



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

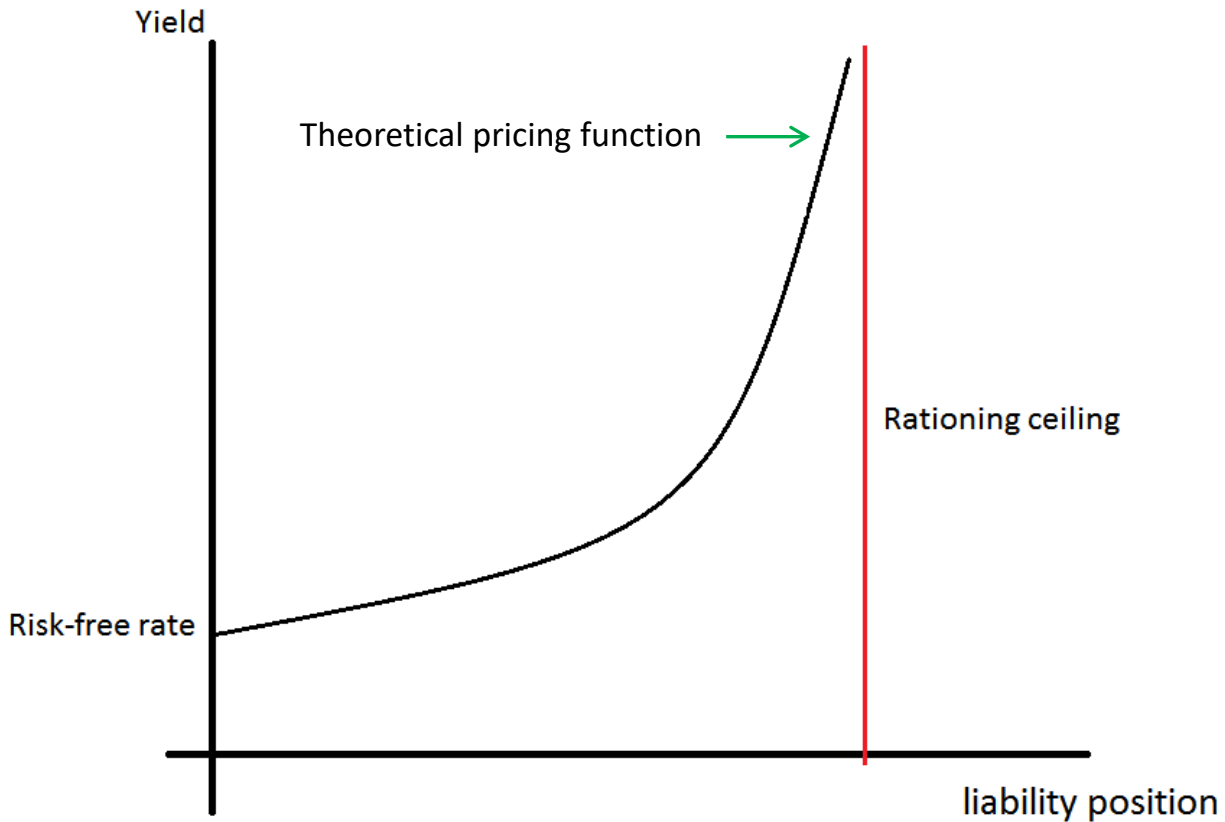


The challenges

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)

