Optimal Monetary and Macroprudential Policies:

Gains and Pitfalls in a Model of Financial Intermediation

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Disclaimer: This is our view, not necessarily shared by the Board of Governors of the Federal Reserve System

Proposal for Macroprudential Policy

- Recently, a proposal for macroprudential oversight has been made.
- “Safeguard the financial system as a whole” in general equilibrium.
  - Bernanke [2008], Hanson, Kashyap, and Stein [2011]
- Countercyclical capital buffer, contingent capital, reserve requirement.
- Macroprudential policy has unavoidable macroeconomic consequences.
- In turn, monetary policy also has implications for financial stability.
- What are the differential effects of the two stabilization tools?

Marginal Gains of Macroprudential Policy

- What are the marginal gains from adopting macroprudential policy?
  - When monetary policy is set optimally/suboptimally.
  - When macroprudential policy is set optimally/suboptimally.
  - cf. Debate between Woodford [2012] and Svensson [2012]
- Develop a general equilibrium model in which the liquidity conditions of intermediaries may distort the value of assets
- Study how optimal policies can eliminate inefficient business cycles

Model Overview

- Risk averse households lack the skills of investing in risky assets: invest only indirectly by holding intermediary debt and equity.
- Risk neutral intermediaries raise debt $(1 - m_t)$ and equity capital (m_t) in frictional capital markets, invest funds on behalf of households.
  - Debt market friction: limited liability and moral hazard
  - Equity market friction: discount sales of new shares (dilution) due to asymmetric information, lemon premium, a key to valuation wedge
- Otherwise, the model is similar to Smets and Wouters [2007]
  - Preferences: external habit in consumption, "Catching up with Joneses"
  - Technology: Monopolistic competition, CRS production technology, nominal rigidity (Rotemberg [1982] type), investment adjustment friction

Intermediary Asset Pricing

- A conventional pricing formula for an arbitrary asset X.
  - If the marginal investor is the representative household,

$$1 = \mathbb{E}_t[M^H_{t,t+1} \cdot R^H_{X,t+1} / \Pi_{t+1}]$$

- We ask what happens?
  - (i) If the marginal investor is the financial intermediaries
  - (ii) If the intermediaries face financial frictions in raising funds

$$1 = \mathbb{E}_t[M^F_{t,t+1} \cdot R^F_{X,t+1} / \Pi_{t+1}]$$

- Liquidity problems generate a *valuation wedge*: $M^F_{t,t+1} \neq M^H_{t,t+1}$
  - We call $R^F_{X,t+1} - R^H_{X,t+1}$ lending spreads, essentially liquidity premium
  - Holmstrom and Tirole [2001]
- The *liquidity* conditions compete with the fundamentals of the economy as determinants of asset valuations

How to Create the Wedge

- How to create a pricing factor from a risk neutral agent?
  - He and Krishnamurthy [2013]: risk averse intermediary
- Liquidity const: let the shadow value of the const play the risk aversion
  - Brunnermeier and Sannikov [2014]: occasionally binding div const
- Our approach: idiosyncratic uncertainty + timing convention
  - Lending/borrowing to be made before the resolution of idio. uncertainty
  - Ex post, you may sit on a load of cash due to a good draw, or face a funding gap to be filled with costly external funds due to a bad draw
  - In the latter case, sell new shares at a discount $1 - \varphi \in (0, 1)$
  - ϵ_t^E: an idiosyncratic shock just good enough to avoid external financing
  - Ex ante shadow value of internal funds:

$$\mathbb{E}_t[\lambda_t|\Omega_t] = \Pr(\epsilon_{it} \geq \epsilon_t^E) \cdot 1 + \Pr(\epsilon_{it} < \epsilon_t^E) \cdot \frac{1}{1-\varphi} \geq 1$$

