



Macroprudential Policy: Promise and Challenges

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The promise

- Macroprudential policy (MPP) aims to weaken credit booms in order to reduce frequency & severity of crises
- Rationale: Credit booms are infrequent, but end in deep, protracted crises. In Mendoza & Terrones (2012):
 1. Credit booms occur with 2.8% frequency
 2. 1/3rd end in banking or currency crises.
 3. After 3 years, GDP is still 5%-8% below trend
- Fisherian models provide useful quantitative framework
 1. Strong financial amplification captures nonlinearities & explains key features of credit booms/crises
 2. Externalities (market-failure) justify policy intervention
 3. Toolbox for evaluation of optimal policy and simple rules



The challenges

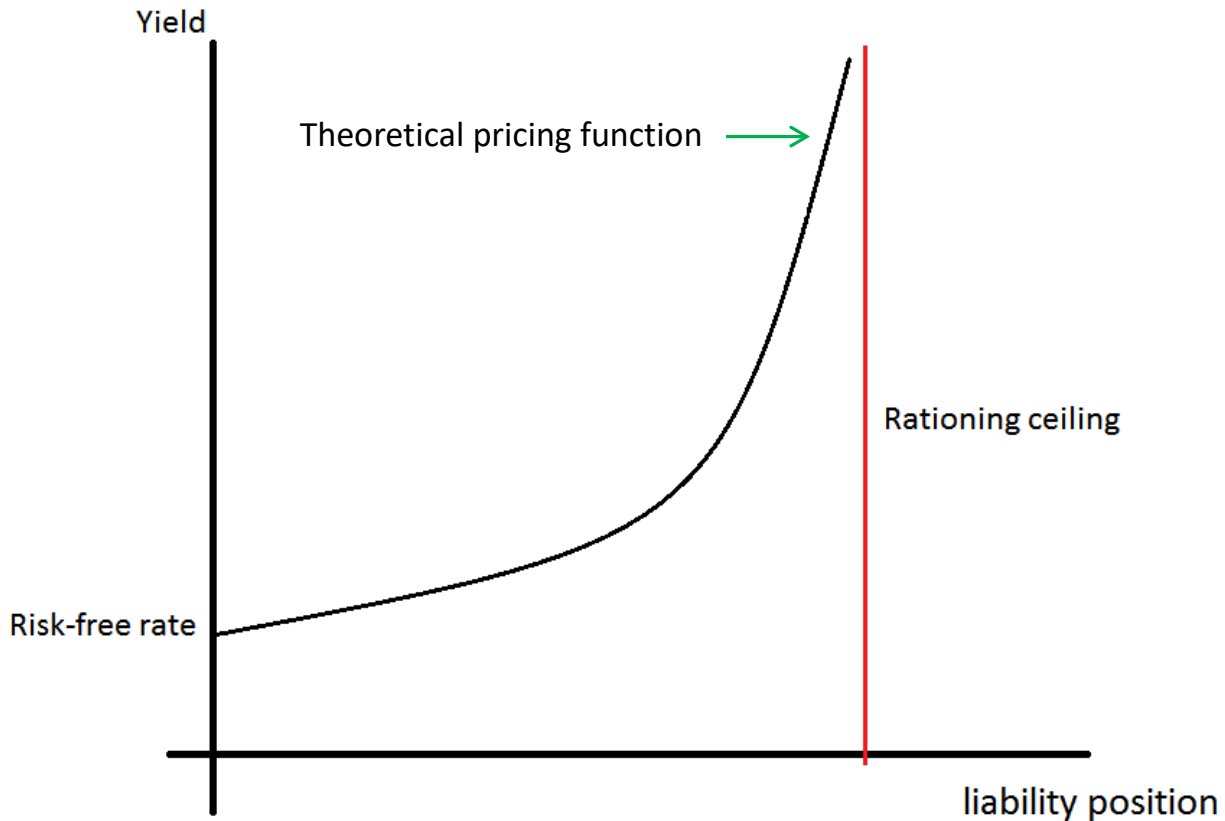
1. *Nonlinearities & amplification*: A general case for global, nonlinear models of credit booms/crises and MPP (particularly Fisherian models)
2. *Complexity & credibility*: Optimal MPP follows complex rules and lacks credibility because of time-inconsistency
3. *Coordination failure*: Mismanaged interaction with monetary policy yields costly Tinbergen's rule violations and strategic interaction



