On the use of monetary and macroprudential policies for small open economies

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Roadmap

- Motivation
- Overview of the model
- Model dynamics
  - Calibration
  - Should monetary policy lean against the wind?
- Optimal policy rules and welfare evaluations
- Summary and next steps

Motivation (1)

- 'Lean versus clean' debate prior to and in the aftermath of the 2008-2009 global financial crisis (GFC).

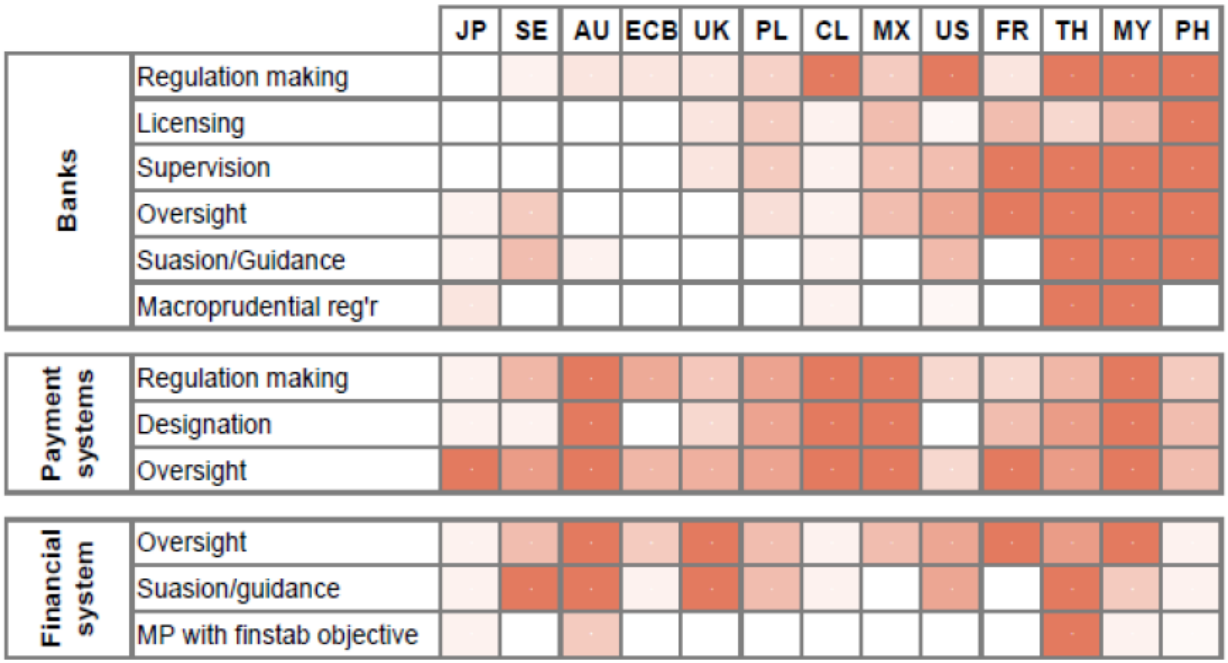
- The conventional wisdom prior to GFC was 'better to clean up after the bubble bursts'.
- It was also argued that using interest rates towards the financial stability aim is potentially costly;
  - unclear what the impact of policy rates would have been on risk taking behaviour
  - interest rates would have needed to go up substantially with serious consequences for the real economy
  - using interest rates to de-anchor against asset price bubbles may de-anchor inflation expectations

Motivation (2)

- Prior to the crisis...

Financial stability related mandates of central banks in 2009

(The darker the shading the bigger the mandate)



Source: BIS.

Motivation (3)

- GFC $\Rightarrow$ price stability didn't ensure overall macroeconomic and financial stability.
- Costs of financial crises pointed to the importance of preserving financial stability.
- Macroprudential measures are recommended to reduce the systemic risk—procyclical behaviour of financial markets.
- New arrangements in mature economies and EMs; a new consensus on the need to use both monetary and macroprudential policies as tools of countercyclical management.