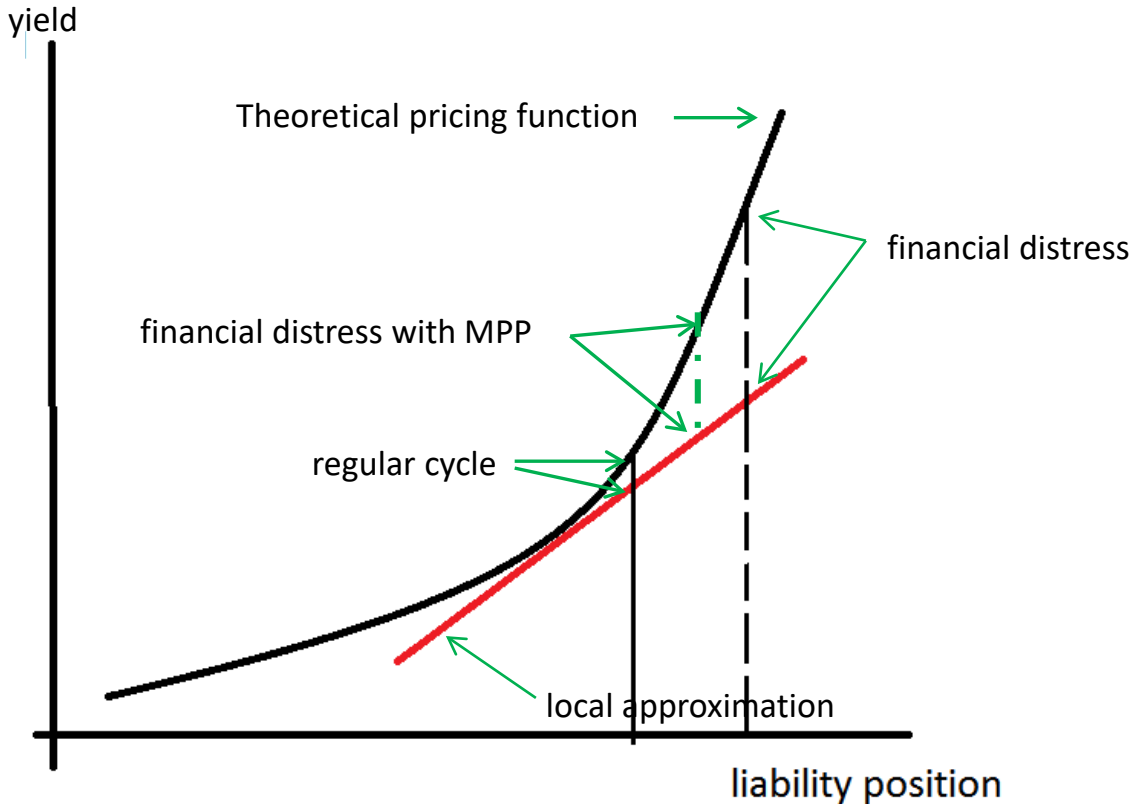


1. General case for global, nonlinear methods





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: $f(p_t^N) = y_t^T + p_t^N y_t^N$
 2. Loan-to-value (LTV) models: $f(q_t) = q_t k_{t+1}$
- Market price of collateral determined by aggregate allocations: $f(p_t^N(C_t^T, C_t^N))$, $f(q_t(C_t, C_{t+1}))$
 - Pecuniary externality: Agents choose debt in “good times” ignoring price responses in “crisis times”



Where is the externality?

- Decentralized Euler eq. for bond holdings:

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

– In normal times $\mu_t=0 \Rightarrow$ 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:

$$\frac{\partial p_{t+1}^N}{\partial C_{t+1}^T} = \frac{-p_{t+1}^N u_{c^T c^T}(t+1)}{u_{c^T}(t+1)} > 0$$

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:

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

- $\tau_t > 0$ 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

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

s.t.

$$c + \frac{b'}{R} = b + [z1^{\alpha k} m^{\alpha m} h^{\alpha h} - p^m m]$$

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

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



Commitment & time inconsistency

- When $\mu_t > 0$, 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 \Rightarrow time inconsistency
- *Discretion*: The planner of date t considers how its choices affect choices of the planner of $t+1$ \Rightarrow Markov stationarity eq. is time-consistent