1. General case for nonlinear models

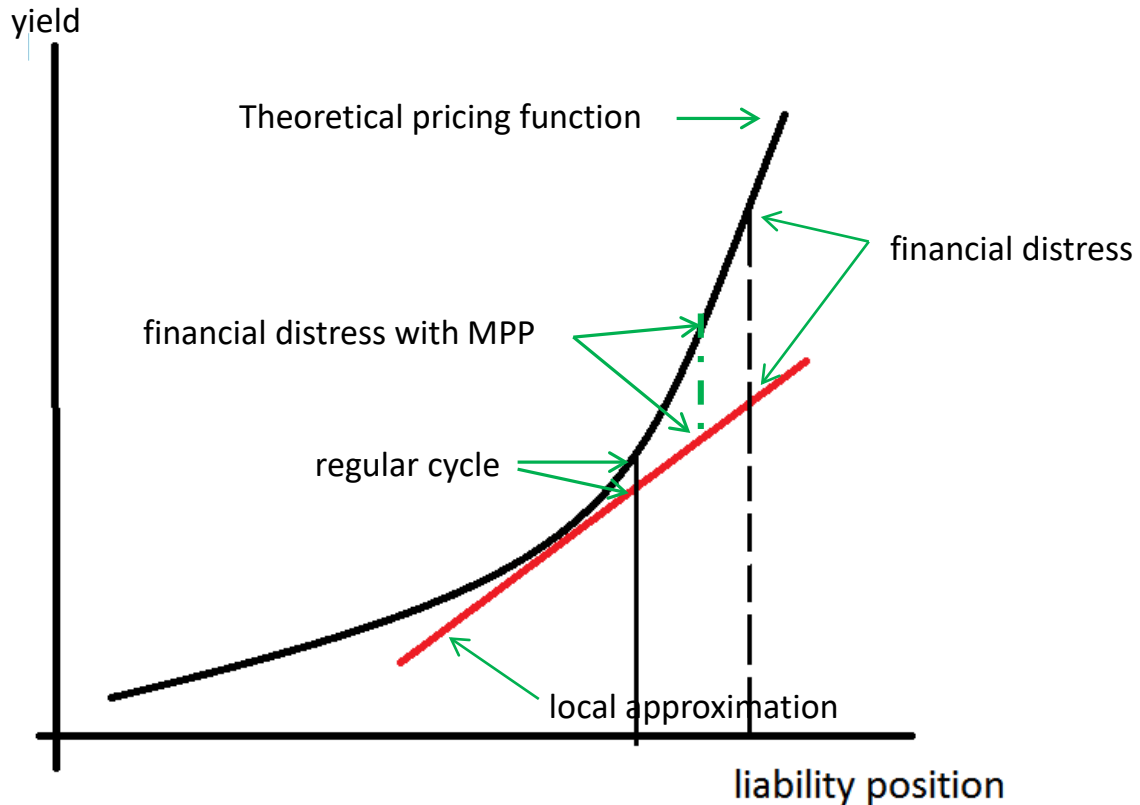


A “general theory” of risk pricing





What a model of MPP needs to do





2. Fisherian models, market failure and optimal MPP



Fisherian models

- Wide class of models in which market prices affect borrowing capacity (e.g. collateral, scoring, etc.)
- Occasionally binding credit constraints:

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

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?

- Private agents' Euler eq. for debt choice:

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

– In normal times $\mu_t=0 \Rightarrow$ standard Euler equation

- But for a planner choosing debt 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:

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

- 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” implements 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.



