Preventive monetary and macroprudential policy response to anticipated shocks to financial stability

1st International Conference “Frontiers in International Finance and Banking”

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October 28-29, 2021

Motivation

- Recent Crises (GFC 2008) have prompted active rethinking about banking regulation and the coordination between monetary and macroprudential policies
- Increased number of macroprudential measures, especially in EMEs (Cerutti et al., 2017)
- Monetary policy is well studied in economic literature (Clarida et al., 1999; Kaplan et al., 2018) ...
- ... and macroprudential policy as well (Bianchi & Mendoza, 2018; Kara & Ozsoy, 2016; Schmitt-Grohé & Uribe, 2021; Stavrakeva, 2020; Woodford, 2003)
- What's about their combination or coordination?
  - Integrated Policy Framework (Adrian et al., 2020; Basu et al., 2020)
  - Coordination during recurrent boom-bust cycles (Van der Ghote, 2021)
  - How does monetary policy affect the transmission of macroprudential measures and vice versa? (Cozzi et al., 2020)

What Question We Ask

This paper: Characterize *optimal coordination between monetary and macroprudential policies* with pecuniary and aggregate demand externalities in economy with financial frictions

Our approach: rationalize the use of both monetary and macroprudential policies

- Agents do not internalize effects of their decisions
  - Aggregate demand externalities (Farhi & Werning, 2016; Korinek & Simsek, 2016; Schmitt-Grohé & Uribe, 2016)
    - ⋆ nominal rigidities
  - Pecuniary externalities / fire-sales (Dávila & Korinek, 2017; Lorenzoni, 2008)
    - ⋆ aggregate assets price movements

Question:

- How do monetary and macroprudential policies interact?

$\Rightarrow$ Are these policies substitutes or complements?

How We Contribute

How we differ from other articles:

1. Endogenous capital accumulation under sticky prices (opposite to Basu et al., 2020; Stavrakeva, 2020)
   - previous papers: either no capital accumulation but sticky prices (Farhi and Werning, 2016)
   - or capital accumulation without sticky prices (Dávila and Korinek, 2017)
2. Study "credit booms" – overaccumulation of debt

→ Study the transmission of macroprudential policy through two channels:

1. Effect on aggregate capital accumulation
2. Effect on re-distribution of capital between agents in the pre-crisis period

3. Study interactions between monetary and macroprudential policies (Dávila & Korinek, 2017; Farhi & Werning, 2016)
4. We use global methods to solve (non-linear solution) (Bianchi & Mendoza, 2018; Clerc et al., 2015)
5. Easily extendable for different policy experiments

Preview of the results

- We find a complementarity relation between ex-ante monetary policy and preventive macroprudential policy.
- Need to combine ex ante macroprudential policy and tight monetary policy in the credit cycle.
- Policy intervention (both monetary and macroprudential) can improve allocations by
  - restricting borrowing ex-ante (during the accumulation of risks)
  - stimulating the economy ex-post (during a crisis)
- We also compare this result with a flexible prices model (and with first-best in the paper) and conduct several sensitivity analysis exercises. ▸ Supplemental Results

Model

What We Do

- Standard NK model with nominal rigidities
- $t = 0; 1; 2...$ starting from $t = 3$ the economy is in flexible price steady state
- Final goods prices are fixed in $t = 0; 1$
- Cobb-Douglas technology for final goods: labor and raw inputs
- Raw inputs are produced using capital by firms using two technologies
- Firms with linear technology (superior) which might be constrained at $t = 1$
- Firms with concave technology (inferior) and always unconstrained
- Uncertainty $s \in \{High(good), Low(bad)\}$, realized at $t = 1$
- Assume that in "bad" state borrowing constraint binds
- Capital is created in $t = 0$ (by HHs from a final good), is traded with price q_t and used with a lag
- Available policy instruments: preventive θ_1 for macropru and i_1, and ex-post $i_{2,L}, i_{2,H}$ for monetary policies (actually, we can add ex-post macropru)