Optimal, time-consistent policy

1. Macprudential component (tackles standard pecuniary externality when $\mu_t=0$ and $E_t[\mu_{t+1}] >0$):

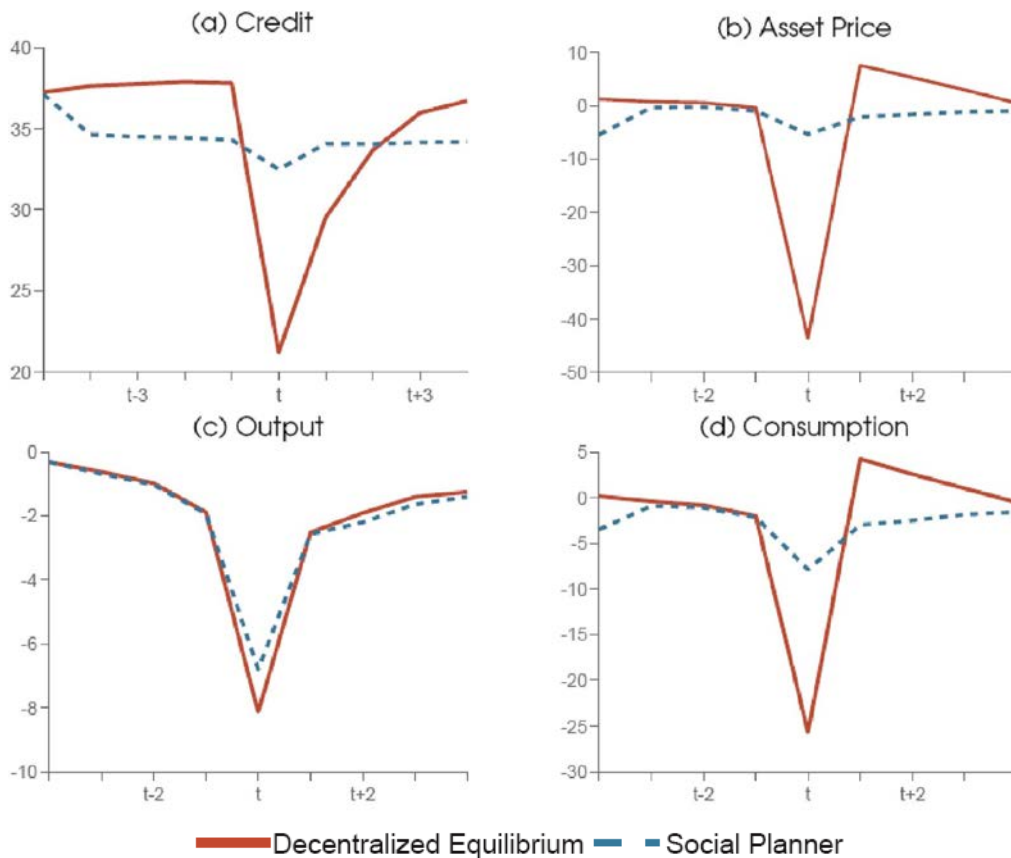
$$\tau_t^{MP} = \frac{E_t \left[-\kappa_{t+1} \mu_{t+1}^* \frac{u_{cc}(t+1)}{u_c(t+1)} Q_{t+1} \right]}{E_t [u_c(t+1)]}$$