3. Complexity and time-inconsistency



Bianchi & Mendoza (JPE 2018)

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 prices (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

$$\max E_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_t - G(n_t)) \right]$$

$$u(c - G(h)) = \frac{\left(c - \chi \frac{h^{1+\omega}}{1+\omega} \right)^{1-\sigma} - 1}{1-\sigma} \quad \omega > 0, \sigma > 1$$

s.t.

$$q_t k_{t+1} + c_t + \frac{b_{t+1}}{R_t} = q_t k_t + b_t + [z_t F(k_t, h_t, v_t) - p_v v_t] \quad (\lambda_t)$$

$$-\frac{b_{t+1}}{R_t} + \theta p_v v_t \leq \kappa_t q_t k_t \quad (\mu_t)$$



Optimality conditions

$$z_t F_h(k_t, h_t, v_t) = G'(h_t)$$

$$z_t F_v(k_t, h_t, v_t) = p_v(1 + \theta\mu_t/u'(t))$$

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

$$q_t u'(t) = \beta \mathbb{E}_t [u'(t+1) (z_{t+1} F_k(k_{t+1}, h_{t+1}, v_{t+1}) + q_{t+1}) + \kappa_{t+1} \mu_{t+1} q_{t+1}]$$



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



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.

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

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

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



Optimal, time-consistent policy

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

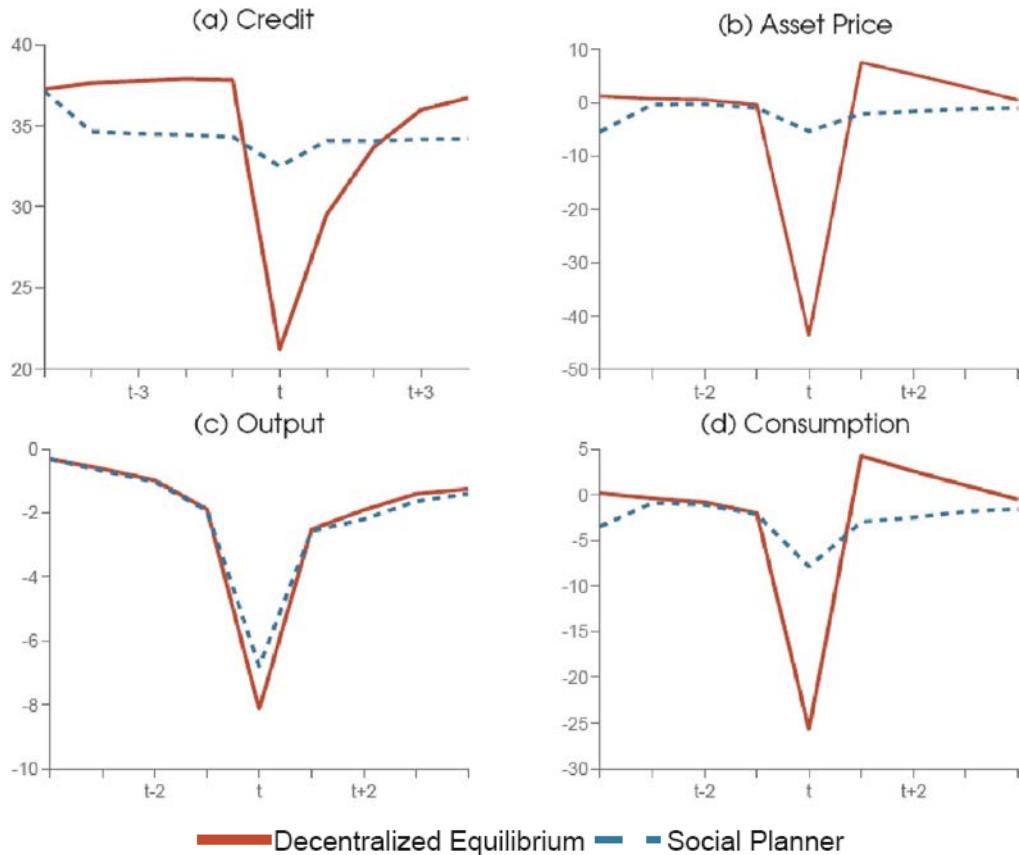
$$\tau_t^{MP} = \frac{E_t \left[-\kappa_{t+1} \mu_{t+1}^* \frac{u_{cc}(t+1)}{u_c(t+1)} Q_{t+1} \right]}{E_t [u_c(t+1)]}$$