Timing

- $t \geq 2$ – all prices are flexible and no borrowing constraint and all capital in hands of firms with linear (superior) technology
- $t = 1$ – financial shock comes with probability ρ_L and borrowing constraint is binding – firms with linear technology are forced to deleverage – fire sales

$$d_{2,L}^{linear} = \kappa q_{1,L} k_{1,L}^{linear}\text{: L is for low (crisis) state}$$
$$d_{2,H}^{linear} < \kappa q_{1,H} k_{1,H}^{linear}\text{: H is for high (no crisis) state}$$

- $t = 0$ – agents know distribution of uncertainty, physical capital is produced – in the absence of taxes (if $\theta_1 = 0$) firms with linear technology buy all capital

Model and Environment

- **Households:** consume final good, provide labor for final good production, produce capital with quadratic costs at $t = 0$, own concave technology, finance firms with linear technology

$$\mathbb{E}\sum_{t=0}^{\infty}\beta^t[\log(c_{t,s}) - h_{t,s}] \qquad c_0 + inv_0(1 + \frac{\phi}{2}\frac{inv_0}{k_{-1}}) = y_0$$

- **Capital utilizing firms:** use capital ($k^f_t, f \in \{linear, concave\}$), traded at a price q_t, to produce raw inputs (x_t) which used in production of final good y_t

$$x_{t,s} = \underbrace{log(1 + k^{concave}_{t,s})}_{\text{concave tech}} + \underbrace{k^{linear}_{t,s}}_{\text{linear tech}} \qquad k_{-1} + inv_0 = K = k^{linear}_{t,s} + k^{concave}_{t,s}$$

- **Final goods producer:** combine labor and raw inputs. Fixed prices at $t = 0; 1$ and fully flexible prices at $t \geq 2$

$$y_t = \underbrace{h^{\alpha}_{t,s}}_{\text{labor}}\underbrace{x^{1-\alpha}_{t,s}}_{\text{raw good}} \qquad \underbrace{1 = \frac{\epsilon}{\epsilon - 1}\left(\frac{w_{t,s}}{\alpha}\right)^{\alpha}\left(\frac{p_{x,t,s}}{1-\alpha}\right)^{1-\alpha}}_{\forall t \geq 2}$$

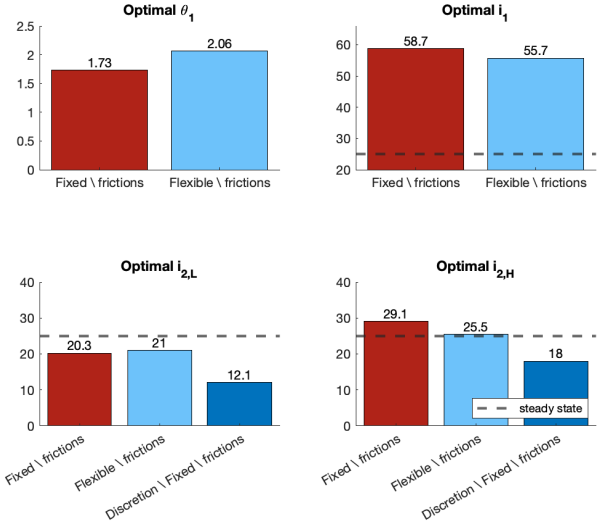
Solving the Model and Constrained Social Planner

- **Decentralized equilibrium**
- Results for equilibrium under commitment (policymaker chooses the macropru and monetary tools in the beginning of $t = 0$ once and for all)
- Also compare with discretion case
- Numerically solve problem for some fixed $\bar{\theta}_1, \bar{i}_1, \bar{i}_{2,H}, \bar{i}_{2,L}$.
- **Social Planner**
- SP internalizes adverse effects of the fire-sales externalities on aggregate prices and allocations
- SP maximizes households expected utility for every combination of $\theta_1, i_1, i_{2,H}, i_{2,L}$
- Therefore we numerically maximize expected utility function varying $\theta_1, i_1, i_{2,H}, i_{2,L}$
- Parameters values ▸ Appenidx

