Macroprudential policy: its foundations and challenges

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Foundations: Empirical

- Macroprudential policy (MPP) aims to weaken credit booms in “good times” so as to reduce frequency & severity of financial crises
- Empirical rationale: Credit booms are infrequent, but end in deep, protracted crises
- Mendoza & Terrones (2012), 1960-2010 data:
    1. Credit booms occur with 2.8% frequency
    2. 1/3rd end in banking or currency crises.
    3. 3 years after credit peaks, GDP is 5% (8%) below trend in adv. (emerg.) economies

Foundations: Theoretical

- Quantitative Macro/Finance MPP models require:
  1. A theory that can explain observed features of credit booms/crises
  2. A market-failure argument that can justify policy intervention
  3. A framework that can be used to design MPP, evaluate its effectiveness & analyze its tradeoffs

- Slow progress in developing quantitative MPP models:
  1. Aiming for a powerful toolbox (akin to DSGE models for monetary policy)
  2. Few models yield crises fully driven by endogenous financial amplification and nonlinearities (instead of being caused by large, non-standard shocks)

Foundations: Fisherian models

- Fisherian models: borrowing capacity limited to a fraction of market value of collateral
- Fisherian deflation produces strong financial amplification and nonlinearities, and accounts for several stylized facts of financial crises
- Market failure present as pecuniary externalities
- Quantitatively, optimal MPP reduces markedly the magnitude & frequency of crises…but with nontrivial challenges

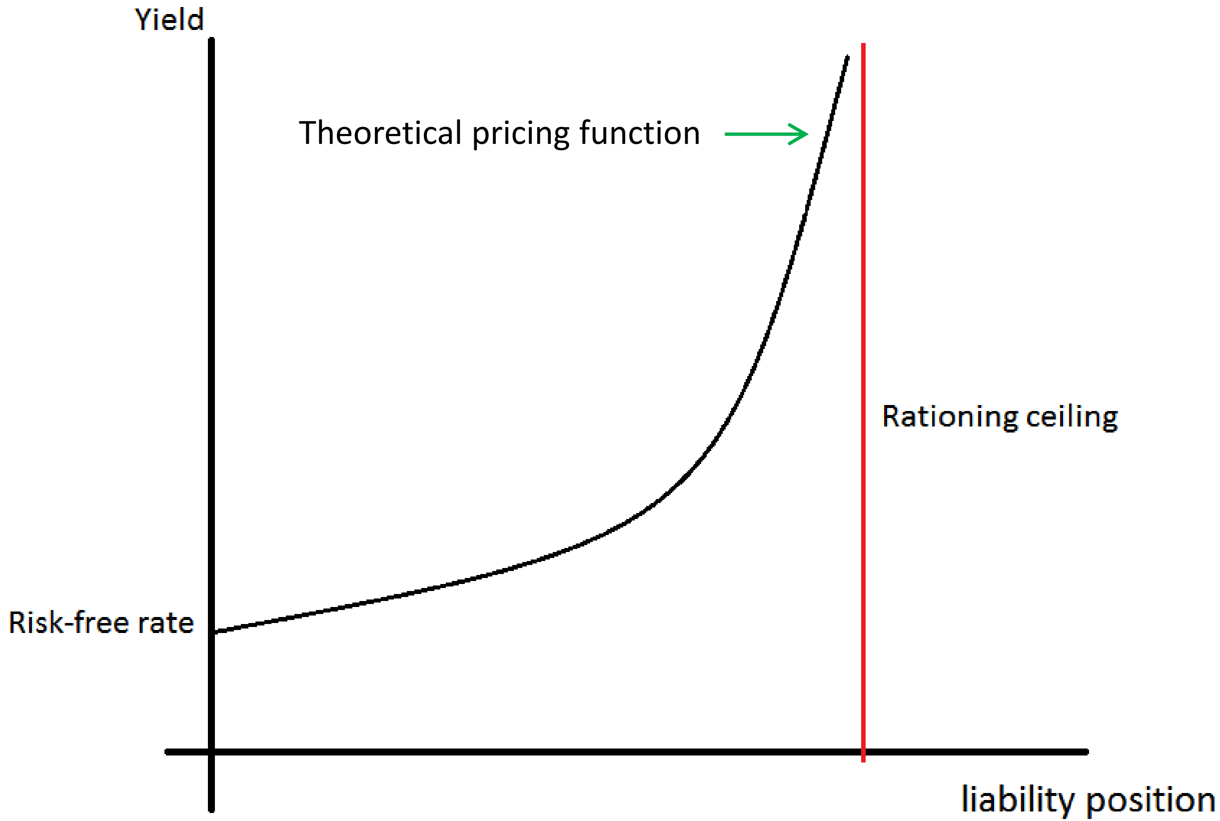
The challenges

1. *Nonlinearities & amplification:* A general case for global, nonlinear methods to study models of fin. crises and MPP (particularly Fisherian models)