The Engine of the Model

- Asset return consists of aggregate and idiosyncratic components:

$$R^F_{it+1} = \epsilon_{it+1} R^F_{t+1} = \epsilon_{it+1} \left[\frac{\tilde{r}^K_{t+1} + (1-\delta) Q_{t+1}}{Q_t} \right]$$

- Model implied asset pricing equation:

$$1 = \mathbb{E}_t \left[M^F_{t,t+1} \cdot \frac{1}{m_t} \left(\frac{\mathcal{R}^F_{t+1}}{\Pi_{t+1}} - (1-m_t) \frac{R^B_{t+1}}{\Pi_{t+1}} \right) \right]$$

  - Pricing wedge:

$$M^F_{t,t+1} \equiv M^H_{t,t+1} \frac{\mathbb{E}_{t+1}[\lambda_{t+1} | \Omega_{t+1}]}{\mathbb{E}_t[\lambda_t | \Omega_t]} \begin{array}{l} \leftarrow \text{ liquidity tomorrow} \\ \leftarrow \text{ liquidity today} \end{array}$$

  - Return wedge:

$$\mathcal{R}^F_{t+1} \equiv R^F_{t+1} \left[\frac{\mathbb{E}_{t+1}[\lambda_{t+1} \epsilon_{t+1} | \Omega_{t+1}]}{\mathbb{E}_{t+1}[\lambda_{t+1} | \Omega_{t+1}]} \leftarrow \text{ dilution effect} \right.$$

$$\left. + \frac{\mathbb{E}_{t+1}[\lambda_{t+1} \max\{0, \epsilon^D_{t+1} - \epsilon_{t+1}\} | \Omega_{t+1}]}{\mathbb{E}_{t+1}[\lambda_{t+1} | \Omega_{t+1}]} \right] \leftarrow \text{ default option}$$

Calibration

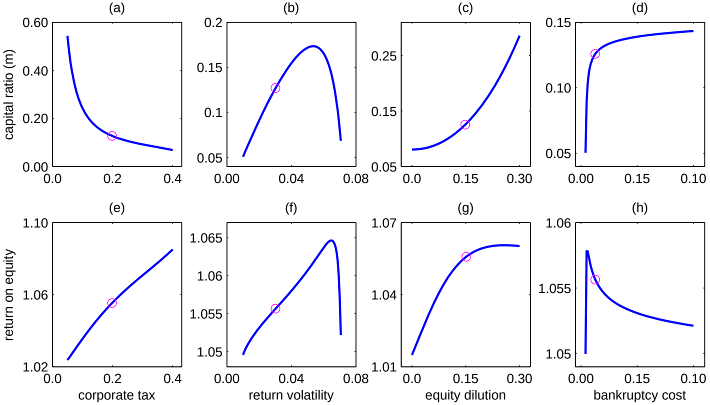
- We consider two sets of calibrations for shocks:
  - **New Keynesian**: technology, markup and risk premium shocks
  - **Financial Disturbance**: technology, markup and cost of capital shocks
  - S.D. of technology shock is fixed at 1 percent in both cases
  - Other volatilities chosen so that each contribute 1/3 to the total variance
- Standard Parameters
  - CRRA=4; habit=0.75; labor supply elasticity=3; elasticity of subs.=8
  - Price adjustment cost =120; investment adjustment cost=2;
- Baseline monetary policy setting
  - Following Levin, Wieland and Williams [1999] and Chung, Herbst and Kiley [2014], we set a difference rule with equal weights,