Motivation (4)—Examples

- Caps on loan-to-value (LTV) ratio (Canada, Sweden, China)
- Caps on debt-to-income (DTI) ratio (Korea, Norway, Russia)
- Caps on foreign currency lending (Hong Kong)
- Limits on net open currency positions/currency mismatch (Brazil, Mexico)
- Limits on maturity mismatch (Singapore, New Zealand)
- Reserve requirements (Turkey, Korea, Indonesia)
- Countercyclical capital requirements (China)
- Restrictions on profit distribution (Argentina, Colombia, Turkey)

Motivation (5)

- How can a policy intervention that directly affects private borrowing decisions be justified in economic terms?
  - Negative externalities associated with private borrowing decisions (Jeanne and Korinek, 2009; Korinek, 2009; Bianchi and Mendoza, 2011; Benigno et al., 2013; among others).
  - Role of macroprudential measures in mitigating the effects of shocks that cannot be offset with monetary/fiscal policies (Angeloni and Faia, 2009; Angelini et al., 2010, Kannan at al., 2012; Unsal, 2013; Quint and Rabanal, 2014; among others).

Motivation (6)—This paper

- Optimal monetary and macroprudential rules for a SOE in a two-country sticky-price DSGE model with financial frictions.
  - Taylor rule as a function of inflation, output and credit growth.
  - Macroprudential rule as a function of credit growth.
- An open economy dimension to analyze
  - policy issues relevant for emerging market economies (i.e. large capital outflows/inflows).
  - the role of exchange rate and the source of liabilities (foreign vs. domestic) on the use of macroprudential measures.
- Consider different shocks to provide operational suggestions for a more robust policy mix to real-time shock uncertainty.

Model (1)

- A two-country NK model with the financial accelerator mechanism developed by Bernanke et al. (1999).
  - The world economy consists of two economies; a domestic economy (n), and a foreign economy ($1-n$). We assume that the domestic economy is small.
- Three modifications
  - Macroprudential measures.
  - In the extension, entrepreneurs can borrow both from domestic and foreign resources—allows to analyze the role of borrowing sources in the desirability of policy tools.
  - Capital inflows reflect favorable changes in the perception of lenders. As they become "overoptimistic" about the economy, financing conditions become easier.

Model (2)—Households

- —— Receive utility with GHH preferences

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\sigma}(C_t - \frac{\chi}{1+\varphi} H_t^{1+\varphi})^{1-\sigma},$$

with

$$C_t = \left[\alpha^{\frac{1}{\gamma}} C_{H,t}^{(\gamma-1)/\gamma} + (1-\alpha)^{\frac{1}{\gamma}} C_{M,t}^{(\gamma-1)/\gamma}\right]^{\gamma/(\gamma-1)},$$

where $\alpha \equiv (1-n)\upsilon$ depends on $(1-n)$, the relative size of foreign economy, and on υ, the degree of trade openness.

—— Provide labor to production firms.

—— Participate in domestic and foreign financial markets.

Model (3)—Production firms

- —— Produce a differentiated good indexed by $j \in [0,1]$:

$$Y_t(j) = A_t N_t(j)^{1-\eta} K_t(j)^{\eta},$$

—— Have some market power and segment domestic and foreign markets with local currency pricing.

—— Subject to Rotemberg (1982) type quadratic menu cost.

—— Maximize

$$E_o \sum_{t=0}^{\infty} \frac{\beta^t U_{c,t}}{P_t} [P_{H,t}(j) Y_{H,t}(j) + S_t P_{X,t}(j) Y_{X,t}(j) - MC_t Y_t(j)$$

$$- P_t \sum_{i=H,X} \frac{\Psi_i}{2} \left(\frac{P_{i,t}(j)}{P_{i,t-1}(j)} - 1\right)^2],$$

where $Y_{i,t}(j) = \left(\frac{P_{i,t}(j)}{P_{i,t}}\right)^{-\lambda} Y_{i,t}$, for $i = H, X$.