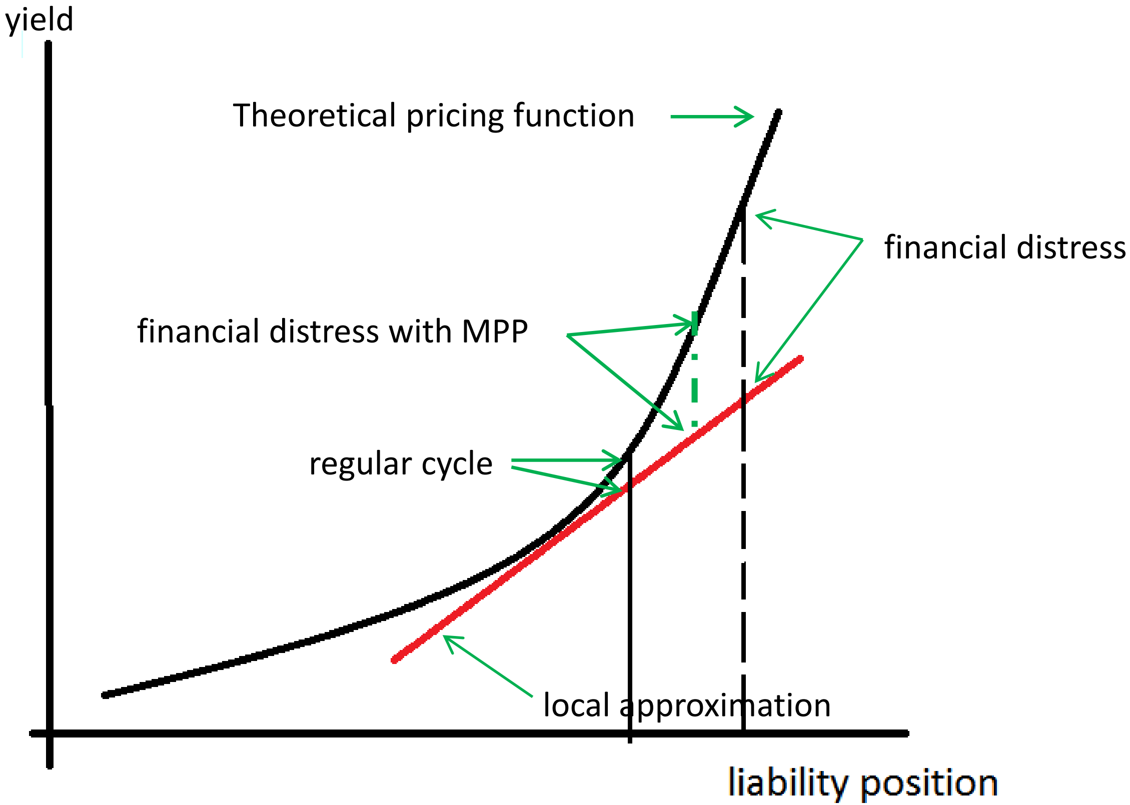
2. *Complexity & credibility*: Optimal MPP follows complex rules and is time-inconsistent under commitment, hence lacks credibility (illustrated using a model w. assets as collateral)

3. *Coordination failure in financial & monetary policies*: Costly inefficiencies due to Tinbergen's rule violations and strategic interaction (illustrated using variant of Christiano, Motto & Rostagno's (2014) BGG model with risk shocks)

1. General case for global, nonlinear methods



1. General case for global, nonlinear methods



Fisherian models & pecuniary externalities

- Fisherian models: occasionally binding collateral constraints with collateral valued at market prices:

$$\frac{b_{t+1}}{R_t} \geq -\kappa_t f(p_t)$$

1. Debt-to-income (DTI) models: $f\left(p_t^N\right) = y_t^T + p_t^N y_t^N$
2. Loan-to-value (LTV) models : $f(q_t) = q_t k_{t+1}$

- Market price of collateral determined by aggregate allocations: $f\left(p_t^N(c_t^T, c_t^N)\right)$, $f(q_t(C_t, C_{t+1}))$

- Pecuniary externality: Agents choose debt in "good times" ignoring price responses in "crisis times"

Where is the externality?