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

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



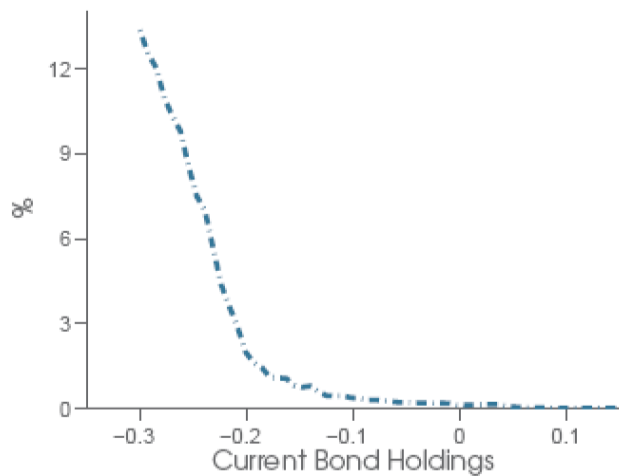
Financial crises & policy effectiveness



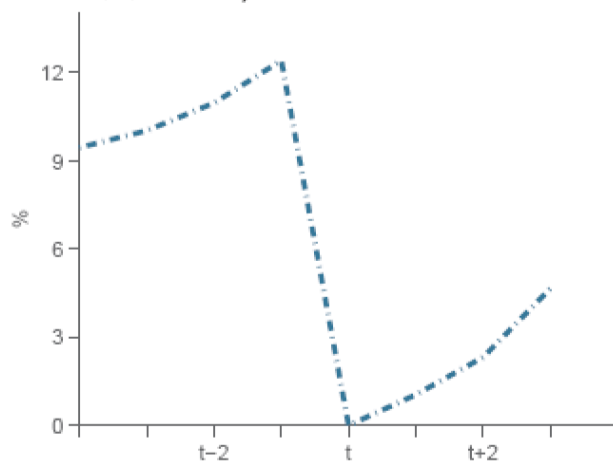


Complexity

(a) Tax Schedule in Good States



(b) Tax Dynamics around Crises





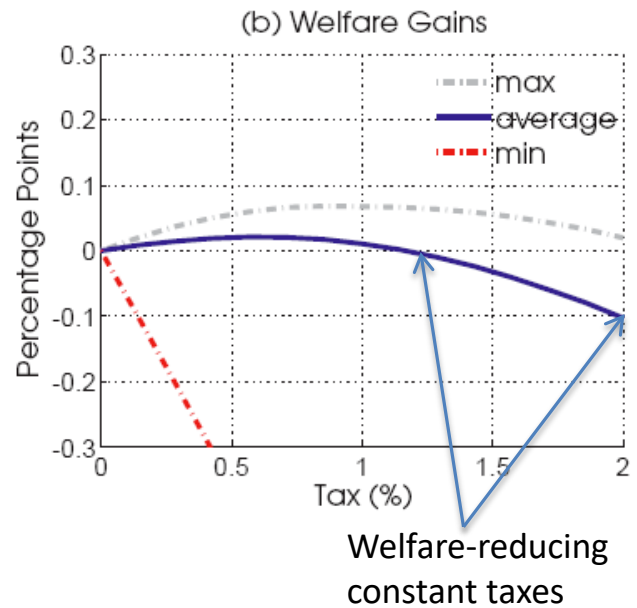
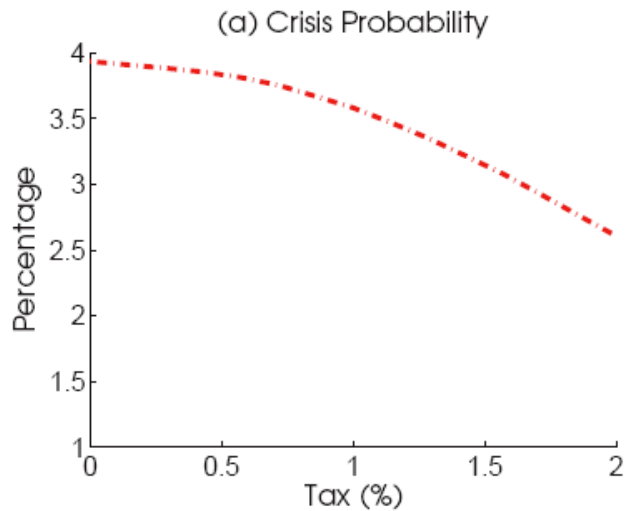
Optimal (TC) policy & simpler rules

