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

INFER 2021, 23rd Annual Conference

Konstantin Styrin[1,2] Alexander Tishin[1]

styrinka@mail.cbr.ru *tishinav@mail.cbr.ru*

[1]Bank of Russia [2]New Economic School

September 8-10, 2021

Motvation

- 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.
- Policy intervention (both monetary and macroprudential) can improve allocations by
  - restricting borrowing ex-ante (during the accumulation of risks and imbalances)
  - 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 date 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 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 firms:** use capital ($k_t^f, f \in \{linear, concave\}$) at a price q_t to produce raw inputs (x_t) which used in production of final good y_t

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

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

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

Macroprudential and Monetary polcies

- Ex-ante macroprudential policy

$$q_0 = \frac{\beta c_0}{1+\theta_1} \sum_s \left[\frac{\pi_s}{c_{1,s}} (p_{x,1,s} + q_{1,s}) \right]$$

- Ex-ante monetary policy (also EE for ex-post monetary policy)

$$\frac{1}{c_0} = \beta(1+i_1) \sum_s \left[\pi_s \frac{1}{c_{1,s}} \right]$$

- Ex-post monetary policy

$$q_{1,H} = \frac{p_{x,2,H} + q_{2,H}}{1+i_{2,H}}$$

$$q_{1,s} = \frac{p_{x,2,s} + q_{2,s}}{(1+k_1^{concave})(1+i_{2,s})}$$

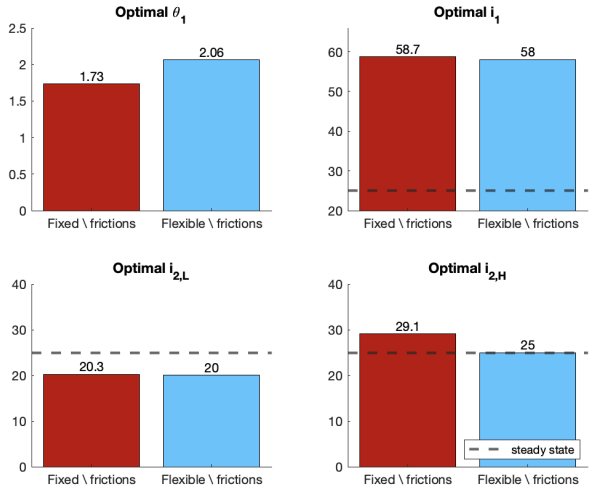
Solving the Model and Constrained Social Planner

- **Decentralized equilibrium**
- 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

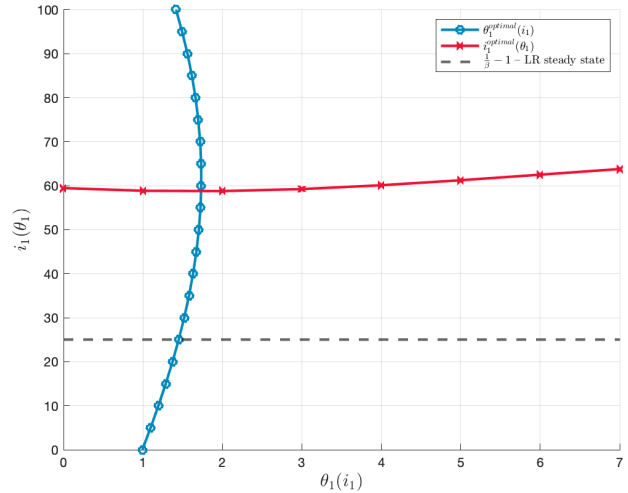
Tightening both ex-ante monetary and macroprudential policy



- 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

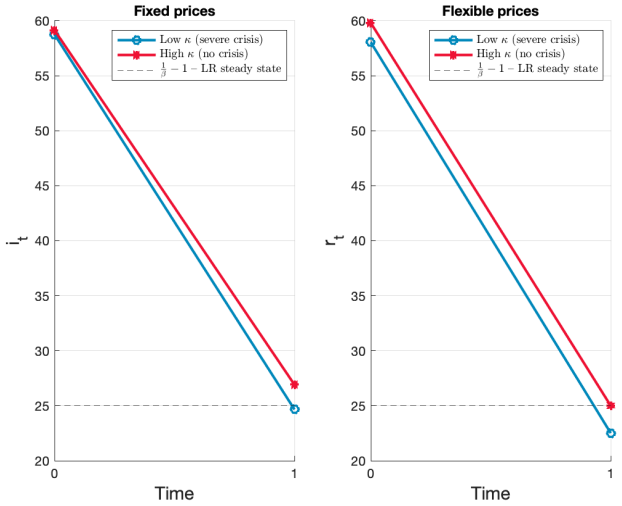


- Optimal macroprudential shows a U-shape curve, i.e. θ_1 grows when i_1 is small but with higher values of i_1 it declines. Optimal ex-ante monetary policy is almost insensitive to changes in θ_1.

$\rightarrow$ 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 response 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.

$\rightarrow$ 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 consultant 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!