- Decentralized Euler eq. for bond holdings:

$$u'(t) = \beta R_t E\left[u'(t+1)\right] + \mu_t$$

  - In normal times μ_t=0 => standard Euler equation

- But for a planner choosing bonds internalizing the externality, the Euler eq. is:

$$u'(t) = \beta R_t E\left[u'(t+1) + \mu^{*}_{t+1}\kappa_{t+1} f'(t+1)\frac{\partial p_{t+1}}{\partial \tilde{C}_{t+1}}\frac{\partial \tilde{C}_{t+1}}{\partial b_{t+1}}\right]$$

- If social MC of debt exceeds private MC, private agents “overborrow” in good times

Proving the social MC of debt *is* higher

- Higher social MC of debt requires:

$$f'(t+1)(\partial p_{t+1}/\partial \tilde{c}_{t+1})(\partial \tilde{c}_{t+1}/\partial b_{t+1}) > 0$$

- These are trivially positive: borrowing capacity rises with collateral values and consumption rises with wealth

- But the sign of this is a key endogenous equilibrium outcome, which can be proven to be positive:

DTI setup:

$$\frac{\partial p^N_{t+1}}{\partial C^T_{t+1}} = \frac{-p^N_{t+1} u_{c^T c^T}(t+1)}{u_{c^T}(t+1)} > 0$$

LTV setup:

$$\frac{\partial q_{t+1}}{\partial C_{t+1}} = \frac{-q_{t+1} u_{cc}(t+1)}{u_c(t+1)} > 0$$

- A large externality is implied if the model is able to generate large price drops during crises!

Optimal MPP

- An optimal macroprudential debt tax decentralizes the planner’s allocations:

$$\tau_t = \frac{E_t\left[\mu^*_{t+1}\kappa_{t+1} f'(t+1)\frac{\partial p_{t+1}}{\partial \tilde{C}_{t+1}}\frac{\partial \tilde{C}_{t+1}}{\partial b_{t+1}}\right]}{E_t\left[u'(t+1)\right]}$$

  - $\tau_t > 0$ only if the constraint is expected to bind with some probability at t+1.

- Equivalent instruments: capital requirements, regulatory LTV or DTI ratios.

2. A model with assets as collateral

(complexity & time inconsistency of optimal MPP)

- Model from Bianchi & Mendoza (JPE 2017):
  1. RBC-SOE model with Fisherian constraint
  2. Production w. intermediate goods that require working capital (credit-induced output drop)
  3. Rep. firm-household uses assets in fixed supply as collateral for debt and working capital
  4. Planner internalizes asset pricing condition (asset Euler eq. becomes implementability constraint)
  5. Shocks: TFP (z_t), world interest rate (R_t), and regime-switching LTV or global liquidity (κ_t).
  6. Calibrated to U.S. and OECD data

Rep. firm-household problem

$$\max E_0 \left[\beta^t \frac{\left(c_t - \chi \frac{h^{1+\omega}}{1+\omega} \right)^{1-\sigma}}{1-\sigma} \right]$$

s.t.

$$q_t k_{t+1} + c_t + \frac{b_{t+1}}{R_t} = q_t k_t + b_t + \left[z_t k_t^{\alpha k} m_t^{\alpha m} h_t^{\alpha h} - p^m m_t \right]$$

$$\frac{b_{t+1}}{R_t} - \theta p^m m_t \geq -\kappa_t q_t k_t,$$

Time-consistent social planner

$$V(b,\varepsilon) = \max_{c,b',h,m} \left[\frac{\left(c - \chi \frac{h^{1+\omega}}{1+\omega}\right)^{1-\sigma}}{1-\sigma} + \beta E\left[V(b',\varepsilon')\right] \right]$$

s.t.

$$c + \frac{b'}{R} = b + \left[z 1^{\alpha k} m^{\alpha m} h^{\alpha h} - p^m m \right]$$

$$\frac{b'}{R} - \theta p^m m \geq -\kappa q$$

$$q u_c \left(c - \chi \frac{h^{1+\omega}}{1+\omega}\right) = \beta E\left[u_c \left(\enclose{circle}{\hat{c}'} - \chi \frac{\enclose{circle}{\hat{h}'}^{1+\omega}}{1+\omega}\right)\left(z' F_k(1, \enclose{circle}{\hat{m}'}, \enclose{circle}{\hat{h}'}) + \enclose{circle}{\hat{q}'}\right) + \kappa' \enclose{circle}{\hat{\mu}'} \enclose{circle}{\hat{q}'} \right]$$

Commitment & time inconsistency

- When μ_t >0, the planner views the effects of the choice of b_{t+1} on C_{t+1}, and hence on q_t, differently depending on its ability to commit

