of  $RHS$  is larger than 1 over some range

---

<sup>2</sup>Assuming  $a = 0.5$ ,  $\sigma = 1/\xi = 2$ ,  $y_t^N = 1$

# Basics of multiple equilibria

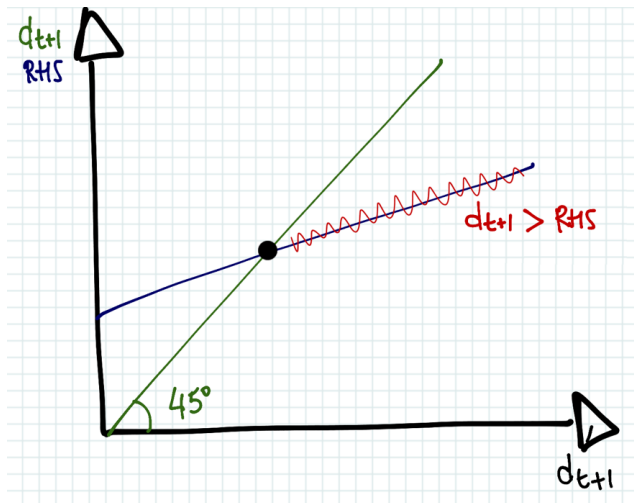
Intuition – Unique (binding) equilibrium



NOTE. I'm ignoring the existence of an unconstrained equilibrium (like equilibrium A in the paper) for simplicity.

# Basics of multiple equilibria

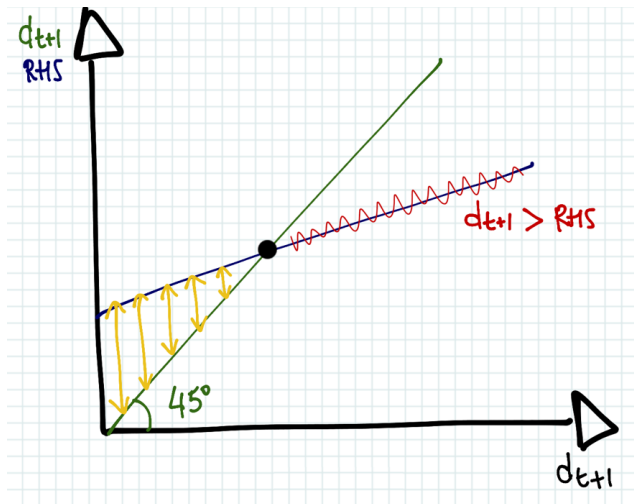
Intuition – Unique (binding) equilibrium



NOTE. I'm ignoring the existence of an unconstrained equilibrium (like equilibrium A in the paper) for simplicity.

# Basics of multiple equilibria

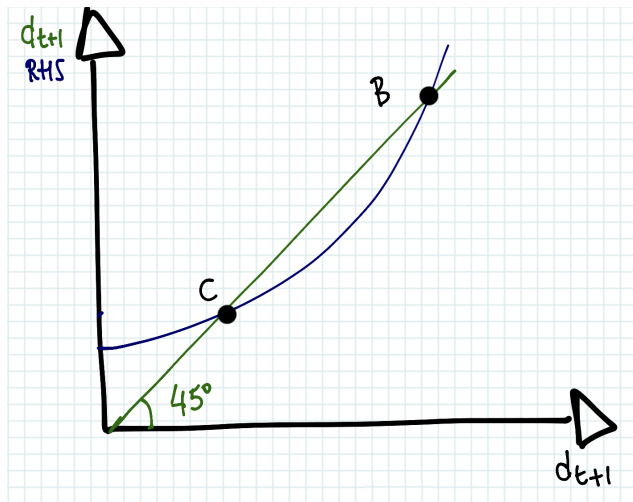
Intuition – Unique (binding) equilibrium



NOTE. I'm ignoring the existence of an unconstrained equilibrium (like equilibrium A in the paper) for simplicity.

# Basics of multiple equilibria

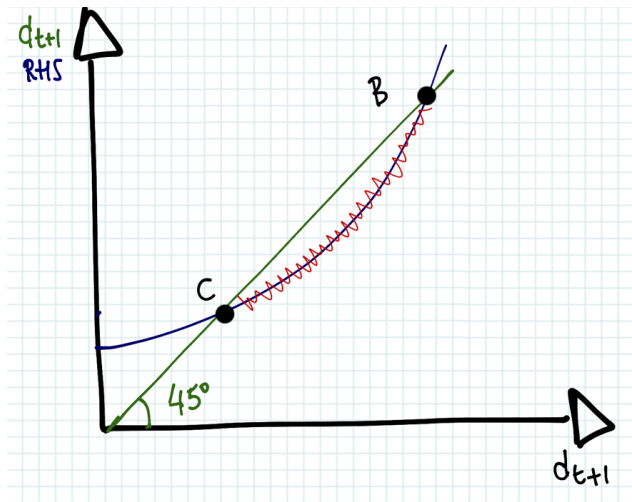
## Intuition – Multiple (binding) equilibria



NOTE. I'm ignoring the existence of an unconstrained equilibrium (like equilibrium A in the paper) for simplicity.

# Basics of multiple equilibria

## Intuition – Multiple (binding) equilibria



NOTE. I'm ignoring the existence of an unconstrained equilibrium (like equilibrium A in the paper) for simplicity.

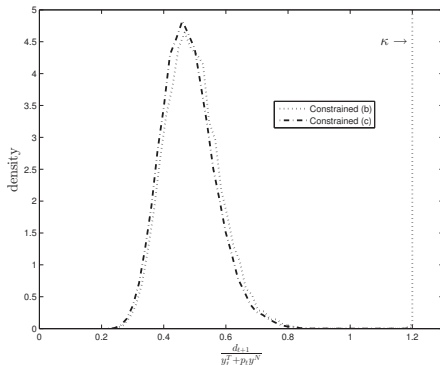
# Analytical results – How general is the result on the existence of multiple equilibria?