$$r_t = r_{t-1} + 0.5\Delta \log y_t + 0.5\Delta \log p_t$$

Stochastic Steady State

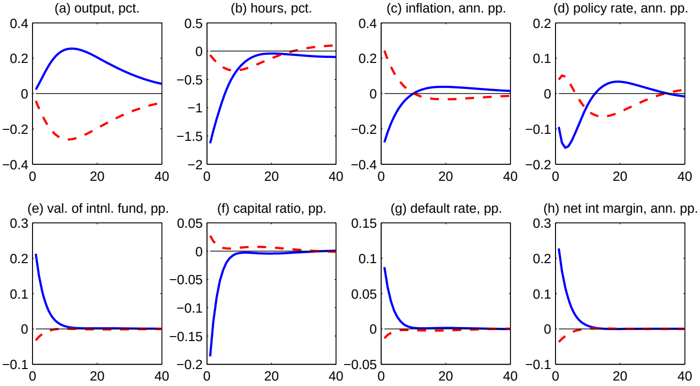
- The stochastic steady state (2nd order) of the model crucially depends on 4 financial parameters:
  - Corporate tax rate; return volatility; equity dilution; bankruptcy cost

Figure: Financial Parameters and Stochastic Steady State



Model Dynamics

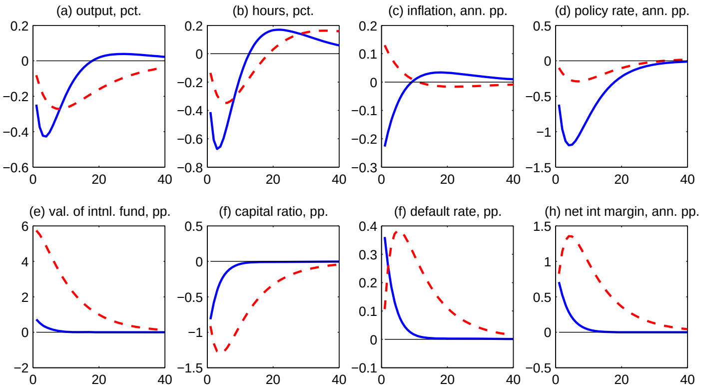
Figure: Impacts of Technology and Markup Shocks



Note: Blue solid: Technology shock, Red dash-dotted: Markup shock

Model Dynamics

Figure: Impacts of Risk Premium and Cost of Capital Shocks



Note: Blue solid: Risk premium shock, Red dash-dotted: Cost of capital shock

Ramsey Problem

- Ramsey planner maximizes

$$W_0(\mathbf{s}) = U(\mathbf{s}) + \beta E[W_0(\mathbf{s}')]$$

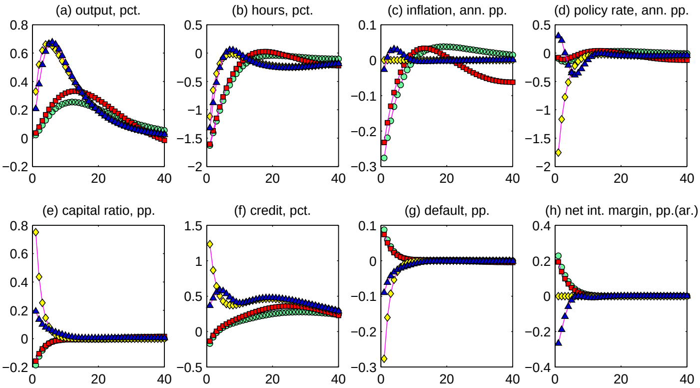
  subject to all private sector equilibrium conditions
- Typical of Ramsey allocation is the instrument volatility
- We assume a preference for smooth adjustment

$$W_1(\mathbf{s}) = U(\mathbf{s}) - \gamma^P (\Delta r)^2 C_{-1} + \beta E[W_1(\mathbf{s}')]$$

  - The difference in welfare created by the cost is miniscule
- We compare the welfare under the optimal policy and optimized simple rule (the difference rule)
  - We also a simple rule that reacts to a credit market condition
  - All welfare comparisons are based on 2nd order approximation