Model (4)

- Importing Firms

  —— Buy foreign goods at prices $P^*_{X,t}$ (in local currency) and sell to the domestic market

  —— Subject to a price adjustment cost with $\Psi_M \succeq 0$, analogous to the production firms.

- Competitive Unfinished Capital Goods Producers

  —— Use investment as an input, I_t and combine it with rented capital K_t to produce unfinished capital goods, which are then sold to the entrepreneurs.

  —— Subject to an investment adjustment cost, and maximize $\Xi_t(I_t, Kt) = [\frac{I_t}{K_t} - \frac{\Psi_I}{2}(\frac{I_t}{K_t} - \delta)^2]K_t$

Model (5)—Entrepreneurs

- —— Transform unfinished capital goods to capital goods through $\omega_{t+1} K_{t+1}$ and rent them.
  —— Finance their investment internally (NW) and externally by borrowing from foreign lenders (F) (extension: domestic borrowers D).

$$P_t NW_t^F(k) = Q_t K_{t+1}^F(k) - S_t D_{t+1}^F(k),$$

  —— Productivity is observed by the entrepreneur ex-ante, but not by the lenders $\omega_{t+1}^*(k) = \omega_{t+1}(k)\varrho_t$. ϱ_t is a misperception factor. Lenders can observe ω_{t+1}ex-post at some cost.
  —— These factors result in an endogenous "risk premium" (Φ_t^F) as a function of leverage and investors' perception.

Model (6)—Financial intermediaries

- —— Receive capital inflows from the foreign economy and lend to entrepreneurs.

  —— Earn zero profit. In the absence of macroprudential measures, lending rate is $E_t[(1+i_t^*)(1+\Phi_{t+1}^F)]$, i_t^* is the foreign policy rate.
- Macroprudential policy

  — The macroprudential policy brings an increase in the lending rates—"regulation premium"

$$RP_t = \Psi\left(\frac{S_t D_t^F}{S_{t-1} D_{t-1}^F} - 1\right)$$

  —— The lending cost becomes $E_t[(1+i_t^*)(1+\Phi_{t+1}^F)(1+RP_t)]$.

Model (8)—Monetary Policy

- —— We start with a standard Taylor-type monetary policy rule.

$$1+i_t = [(1+i)\ (\pi_t)^{\epsilon_\pi}(Y_t/Y)^{\epsilon_Y}(\text{credit growth})^{\epsilon_D})^{\varpi}[1+i_{t-1}]^{1-\varpi},$$

with $\{\epsilon_\pi\} \in (1,\infty]$, $\{\epsilon_Y\} \in (0,\infty]$, $\{\epsilon_D\} \in (0,\infty]$;and $\varpi \in [0,1]$.
—— We then numerically compute the optimal values of ϵ_π, ϵ_Y and ϵ_D using a second order approximation to the utility function.

Calibration (1)—Parameter values for consumption, production and entrepreneurs

$\beta = 0.99$	Discount factor
$\sigma = 2$	Inverse of the intertemporal elasticity of substitution
$\gamma = 1$	Elasticity of substitution between domestic and foreign goods
$\varphi = 2$	Frisch elasticity of labour supply
$(1 - \alpha) = 0.35$	Degree of openness
$\eta = 0.35$	Share of capital in production
$\lambda = 11$	Elasticity of substitution between domestic goods
$\delta = 0.025$	Quarterly rate of depreciation
$\Omega = 0.01$	Share of entrepreneurial labor
$\Psi_I = 12$	Investment adjustment cost
$\Psi_D = 0.0075$	Responsiveness of household risk premium to debt/GDP
$\Psi_i, \Psi_M = 120$	Price adjustment costs for $i = H, X$
$\varpi = 0.5$	Inertia in the policy rule
$\rho_\varrho = 0.5$	Persistence of the domestic perception shock
$\Phi_t = 0.02$	External risk premium
$\mu = 0.2$	Monitoring cost
$\vartheta = 0.9933$	Survival rate