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

Konstantin Styrin[1,2] Alexander Tishin[1]

styrinka@mail.cbr.ru *tishinav@mail.cbr.ru*

[1]Bank of Russia [2]New Economic School

September 8-10, 2021

Appendix

Bibliography I

Adrian, T., Erceg, C., Lindé, J., Zabczyk, P., & Zhou, J. (2020). A quantitative model for the integrated policy framework.

Basu, S. S., Boz, E., Gopinath, G., Roch, F., & Unsal, F. (2020). A conceptual model for the integrated policy framework.

Bianchi, J., & Mendoza, E. G. (2018). Optimal time-consistent macroprudential policy. *Journal of Political Economy*, *126*(2), 588–634.

Cerutti, E., Claessens, S., & Laeven, L. (2017). The use and effectiveness of macroprudential policies: New evidence. *Journal of Financial Stability*, *28*, 203–224.

Clarida, R., Gali, J., & Gertler, M. (1999). The science of monetary policy: A new keynesian perspective. *Journal of economic literature*, *37*(4), 1661–1707.

Clerc, L., Derviz, A., Mendicino, C., Moyen, S., Nikolov, K., Stracca, L., Suarez, J., Vardoulakis, A. P., et al. (2015). Capital regulation in a macroeconomic model with three layers of default. *International Journal of Central Banking*, *11*(3), 9–63.

Cozzi, G., Darracq Paries, M., Karadi, P., Körner, J., Kok, C., Mazelis, F., Nikolov, K., Rancoita, E., Van der Ghote, A., & Weber, J. (2020). Macroprudential policy measures: Macroeconomic impact and interaction with monetary policy.

Dávila, E., & Korinek, A. (2017). Pecuniary Externalities in Economies with Financial Frictions. *The Review of Economic Studies*, *85*(1), 352–395.

Farhi, E., & Werning, I. (2016). A theory of macroprudential policies in the presence of nominal rigidities. *Econometrica*, *84*(5), 1645–1704.

Bibliography II

Kaplan, G., Moll, B., & Violante, G. L. (2018). Monetary policy according to hank. *American Economic Review*, *108*(3), 697–743.

Kara, G., & Ozsoy, S. M. (2016). Bank regulation under fire sale externalities.

Korinek, A., & Simsek, A. (2016). Liquidity trap and excessive leverage. *American Economic Review*, *106*(3), 699–738.

Lorenzoni, G. (2008). Inefficient credit booms. *The Review of Economic Studies*, *75*(3), 809–833.

Schmitt-Grohé, S., & Uribe, M. (2016). Downward nominal wage rigidity, currency pegs, and involuntary unemployment. *Journal of Political Economy*, *124*(5), 1466–1514.

Schmitt-Grohé, S., & Uribe, M. (2021). Multiple equilibria in open economies with collateral constraints. *The Review of Economic Studies*, *88*(2), 969–1001.

Stavrakeva, V. (2020). Optimal bank regulation and fiscal capacity. *The Review of Economic Studies*, *87*(2), 1034–1089.

Uribe, M., & Schmitt-Grohé, S. (2017). *Open economy macroeconomics*. Princeton University Press.

Van der Ghote, A. (2021). Interactions and coordination between monetary and macroprudential policies. *American Economic Journal: Macroeconomics*, *13*(1), 1–34.

Woodford, M. (2003). Interest and prices.

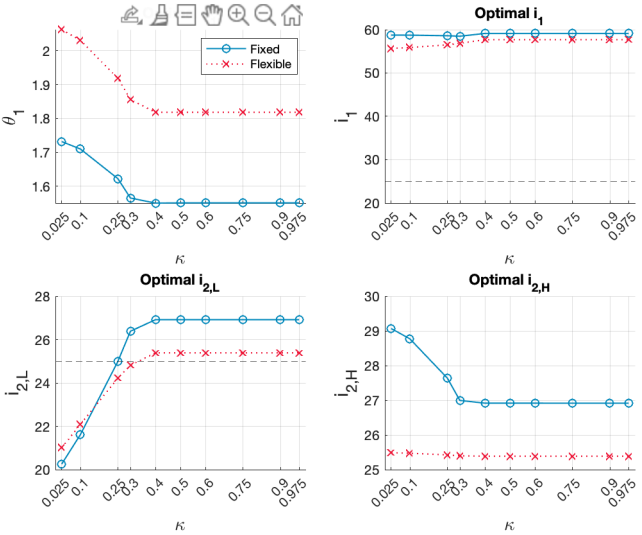
Calibration values

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

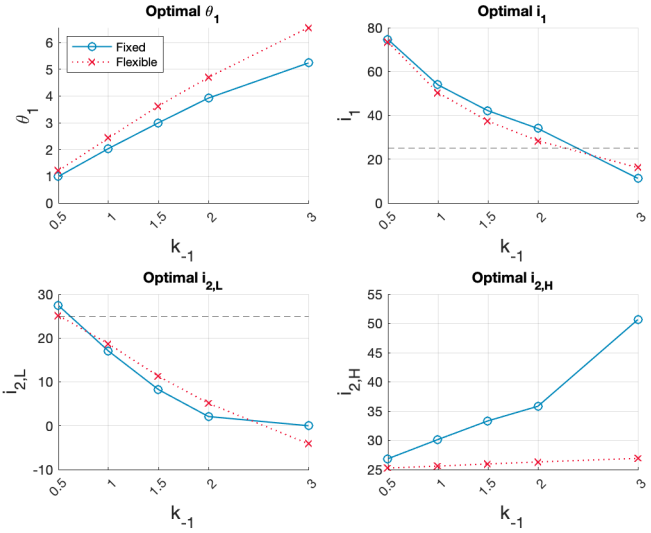
Supplemental Results

Tightening of the restrictions (κ)