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

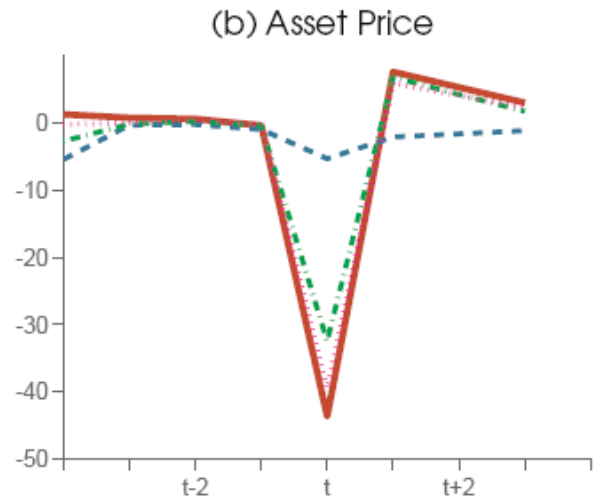
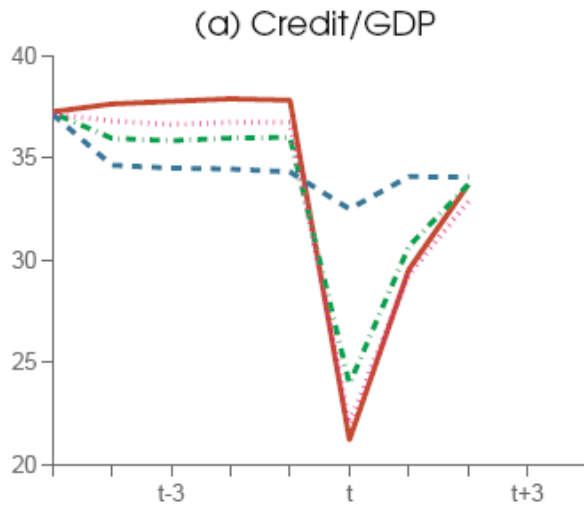


Simple rules: constant taxes





Effects of simple policies on magnitude of crises



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



4. Coordination failure in the interaction with monetary policy



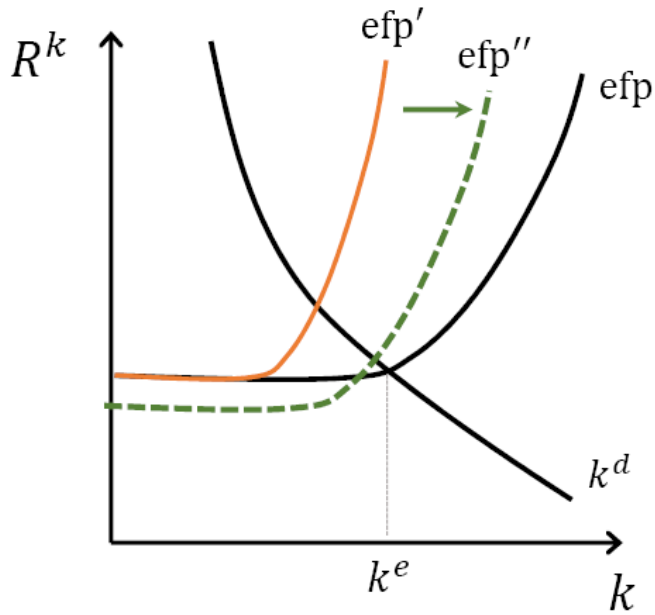
Policy interactions in NK-BGG model

- Carrillo et al. (18) model:
 1. BGG model with risk shocks (Christiano et al. (14))
 2. Calvo pricing=> inefficiencies in goods markets
 3. Costly monitoring=> inefficiencies in credit-capital market
- Risk shocks (fluctuations in variance of entrepreneurs' returns) strengthen financial transmission
- MP instrument is the nominal interest rate, FP instrument is a subsidy to intermediaries (lowers "efp")
- MP (FP) instrument affects target and payoff of FP (MP)
- Two forms of coordination failure: Tinbergen's rule violations and strategic interaction