Calibration (2)—Parameter values for monetary and macroprudential rules

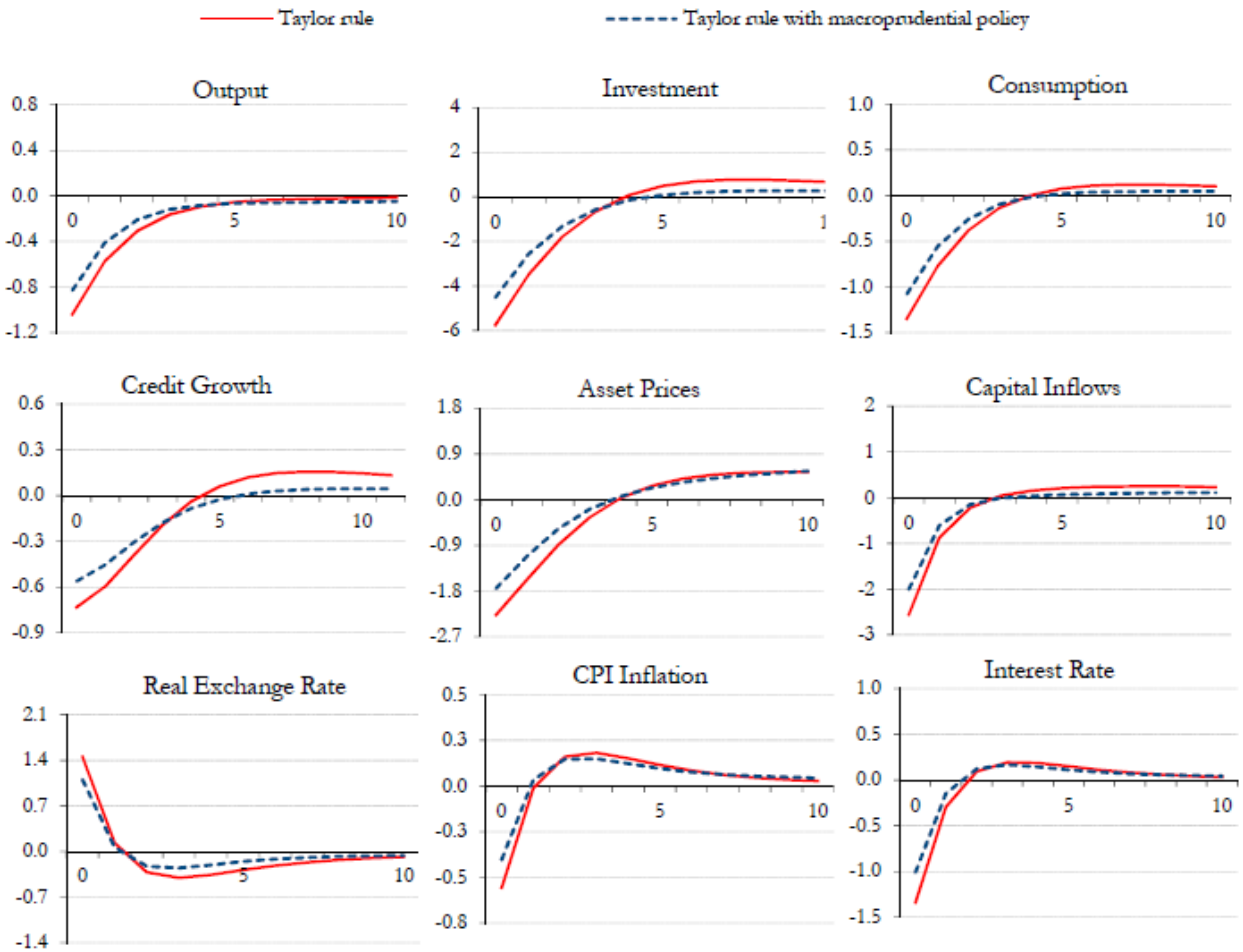
	Monetary policy			Macroprudential policy
	Inflation	Output gap†	Credit gr.	Credit gr.
Taylor rule	1.5	0.5	0	0
Taylor rule with credit gr.	1.5	0.5	0.75	0
Taylor rule + macroprud.	1.5	0.5	0	0.75

†Output gap is calculated as a deviation of output from its steady state.