Results

Result 1: Complementarity in static

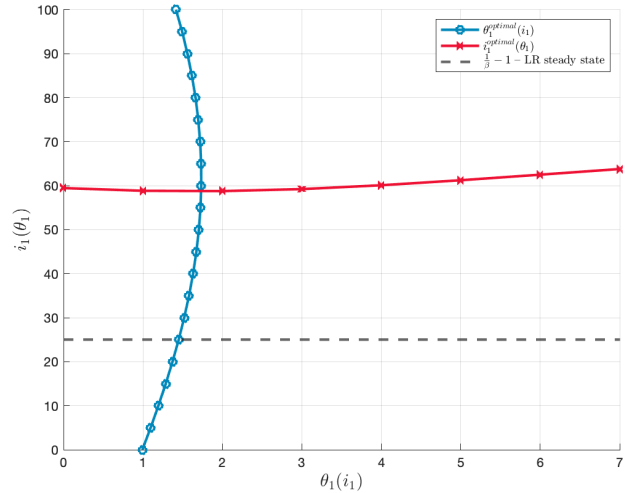
Tightening both ex-ante monetary and macroprudential policy



- Ex-ante tightening happens for both fixed and flexible prices.
- If a crisis, we ex-post ease monetary policy
- If no crisis, we ease only when prices are flexible
- It highlights the importance of assessing the degree of price rigidity in the economy to better understand the behaviour of the economy during a crisis and the speed of recovery after the crisis.

Result 2: Semi-complementarity in dynamic

Macroprudential policy shows an inverse U-shape curve

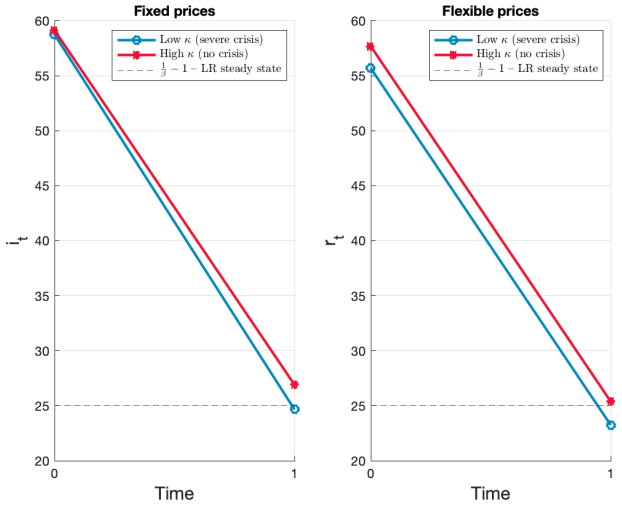


- Optimal macroprudential shows a U-shape curve, i.e. θ_1 grows when i_1 is small but with higher values of i_1 it declines. Optimal ex-ante monetary policy is almost insensitive to changes in θ_1.

$\rightarrow$ In dynamics these policy policies only partly complement.

Result 3: Ex-ante vs ex-post policies

Tightening monetary policy ex-ante and to easing monetary policy ex-post



- In the pre-crisis ($t = 0$) monetary policy tightening is almost the same for both κ's (fixed prices), while in the model with flexible prices monetary policy tightening for high κ is stronger.
- In the crisis period ($t = 1$): for high κ easing is smaller than for low κ.

$\rightarrow$ The "size" (κ) of a crisis matters only ex-post, especially for fixed prices.

▸ Supplemental Results

Conclusion

Question:

- How do monetary and macroprudential policies interact?
  - In anticipation to financial shock, it is optimal to tighten both policies

$\Rightarrow$ Are these policies substitutes or complements?

- Thus, policies behave like complements

$\rightarrow$ We highlight that price rigidity matters.

- If prices in the economy are more rigid, then the ex-ante monetary policy does not recognize the degree of severity of a crisis.

$\rightarrow$ It is important to correctly estimate the severity and probability of a crisis.

- If the debt limit (= severity) is not so tight, then it may be possible that the financial constraint does not bind.

$\rightarrow$ For a policymaker it is important to understand/estimate an initial household endowment, and the amount of financing of firms with linear technology.

- Both of these variables indicate households' or firms resources but the optimal policy response is diametrically opposite.