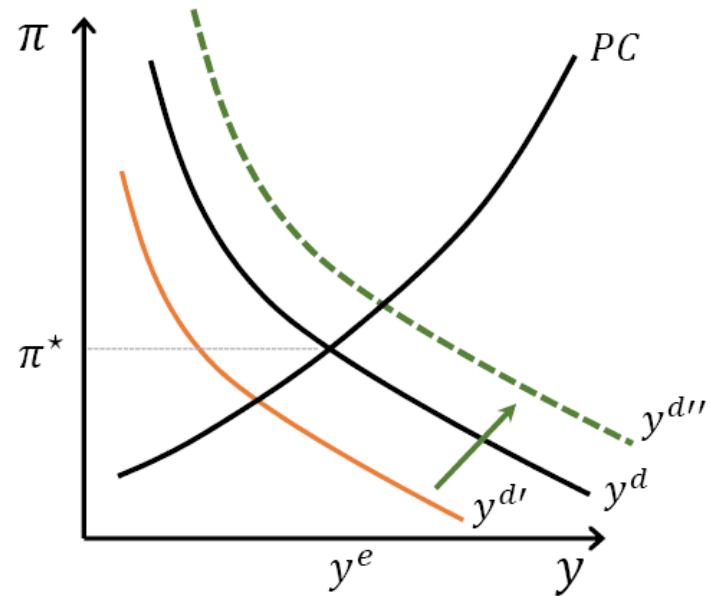


Policy interactions in response to risk shocks

Credit-capital market



Aggregate supply & demand





Policy regimes

- **STR:** Simple Taylor rule, no financial policy rule

$$R_t = R \left(\frac{1 + \pi_t}{1 + \pi} \right)^{a\pi}$$

- **ATR:** Augmented Taylor rule (“leaning against the wind”), no financial policy rule

$$R_t = R \left(\frac{1 + \pi_t}{1 + \pi} \right)^{a\pi} \left(E_t \left\{ \frac{r_{t+1}^k}{r_t} \right\} \right)^{-\check{a}rr}$$

- **DRR:** Dual rules regime, STR + financial rule:

$$R_t = R \left(\frac{1 + \pi_t}{1 + \pi} \right)^{a\pi} \quad \tau_{f,t} = \tau_f \left(E_t \left\{ \frac{r_{t+1}^k}{r_t} \right\} \right)^{arr}$$