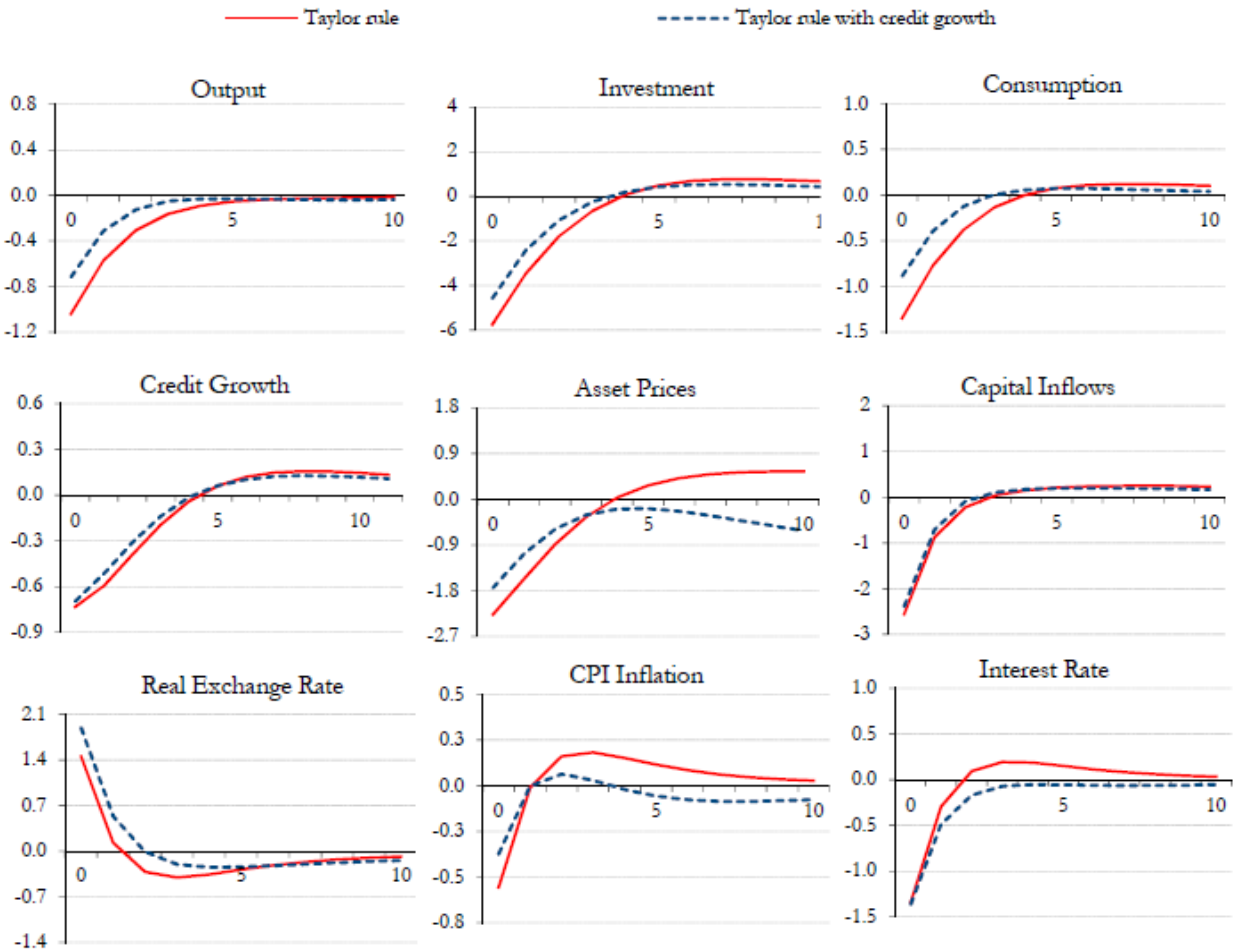
Calibration (3)—A sudden stop scenario

- We simulate an increase in investors' perception of risk in the baseline. As financing costs increase, firms borrow and invest less.
- Lower borrowing also decreases the future supply of capital and hence brings about a decline in consumption and output.
- Weaker demand and lower asset prices damage firms' balance sheets further. Eventually, lower leverage decreases risk premium and economy normalizes.
- Both monetary policy and macroprudential measures have a non-trivial role in mitigating the impact of the shock.