- *Commitment:* Promise lower C_{t+1} ,to prop up q_t, because $q_t(C_t, C_{t+1})$ is decreasing in C_{t+1}, but at t+1 this is suboptimal=> time inconsistency

- *Discretion:* The planner of date t considers how its choices affect choices of the planner of t+1 => Markov stationarity eq. is time-consistent

Optimal, time-consistent policy

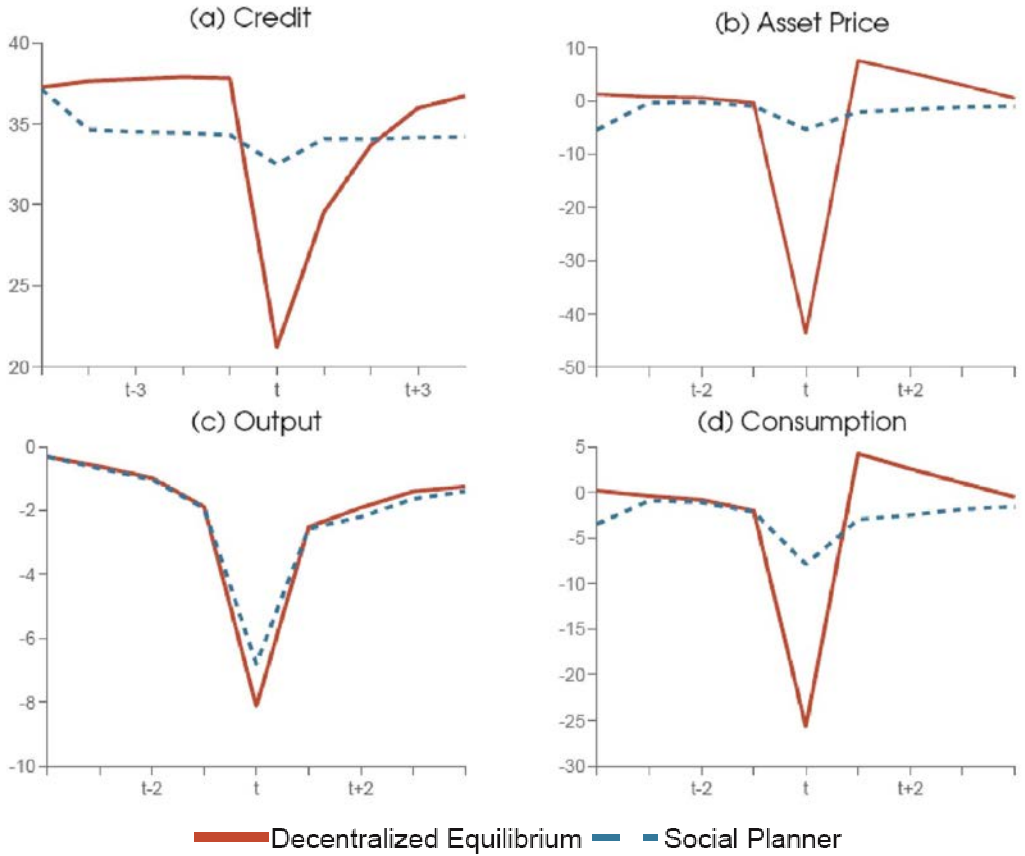
1. Macroprudential component (tackles standard pecuniary externality when μ_t=0 and E$_t[\mu_{t+1}] > 0$):

$$\tau_t^{MP} = \frac{E_t\left[-\kappa_{t+1}\mu_{t+1}^{*}\frac{u_{cc}(t+1)}{u_c(t+1)}Q_{t+1}\right]}{E_t\left[u_c(t+1)\right]}$$

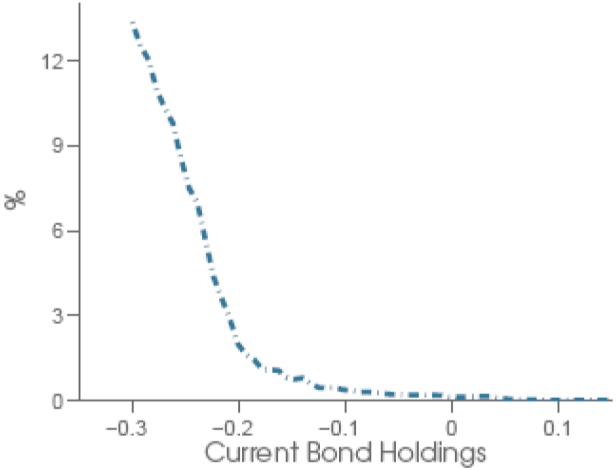
2. Ex-post component (effects on future planners & incentive to prop up value of collateral when $\mu_t > 0$)