Relevance of Tinbergen's rule

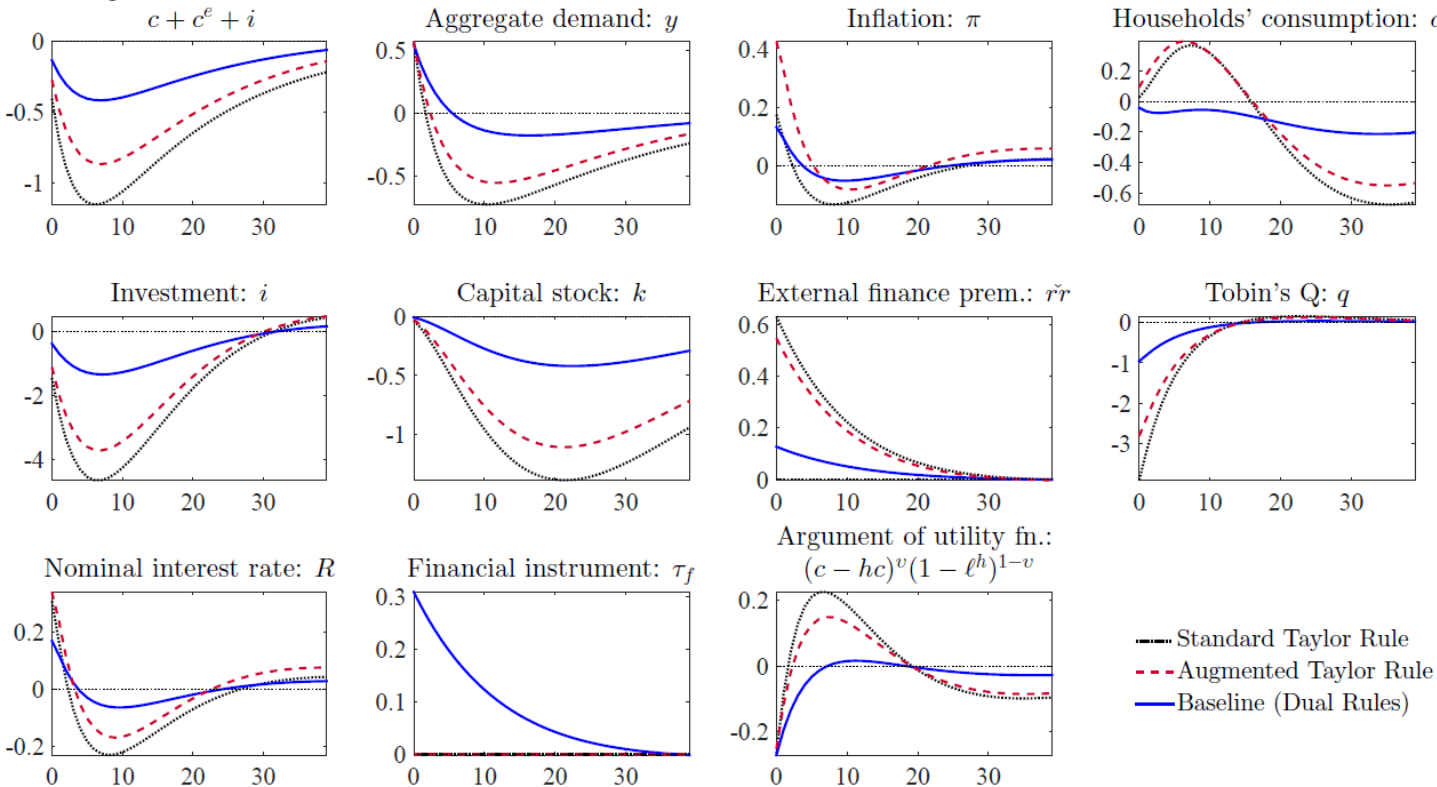
Regime	ce v. DRR	Param. values of x		
		a_π	a_{rr}	\check{a}_{rr}
DRR (Best Policy)	–	1.27	2.43	–
Augmented Taylor Rule	-138 bps.	1.27	–	0.36
Standard Taylor rule	-264 bps.	1.75	–	–

- STR & ATR yield large welfare losses
- Policy rules are “too tight” with STR & ATR
- Larger effects from risk shocks under STR & STR



Effects of risk shocks & policy regimes

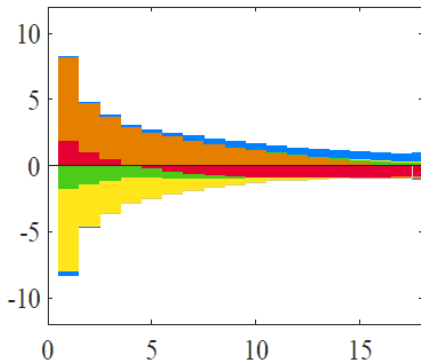
Consumption and investment:



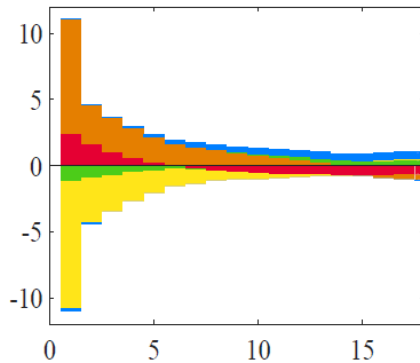


Smoothing consumption under policy regimes

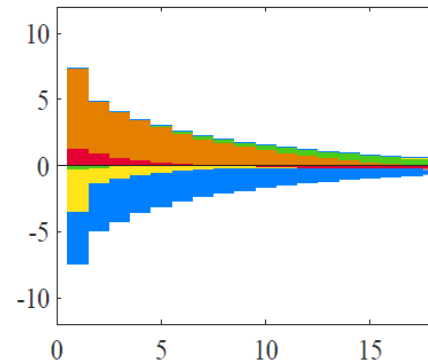
Standard Taylor Rule



Augmented Taylor Rule



Baseline (Dual Rules)