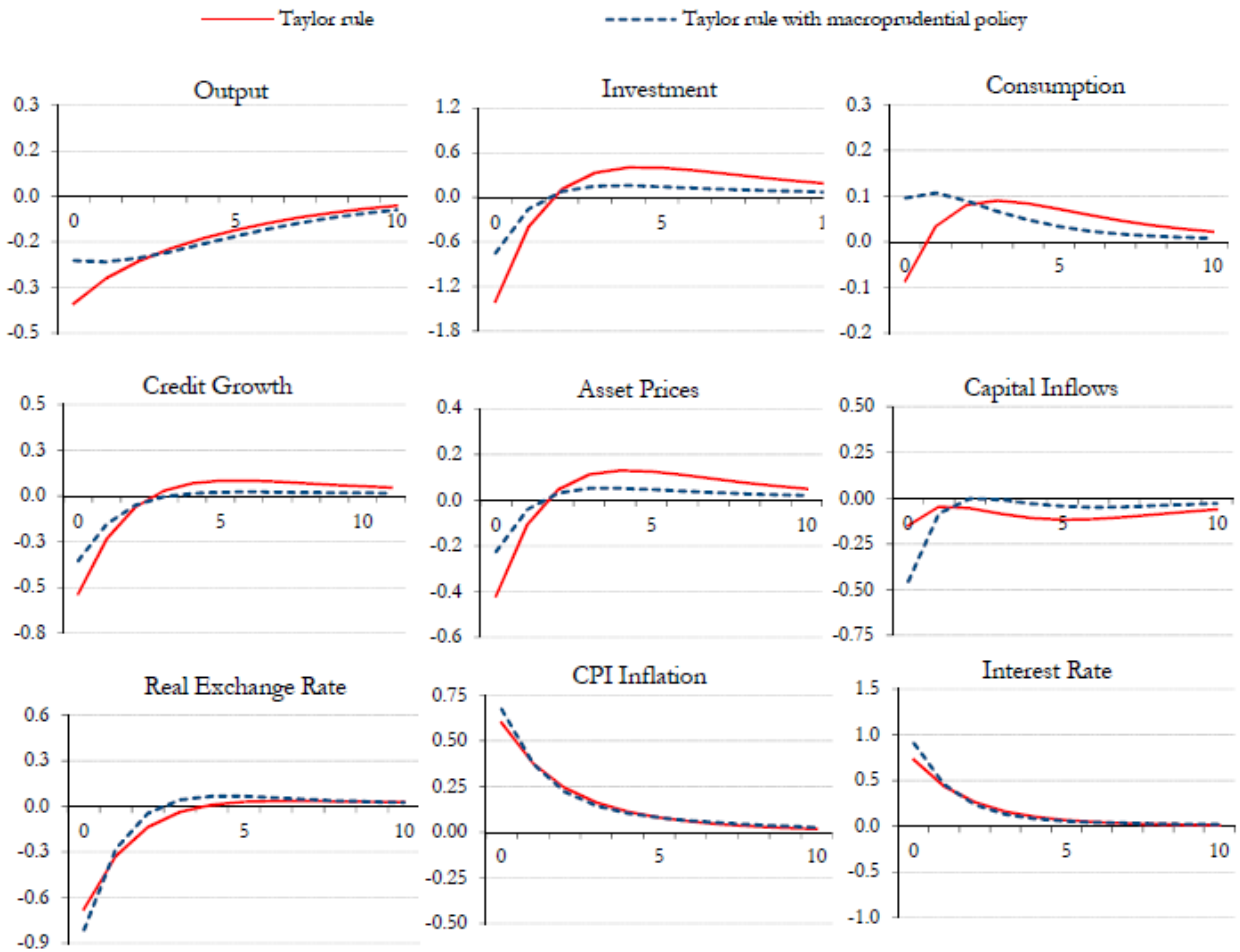
Should monetary policy lean against the wind? (1)—Taylor rule vs. macroprudential rule under a financial shock