- ▶ Analytical results in the paper show that (for some parameter combinations) the model can have up to 3 different equilibria
  - 2 where the collateral constraint is binding, 1 unconstrained
- ▶ **Question** How large is the “multiple equilibria set”? Are the combinations of parameters empirically relevant?
- ▶ **Suggestion** Characterize the presence of multiple equilibria as a function of
  - Share of tradable consumption ( $a$ )
  - Discount factor ( $\beta$ )
  - Borrowing limit ( $\kappa$ )
  - Elasticity of substitution ( $\xi$ )

# Quantitative (positive) results – Frequency of ‘crises’

- ▶ Stochastic simulation of the unregulated economy (reveals multiple equilibria!)

Figure 7: The Equilibrium Distributions of Leverage



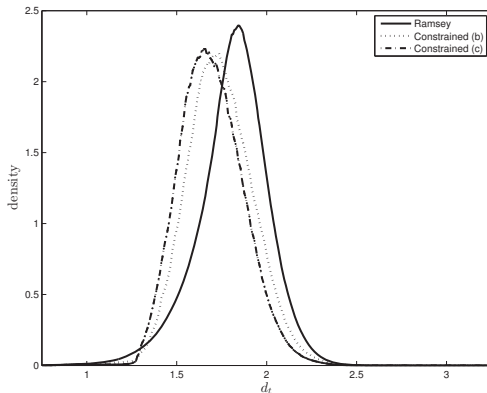
# Quantitative (positive) results – Frequency of ‘crises’

- ▶ Stochastic simulation of the unregulated economy (reveals multiple equilibria!)
- ▶ Collateral constraint almost never binds
- ▶ Annual frequency of ‘crisis’ in simulated data is very low ( $\sim 0.5\%$  in  $B$  equil.,  $\sim 0.1\%$  in  $C$  equil)...
- ▶ ... but historical data suggests higher frequency ( $\sim 2.8\%$ )  
[Laeven & Valencia, 2013]
- ▶ **Question** How to reconcile the model with the data?

# Quantitative (normative) results – Welfare improving policies

- ▶ Stochastic simulation under Ramsey optimal capital control policy (reveals underborrowing!)

Figure 8: Equilibrium Underborrowing



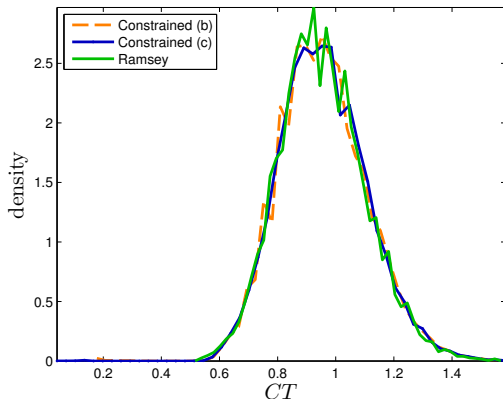
## Quantitative (normative) results – Welfare improving policies

- ▶ Stochastic simulation under Ramsey optimal capital control policy (reveals underborrowing!)
- ▶ Difference between Ramsey and unregulated economies seem quantitatively small
- ▶ Debt to GDP (the variable most directly affected by the pecuniary externality)

Ramsey	(B) Equil.	(C) Equil.
13.1%	12.4%	12.1%

- ▶ **Questions** How big are the welfare gains from capital controls policy?

# Quantitative results – Distribution of tradable consumption



NOTE. Codes available at  
<http://www.columbia.edu/~mu2166/underborrowing/>.








- ▶ Distribution of consumption looks similar across economies
- ▶ Main difference is for extreme events
- ▶ **Conjecture** Collateral constrain does not matter much for medium-to-large sized fluctuations. It matters only for crisis. But crisis are very rare events.

# What future for macroprudential policy?

- ▶ Macropru: policy that limits the build up of vulnerabilities (aka, leverage) in booms to reduce the probability/size of the bust
- ▶ Overborrowing result is at the heart of current macroprudential policy framework
  - Countercyclical capital buffers (CCyB), LTI/LTV policies, etc...
- ▶ This paper challenges this view
- ▶ **Question** What are the implications for policy? What is the optimal policy prescription?

# Summing up

- ▶ Great paper
- ▶ Lots of interesting results
- ▶ Very relevant for macropru policy debate

- 
- Benigno, Gianluca, Huigang Chen, Christopher Otrok, Alessandro Rebucci, and Eric R. Young (2013). Financial Crises and Macro-Prudential Policies. *Journal of International Economics* 89, 453-470.
- 
- Bianchi, Javier (2011). Overborrowing and Systemic Externalities in the Business Cycle. *American Economic Review* 101, 3400-3426.
- 
- Fisher, I. (1933). The debt-deflation theory of great depressions. *Econometrica*, 1(4):337-357.
- 
- Jeanne, O. and Korinek, A. (2010a). Excessive volatility in capital flows: A Pigouvian taxation approach. *American Economic Review*, 100(2):403-407.
- 
- Jeanne, O. and Korinek, A. (2010b). Managing credit booms and busts: A Pigouvian taxation approach. NBER Working Paper, w16377.
- 
- Luc Laeven and Fabián Valencia (2013). Systemic Banking Crises Database, IMF Economic Review, Palgrave Macmillan, vol. 61(2):225-270
- 
- Mendoza, E. G. (2002). Credit, prices, and crashes: Business cycles with a sudden stop. In Edwards, S. and Frankel, J. A., editors, *Preventing Currency Crises in Emerging Markets*. University of Chicago Press.