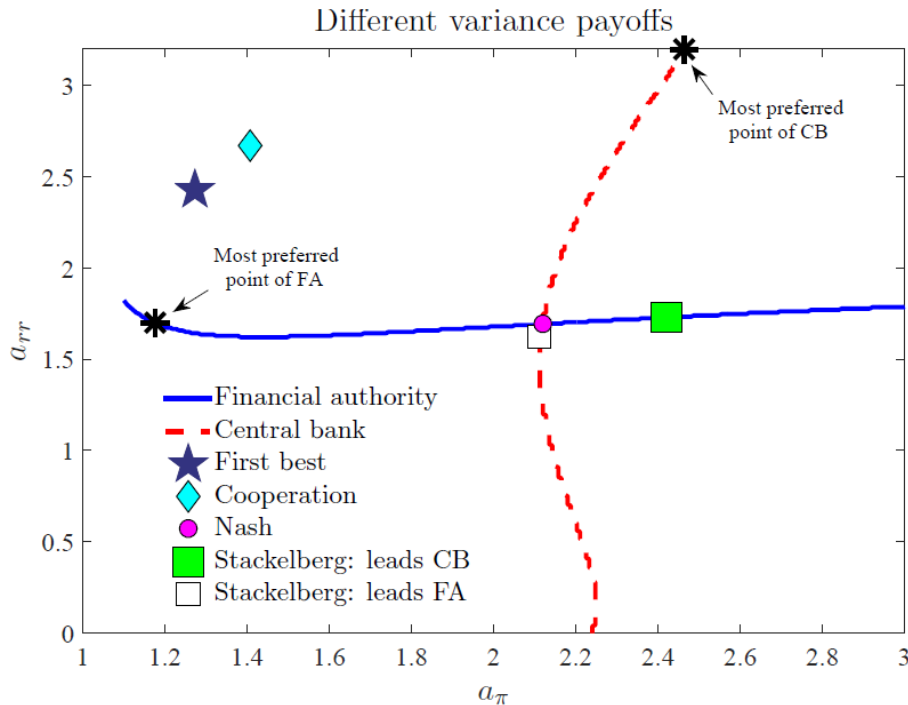


- Labor income, $w\ell^h$
- Net flow from deposits, $r_{t-1}b_{t-1} - b_t$
- Transfers from entrepreneurs, \mathcal{A}
- Dividends from intermediate firms, div
- Lump-sum taxes, T

Note: Sources of disposable income measured as weighted deviations from det. steady state (bars add up to percent deviations of consumption in IRF).



Strategic interaction



- MP and FP have sum-of-variances payoffs
- Strategy space is over policy rule elasticities



Relevance of strategic interaction

Regime x v. regime y	ce bps. diff.	Param. values of x	
		a_π	a_{rr}
Nash v. Best Policy (BP)	30	2.12	1.69
Cooperative ($\varphi = 0.5$) v. BP	4	1.41	2.67
Cooperative (optimal φ) v. BP	1	1.33	2.10
Simple Taylor rule v. Nash	234	1.75	-
Dual rules regime v. BP	—	1.27	2.43

- Cooperation dominates Nash significantly
- Policies again too tight
- ...but even Nash is better than STR & ATR



Conclusions

- *Promise*: Progress in developing quantitative models of fin. crises and MPP, with results showing that it can be a very effective policy
- *Challenges*: Complexity, credibility, coordination. **Careful quantitative evaluation is necessary to avoid outcomes worse than without MPP.**
- *Additional challenges*: fin. innovation, information, heterogeneity, int'l coordination, securitization, interconnectedness