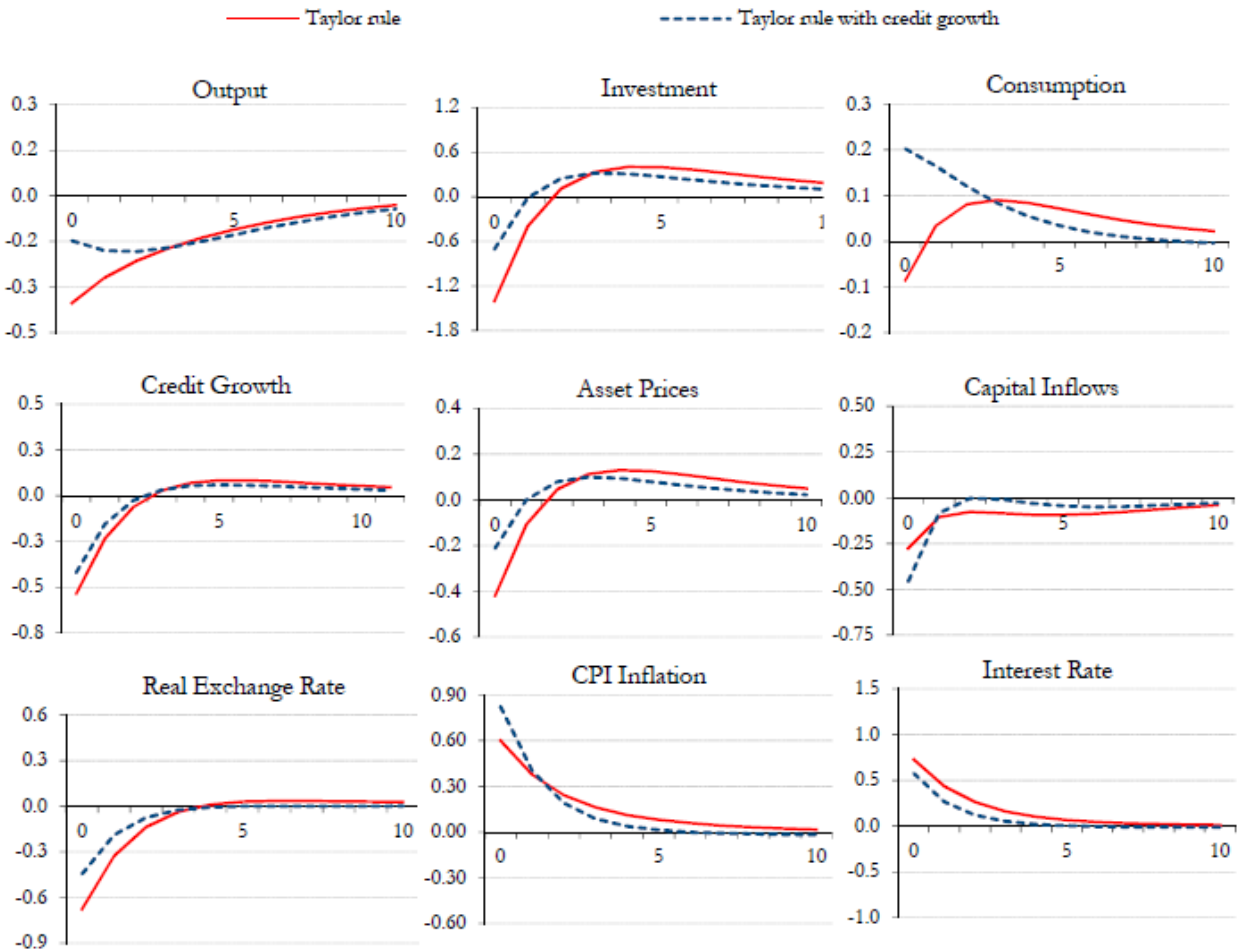
Should monetary policy lean against the wind? (2)—Taylor rule vs. adjusted Taylor rule under a financial shock