Optimal Monetary Policy

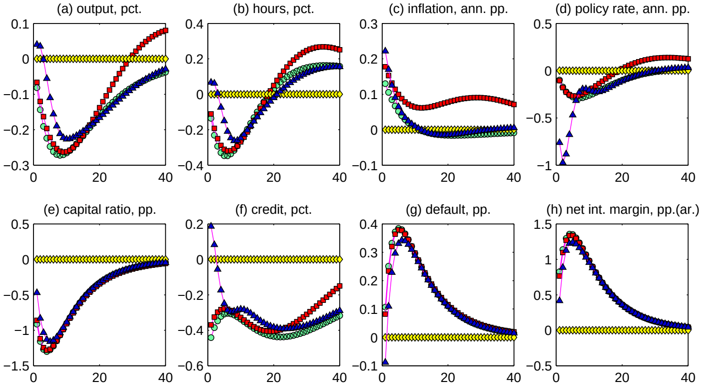
Figure: Impacts of Technology Shock



Note: Green: Baseline Taylor rule, Red: Modified Taylor rule, Yellow: First best, Navy: Ramsey monetary policy.

Optimal Monetary Policy

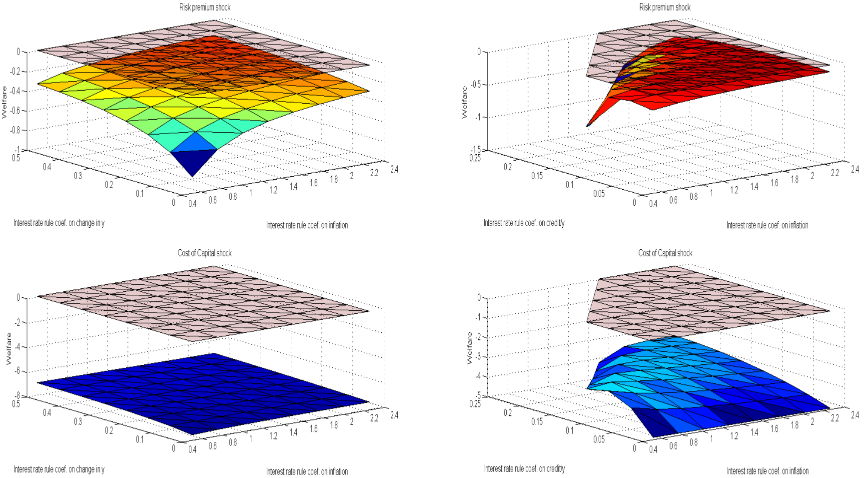
Figure: Impacts of Cost of Capital Shock



Note: Green: Baseline Taylor Rule, Red: Modified Taylor rule, Yellow: First best, Navy: Ramsey monetary policy.

Welfare: Alternative Monetary Policies

Figure: NK Calibration (top) and FD Calibration (bottom)



Pigovian Tax

- The inefficient business cycle arrises because

$$\text{accounting cost } \rightarrow m_t \neq \mathbb{E}_t[\lambda_t|\Omega_t]m_t \leftarrow \text{ economic cost}$$

  - When the discrepancy is large, a vicious circle may emerge between pecuniary externality and de-leveraging

- Theory of second best suggests a distortionary tax/subsidy
  - Leverage tax/subsidy on intermediary borrowing: $\tau_t^m(1-m_t)Q_tS_t$
  - With the leverage tax/subsidy, the economic cost becomes

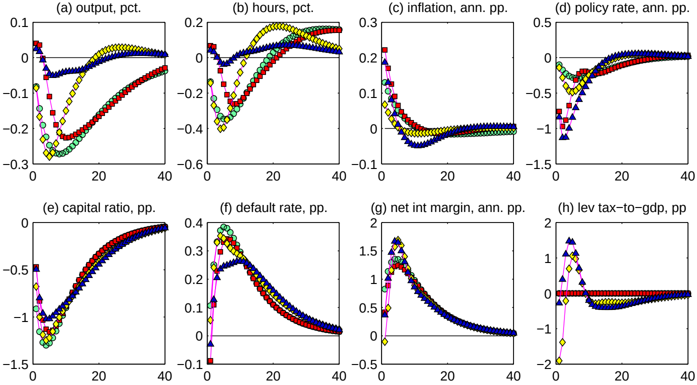
$$\mathbb{E}_t[\lambda_t|\Omega_t][m_t + \tau_t^m(1-m_t)] \gtreqless \mathbb{E}_t[\lambda_t|\Omega_t]m_t \quad \text{if} \quad \tau_t^m \gtreqless 0.$$