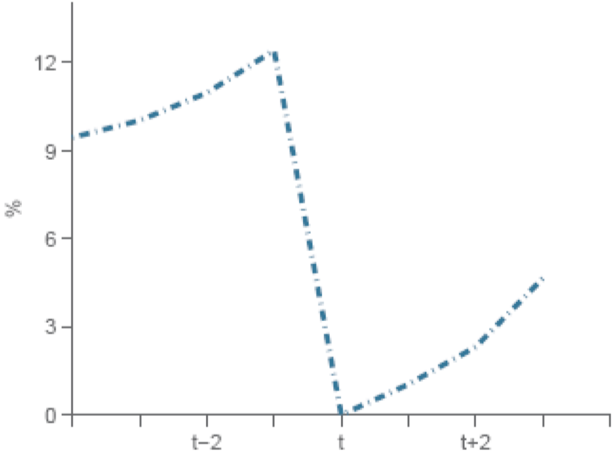
$$\tau_t^{FP} = \frac{E_t\left[\frac{\kappa_t\mu_t^{*}}{u_c(t)}\Omega_{t+1}\right]}{E_t\left[u_c(t+1)\right]} + \frac{\kappa_t\mu_t^{*}\frac{u_{cc}(t)}{u_c(t)}q_t}{\beta R_t E_t\left[u_c(t+1)\right]}$$

Financial crises & policy effectiveness



Complexity


(a) Tax Schedule in Good States

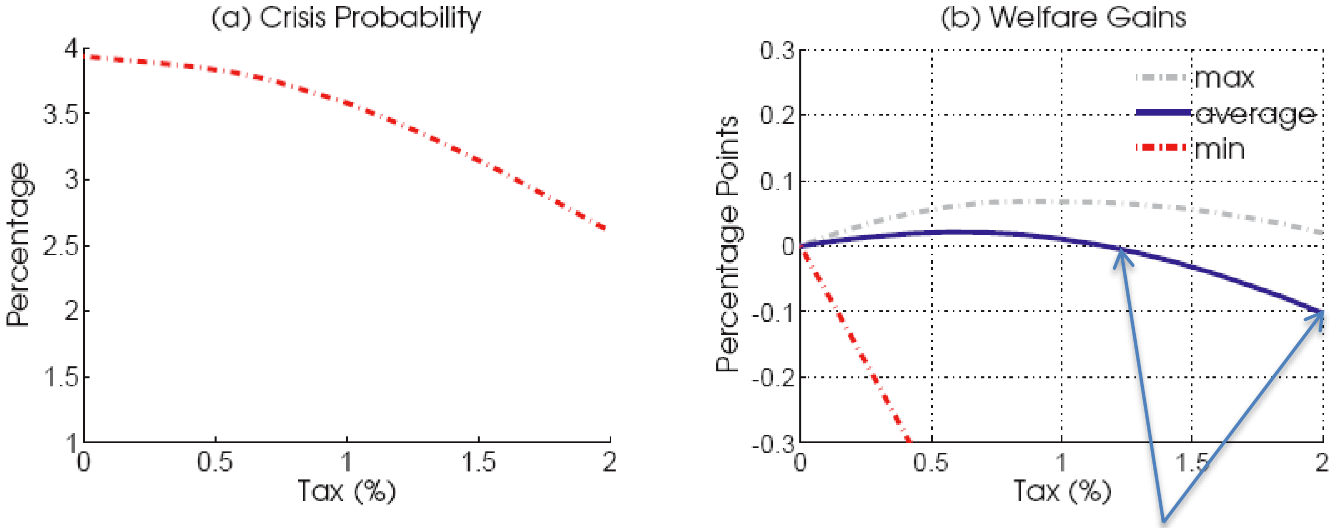

(b) Tax Dynamics around Crises

Optimal (TC) policy & simpler rules

	Decentralized Equilibrium	Optimal Policy	Best Taylor	Best Fixed
Welfare Gains (%)	–	0.30	0.09	0.03
Crisis Probability (%)	4.0	0.02	2.2	3.6
Drop in Asset Prices (%)	−43.7	−5.4	−36.3	−41.3
Equity Premium (%)	4.8	0.77	3.9	4.3
Tax Statistics				
Mean	–	3.6	1.0	0.6
Std relative to GDP	–	0.5	0.2	–
Correlation with Leverage	–	0.7	0.3	–