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

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



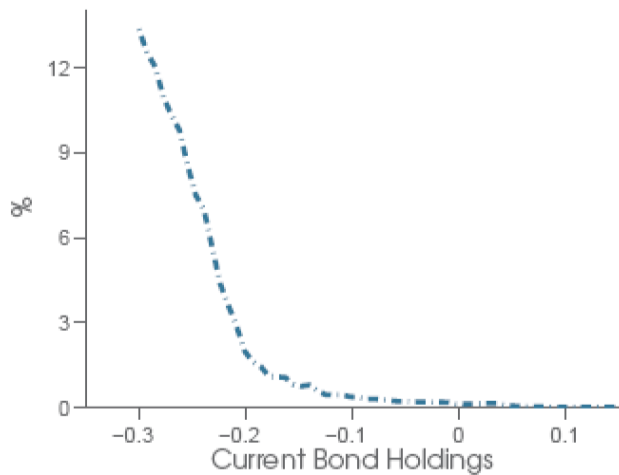
Financial crises & policy effectiveness



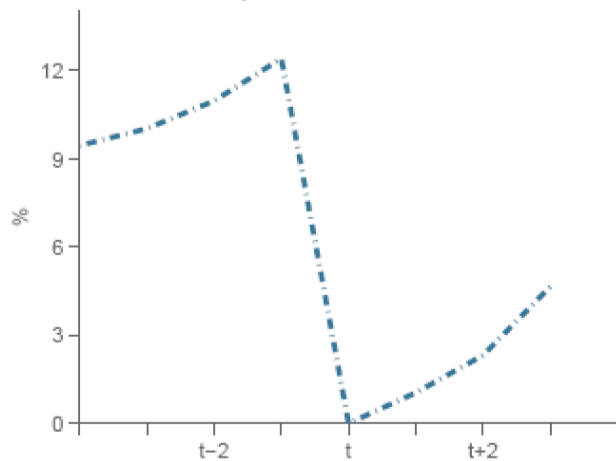


Complexity

(a) Tax Schedule in Good States



(b) Tax Dynamics around Crises





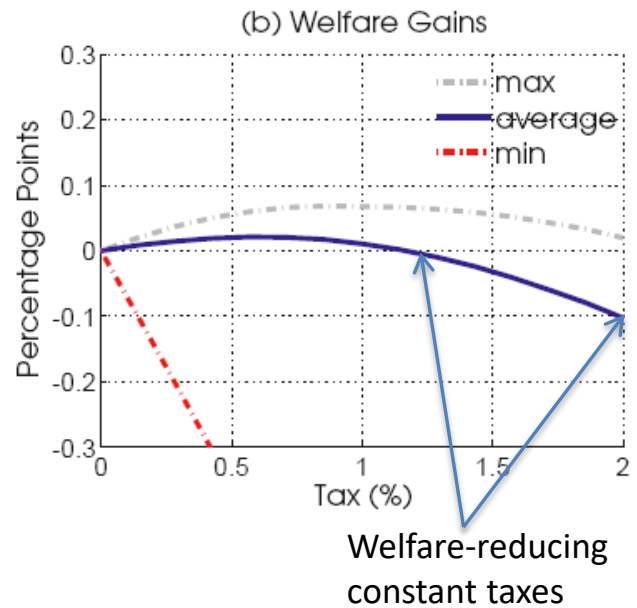
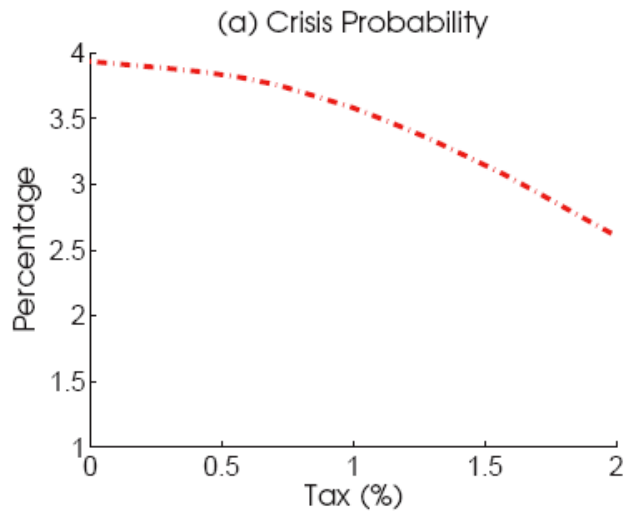
Optimal (TC) policy & simpler rules