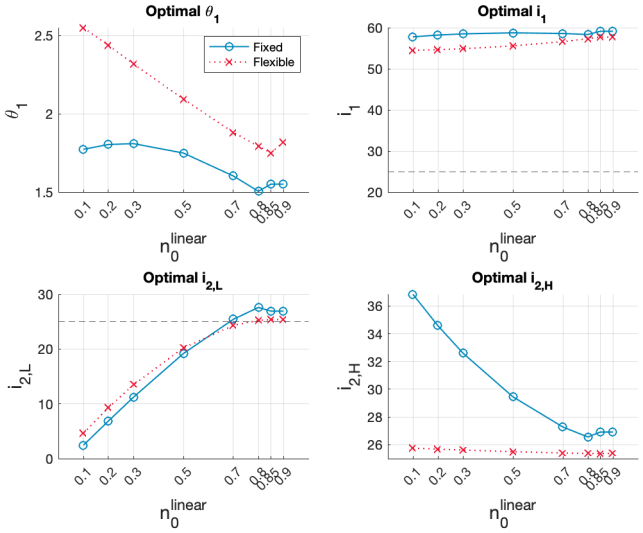
- There is an upper limit in κ after which all policies do not react.
- With relative high values of κ firms with linear technology do not meet financial constraint $\rightarrow$ optimal allocations are unconstrained

Initial HHs' endowment (k_{-1})



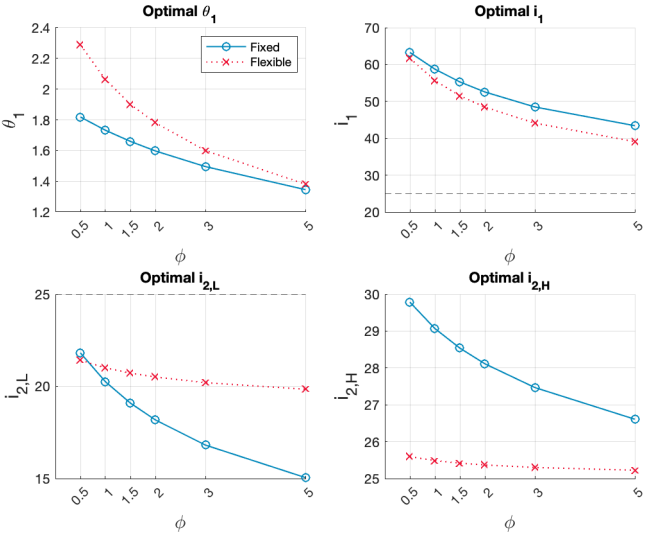
- If households are richer initially (have more k_{-1}), then a policymaker have to set quite a high ex-ante macroprudential policy, θ_1 and ex-post monetary policy, $i_{2,H}$.
- While it have to set ex-ante monetary policy i_1 and ex-post monetary policy, $i_{2,L}$ quite low.
- Low i_1 compensates high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

Initial firms' financing (n_0)



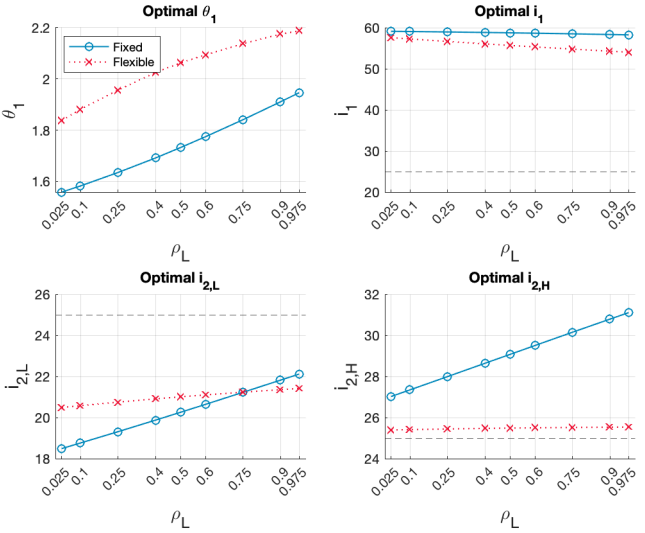
- Depending on n_0^{linear}, optimal θ_1 is non-linear:
- θ_1 rises when n_0^{linear} is low and it decreases when n_0^{linear} becomes higher.
- Also there is an limit for $n_0^{linear} < k_{-1}$.
- If the economy consists of "rich" firms then monetary policy could be constrained.

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.