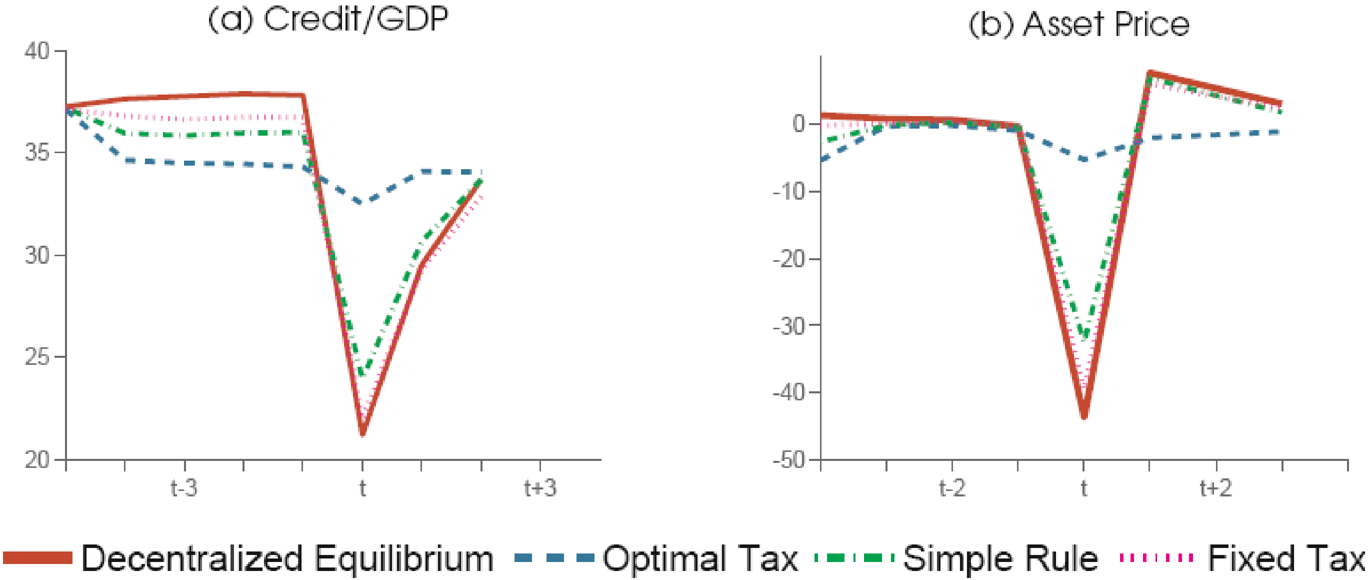
Financial Taylor Rule: $\tau = \max[0, \tau_0(b_{t+1}/\bar{b})^{\eta_b} - 1]$

Simple rules: constant taxes



Welfare-reducing constant taxes

Effects of simple policies on magnitude of crises



3. Coordination failure

- Carrillo et al. (16) model:
  1. DSGE-BGG model with risk shocks (Christiano et al. (14))
  2. Calvo pricing=>inefficiencies in goods markets
  3. Costly monitoring=>inefficiencies in credit-capital market
  4. MP (FP) instrument affects target and payoff of FP (MP)

- Monetary policy follows simple Taylor rule:

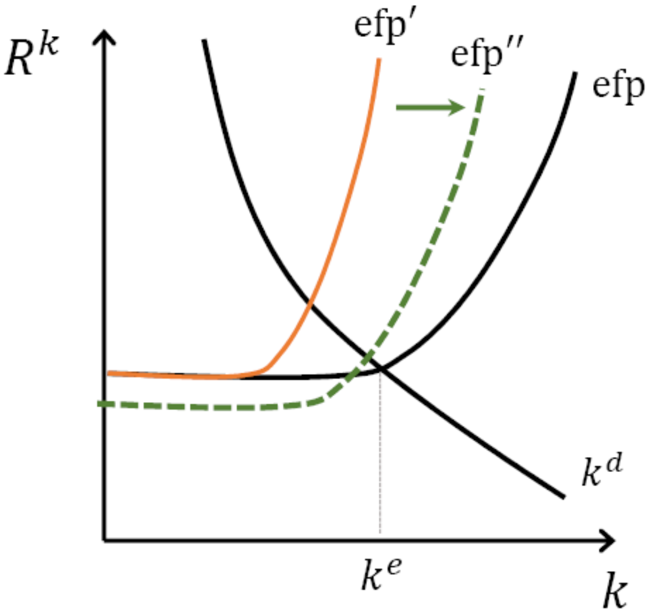
$$(1+i_t) = (1+i)\left(\frac{1+\pi_t}{1+\overline{\pi}}\right)^{a_\pi}$$