Thank you for your attention!

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Appendix

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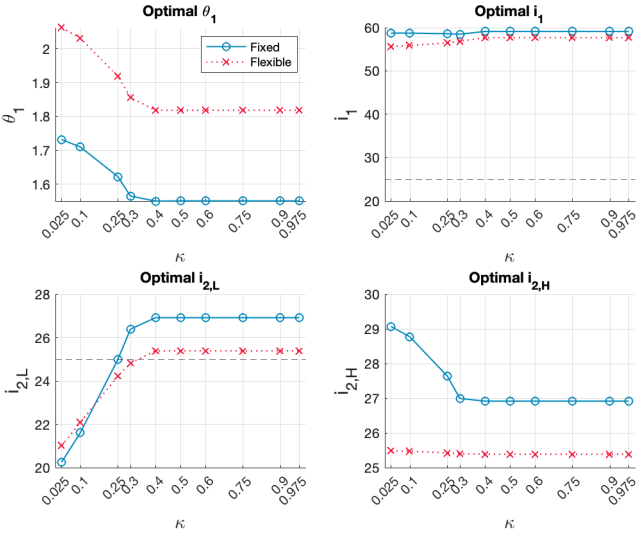
Calibration values

Parameter	Description	Value	Source
β	Discount factor	0.8	Basu et al., 2020
α	Share of capital	$\frac{1}{3}$	Commonly used in the literature
ϵ	Price markup	6	Commonly used in the literature
n_0^{linear}	Initial financing	0.53	US Data
k_{-1}	Initial endowment	0.85	US Data
ϕ	Capital adjustment	1	Uribe and Schmitt-Grohé, 2017
ρ_L	Probability of bad shock	0.5	Basu et al., 2020
κ	Debt limit	0.025	Basu et al., 2020

Back

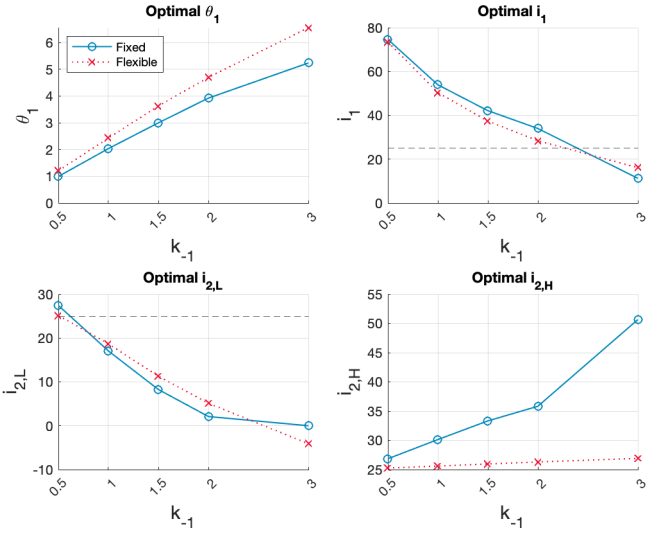
Supplemental Results

Tightening of the restrictions (κ)



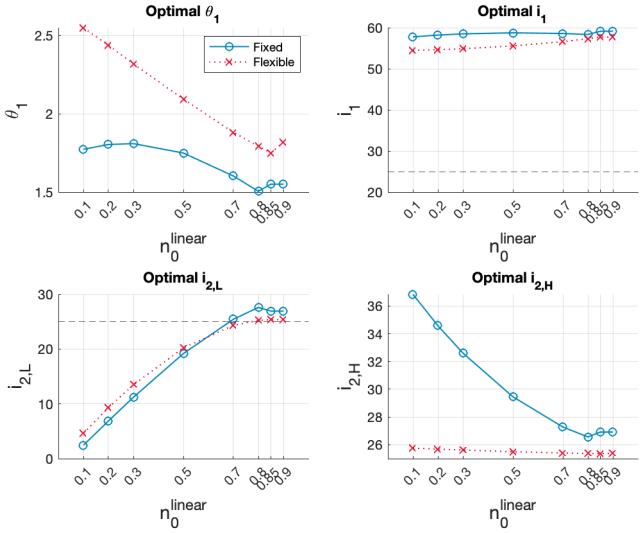
- There is an upper limit in κ after which all policies do not react.
- With relative high values of κ firms with linear technology do not meet financial constraint $\rightarrow$ optimal allocations are unconstrained