Should monetary policy lean against the wind? (3)—Taylor rule vs. macroprudential rule under a productivity shock



Should monetary policy lean against the wind? (4)—Taylor rule vs. adjusted Taylor rule under a productivity shock



Welfare evaluations and optimal policy rules (1)

- Following Faia and Monacelli (2007) and Gertler and Karadi (2010),

$$V_t = U(C_t, H_t) + \beta E_t V_{t+1}$$

where $V_t \equiv E_0 \sum_{t=0}^{\infty} \beta^t U(C_t, H_t)$ denotes the utility function.

- We take a second order approximation of V_t around the deterministic steady state.
- We calculate V_t in under alternative policy options, and compute Ω, the fraction of consumption required to equate V_t to V_t^{opt}. Higher Ω means lower welfare.
- We then search numerically in the grid of parameters $\{\epsilon_\pi, \epsilon_y, \epsilon_D, \Psi\}$ that optimize V_t

Welfare evaluations and optimal policy rules (2)—Optimal rules under a financial shock

	Monetary policy			Macropru. policy
	Inflation	Output gap†	Credit gr.	Credit gr.
Opt.Taylor rule (OTR)	1.1	0	-	-
OTR with CG	1.1	-	0.6	-
OTR + OMP	2.4	-	-	1.1
OTR with CG+OMP	1.7	-	0.1	0.9

†Output gap is calculated as a deviation of output from its steady state.

Welfare evaluations and optimal policy rules (3)—Welfare comparisons under a financial shock

	Welfare Loss (Υ)$^{\lambda}$
Taylor rule (TR)	0.2106
TR with credit growth (CG)	0.1593
TR + macroprud. policy (MP)	0.1140
Optimized Taylor rule (OTR)	-
OTR with CG	-0.0324
OTR + optimized MP (OMP)	-0.1098
OTR with CG+ OMP	-0.1178

Welfare evaluations and optimal policy rules (4)—Optimal rules under a productivity shock

	Monetary policy			Macropru. policy
	Inflation	Output gap	Credit gr.	Credit gr.
Opt.Taylor rule (OTR)	1.1	0	-	-
OTR with CG	1.1	-	0	-
OTR + OMP	1.1	-	-	0
OTR with CG+OMP	1.1	-	0	0

Welfare evaluations and optimal policy rules (5)—Welfare comparisons under a productivity shock

	Welfare Loss (Υ)$^{\lambda}$
Taylor rule (TR)	0.2163
TR with credit growth (CG)	0.3302
TR + macroprud. policy (MP)	0.2411
Optimized Taylor rule (OTR)	-
OTR with CG	-
OTR + optimized MP (OMP)	-
OTR with CG+ OMP	-

Welfare evaluations and optimal policy rules (6)—Optimal rules under a financial shock, sources of borrowing

Sources of Borrowing	Welfare Loss $(\Upsilon)^{\lambda}$		Opt. Coefficent of Credit Gr.*	
	Opt. Taylor Rule	Opt. MP Rule	Taylor Rule	MP Rule
Foreign	-0.0321	-0.1098	0.63	1.14
Domestic	-0.0205	-0.0310	0.47	0.65
Domestic and Foreign	-0.0262	-0.0447	0.51	0.82

Summary and next steps

- We explore how best to design monetary and macroprudential policies in a SOE.
  - When macroprudential policy in place, welfare gains from responding through monetary policy is negligible under a financial shock.
  - It is costly to respond through monetary policy under a productivity shock.
  - In economies with sizeable foreign borrowing, using macroprudential instrument is more desirable.
- Next steps will include:
  - Further analysis on robustness
  - FX interventions and flexibility of exchange rate regime.
  - Counterfactual policy exercise calibrated for a SOE.