- Financial policy rule adjusts a tax on opp. cost of lending depending on credit spread dev. from target:

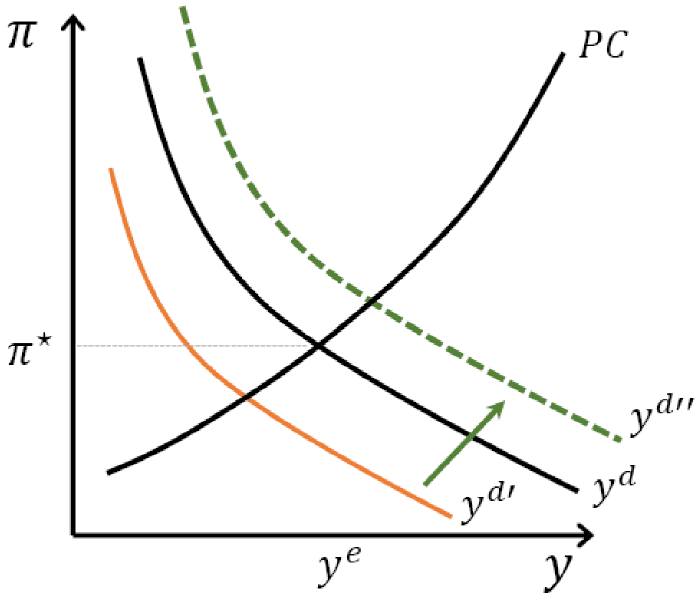
$$\tau_{f,t} = \tau_f \left[E_t \left(\frac{r^k_{t+1}}{R_t}\right) \Big/ \left(\frac{r^k}{R}\right) \right]^{a_r}$$

Policy interactions in response to risk shocks

Credit-capital market



Aggregate supply & demand



Tinbergen’s rule is quantitatively relevant

- Augmented Taylor rule regime:

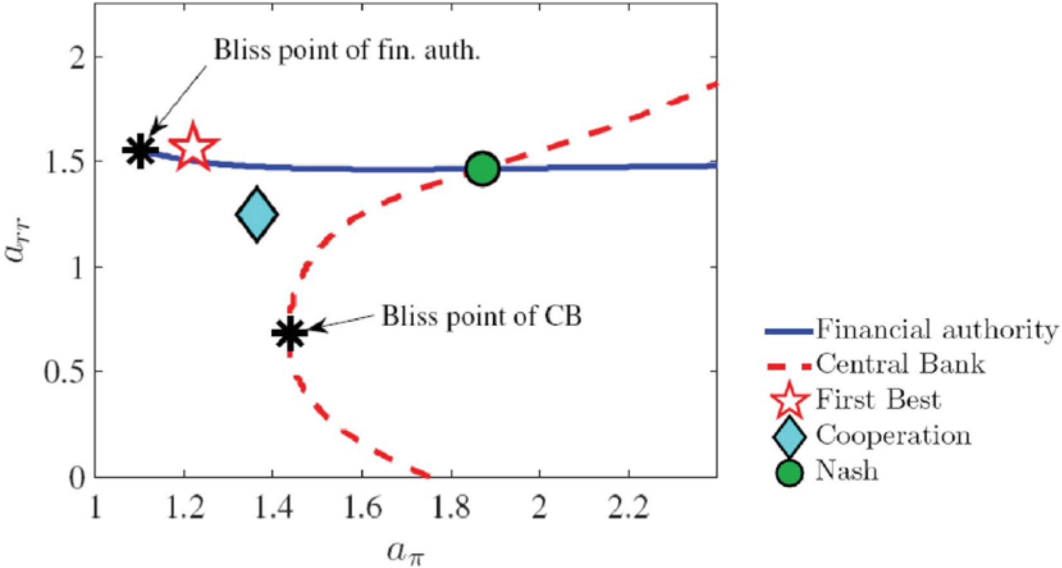
$$(1+i_t) = (1+i)\left(\frac{1+\pi_t}{1+\bar{\pi}}\right)^{\hat{a}_\pi}\left[E_t\left(\frac{r^k_{t+1}}{R_t}\right)\Big/\left(\frac{r^k}{R}\right)\right]^{-\hat{a}_r}$$