	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
<i>Tax Statistics</i>				
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: $\tau = \max[0, \tau_0(b_{t+1}/\bar{b})^{\eta_b} - 1]$

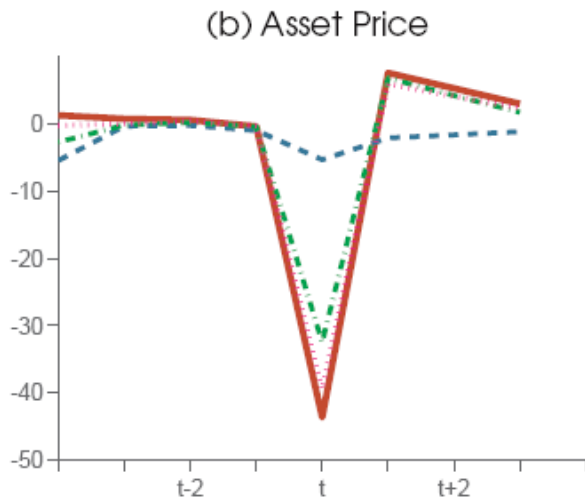
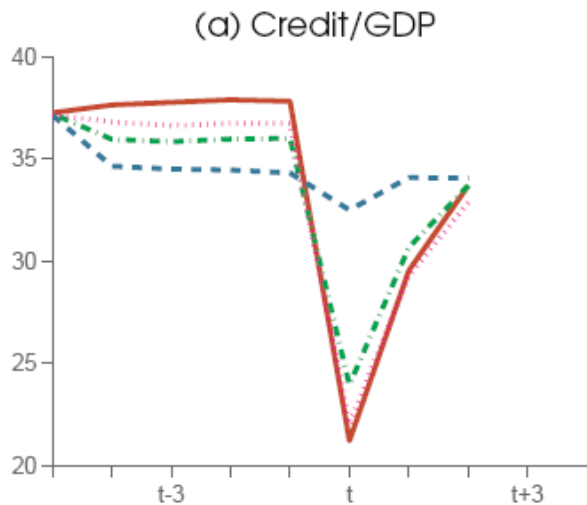


Simple rules: constant taxes





Effects of simple policies on magnitude of crises



— Decentralized Equilibrium - - - Optimal Tax - · - Simple Rule · · · Fixed Tax



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:

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

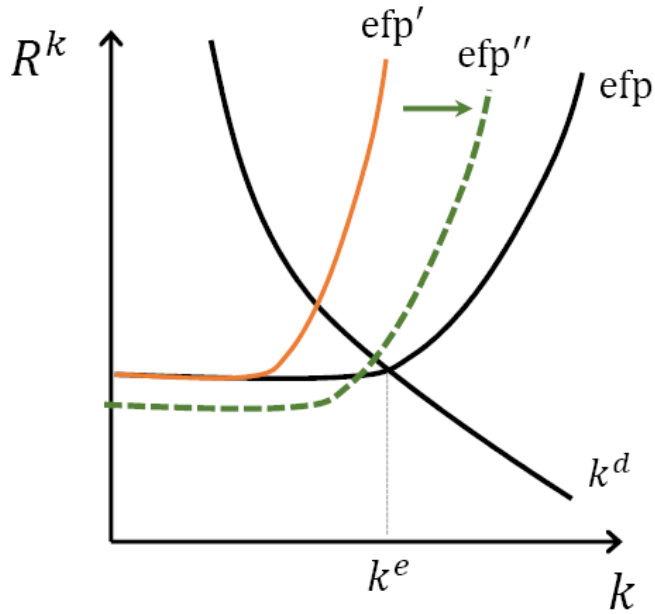
- Financial policy rule adjusts a tax on opp. cost of lending depending on credit spread dev. from target:

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

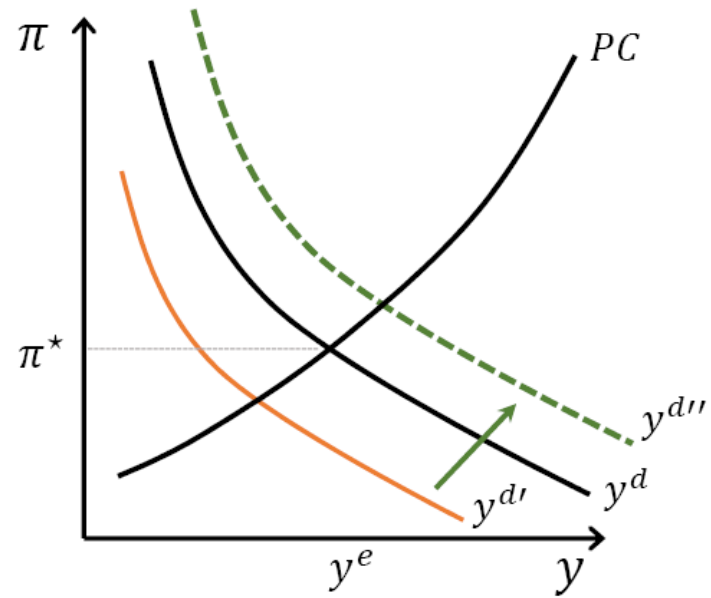


Policy interactions in response to risk shocks

Credit-capital market



Aggregate supply & demand





Tinbergen's rule is quantitatively relevant

- Augmented Taylor rule regime:

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

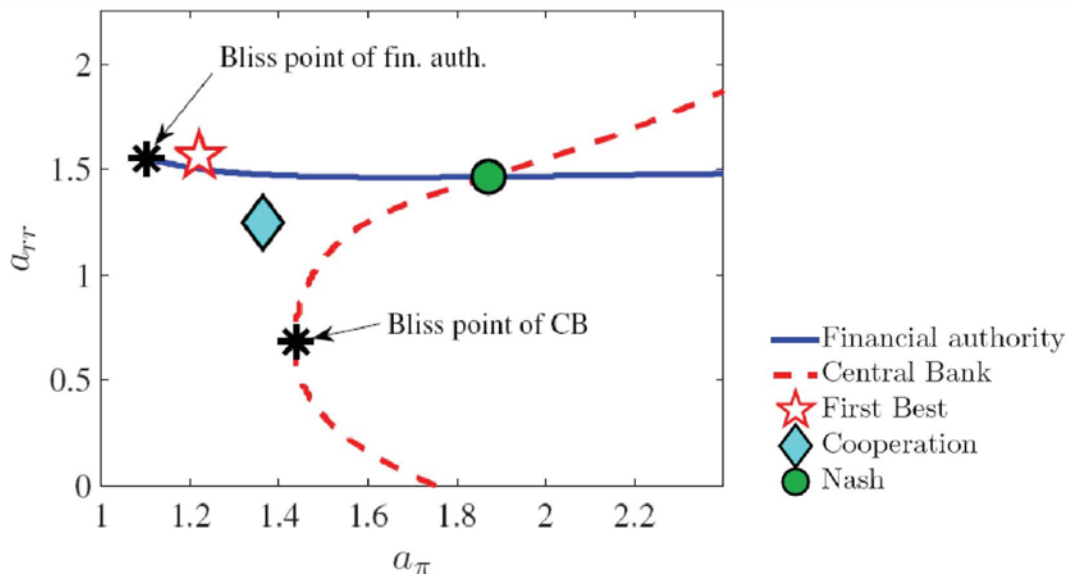
- Dual rule regime is significantly superior
 - Welfare is 34 percent higher
 - Policies are too tight with augmented rule v. dual rules

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

- 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}	\tilde{a}_{rr}
<i>Violations of Tinbergen's rule (payoff is welfare)</i>				
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	-	-
<i>Costs of strategic interaction (payoffs are quadratic loss functions, except for the first best)</i>				
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