  - Under the policy, the asset pricing formula is modified:

$$1 = \mathbb{E}_t\left[M_{t,t+1}^F \cdot \frac{1}{m_t + \tau_t^m(1-m_t)}\left(\frac{\mathcal{R}_{t+1}^F}{\Pi_{t+1}} - (1-m_t)\frac{R_{t+1}^B}{\Pi_{t+1}}\right)\right]$$

Alternative Policies

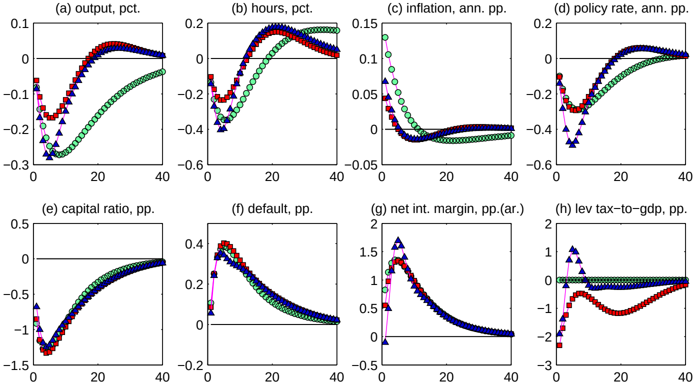
Figure: Impacts of Cost of Capital Shock



Note: Green: Baseline Taylor rule with no macroprudential instrument, Red: Ramsey monetary policy, Yellow: Ramsey macroprudential policy, Navy: Ramsey policy with both policy instruments.

A Simple Rule Macroprudential Policy

Figure: Impacts of Cost of Capital Shock

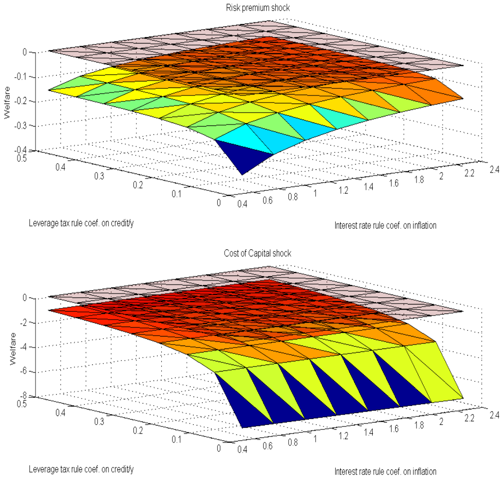


Note: $\tau_t^m = 0.25 \times [\ln(Q_t S_t / \bar{Q}\bar{S}) - \ln(Y_t/\bar{Y})]$

Green: Baseline Taylor rule with no macroprudential instrument, Red: Baseline Taylor rule with the simple rule macroprudential policy, Navy: Baseline Taylor rule with Ramsey macroprudential policy.

Welfare: A Simple Rule for Leverage Tax

Figure: NK Calibration (top) and FD Calibration (bottom)



Conclusion

- We develop a GE model with a special role for intermediary liquidity
- In an efficient business cycle, optimal monetary policy achieves FB
- Optimal monetary policy can be ineffective against financial shock
- A macroprudential instrument, when optimally employed together with optimal monetary policy, can achieve FB allocation
- Absent macroprudential policy tool, dealing with financial imbalance with suboptimal monetary policy may do more harm than good
- Optimizing one policy instrument without fixing the suboptimality of the other may not necessarily improve the results.
- Even when both instruments are optimally employed, welfare gains may not be big depending on the structure of the shocks