Initial HHs' endowment (k_{-1})



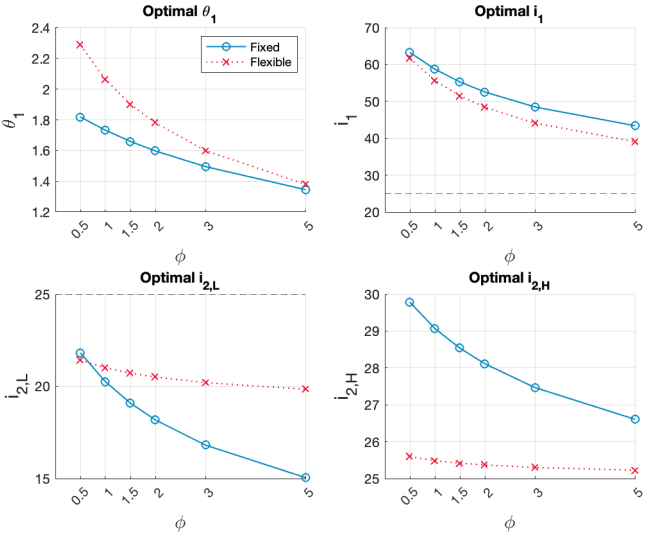
- If households are richer initially (have more k_{-1}), then a policymaker have to set quite a high ex-ante macroprudential policy, θ_1 and ex-post monetary policy, $i_{2,H}$.
- While it have to set ex-ante monetary policy i_1 and ex-post monetary policy, $i_{2,L}$ quite low.
- Low i_1 compensates high θ_1.

Initial firms' financing (n_0)



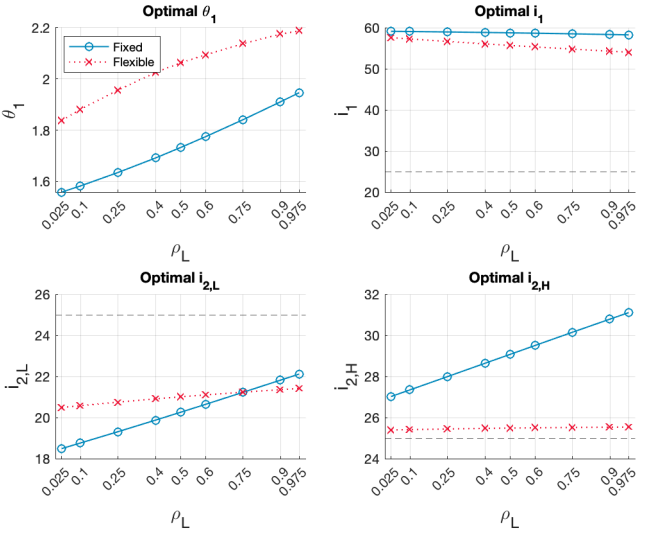
- Depending on n_0^{linear}, optimal θ_1 is non-linear:
- θ_1 rises when n_0^{linear} is low and it decreases when n_0^{linear} becomes higher.
- Also there is an limit for $n_0^{linear} < k_{-1}$.
- If the economy consists of "rich" firms then monetary policy could be constrained.

Tightening of capital production (ϕ)



- With larger ϕ it is more difficult to create a new unit of capital, thus, agents accumulate less capital and it requires a smaller amount of intervention from a policymaker.
- The tightening of i_1 and $i_{2,H}$ is much stronger for fixed prices model, while for θ_1 and $i_{2,L}$ the result is the opposite.

Change in probability of a crisis (ρ_L)



- When the probability of a crisis ρ_L rises, a policymaker tightens macroprudential policy but slightly eases ex-ante monetary policy and tightens ex-post monetary policy.
- Easing ex-ante monetary policy compensates high θ_1.