- Dual rule regime is significantly superior
  - Welfare is 34 percent higher
  - Policies are too tight with augmented rule v. dual rules

$$(a_\pi = 1.2, a_r = 1.6) \text{ v. } (\hat{a}_\pi = 1.25, \hat{a}_r = 0.26)$$

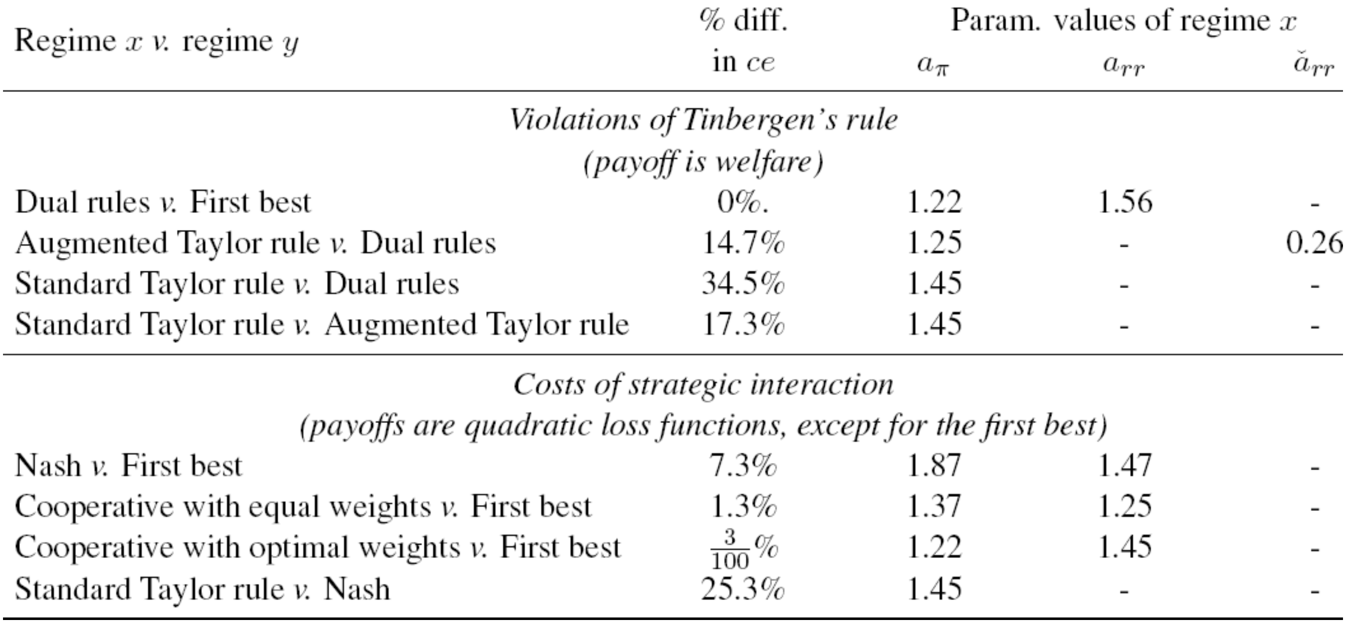
  - Risk shocks cause larger declines in output and investment with augmented rule (30 and 155 basis points larger)
  - …but augmented rule dominates standard Taylor rule

Strategic interaction



- Reaction curves choosing elasticities to minimize sum-of-variance payoffs
- Welfare under Coop. is 6 ppts. higher than under Nash
- Policies under Coop, Nash are too tight relative to “first best”

Welfare costs and elasticities under various policy regimes



Regime x v. regime y	% diff. in ce	Param. values of regime x		
		a_π	a_{rr}	$\check{a}_{rr}$
	Violations of Tinbergen's rule (payoff is welfare)			
Dual rules v. First best	0%.	1.22	1.56	-
Augmented Taylor rule v. Dual rules	14.7%	1.25	-	0.26
Standard Taylor rule v. Dual rules	34.5%	1.45	-	-
Standard Taylor rule v. Augmented Taylor rule	17.3%	1.45	-	-
	Costs of strategic interaction (payoffs are quadratic loss functions, except for the first best)			
Nash v. First best	7.3%	1.87	1.47	-
Cooperative with equal weights v. First best	1.3%	1.37	1.25	-
Cooperative with optimal weights v. First best	$\frac{3}{100}\%$	1.22	1.45	-
Standard Taylor rule v. Nash	25.3%	1.45	-	-

Conclusions

- *Good news*: Progress in developing quantitative models of fin. crises and MPP, with results showing that it can be a very effective policy
- *Bad news*: Optimal MPP faces serious hurdles (complexity, credibility, coordination). Careful quantitative evaluation is necessary to avoid outcomes worse than without MPP.
- Other important hurdles: fin. innovation, information, heterogeneity, int’l coordination, securitization, interconnectedness