Macroprudential Policy with Leakages

Julien Bengui [1] Javier Bianchi [2]

[1]Bank of Canada & CEPR

[2]Federal Reserve Bank of Minneapolis

Conference on Financial frictions: Macroeconomic implications and policy options for emerging economies, May 13, 2021

Motivation

- Macroprudential policy has emerged as central element of post-GFC policy toolkit
- Effectiveness of macroprudential policy is not being taken for granted, and is subject to growing empirical literature
- Common policy concern: macroprudential policy could leak and have unintended consequences

Questions

1. Is transmission of macroprudential policy significantly altered by possibility of leakages?
2. Does macroprudential policy remain desirable in presence of leakages?
3. How is optimal design of macroprudential regulation altered by presence of leakages?

This paper

- Tackle these questions in workhorse model of macroprudential policy in EMEs (Mendoza, 2002, Bianchi, 2011)
- In model, pecuniary externality resulting from financial friction makes macroprudential policy desirable, yet such policy endogenously lead to increased risk taking by shadow sector endowed with ability to bypass regulation
- Unintended spillover effects feed into economy's exposure to crises, limiting effectiveness of macropru policy and altering its optimal design

3-period Model

- 3-period, 2 goods (T, NT) endowment SOE model with preferences allowing for closed form solutions/characterization
- Single source of uncertainty: shock to date 1 tradable endowment
- Key financial friction: credit constraint linked to current income
- Leakages: two type of agents, R (regulated, measure $1-\gamma$) and U (unregulated, measure γ), parsimonious way to capture
    - Shadow banking sector
    - Differences in access to sources of funding
    - Differences in ability to exploit loopholes

Households' problem

Household of type $i \in \{U, R\}$ maximizes

$$c_{i0}^{T} + \mathbb{E}_0 \left[\beta \ln\left(c_{i1}\right) + \beta^2 \ln\left(c_{i2}\right)\right]$$

with $c_{it} = \left(c_{it}^{T}\right)^{\omega} \left(c_{it}^{N}\right)^{1-\omega}$ subject to (BC0), (BC1) and (BC2) and date 1 credit constraint:

$$b_{i2} \geq -\kappa \left(y_1^T + p_1^N y_1^N\right)$$

y_1^T is only stochastic variable

▸ *U* Agent's Full Problem ▸ *R* Agent's Full Problem

Overborrowing, macroprudential tax & risk-shifting

- Equilibrium real exchange rate appreciates with tradable absorption

$$p_t^N = f(\overset{+}{c_t^T})$$

- Together with credit constraint, implies households impose a negative externality on others when they borrow
  - More borrowing today

  → Tomorrow: less spending, more depreciated RER, tighter aggregate credit limit

- Planner seeks to reduce overborrowing by taxing debt of R agents, but this creates risk-shifting to unregulated sphere

Mechanics behind risk-shifting

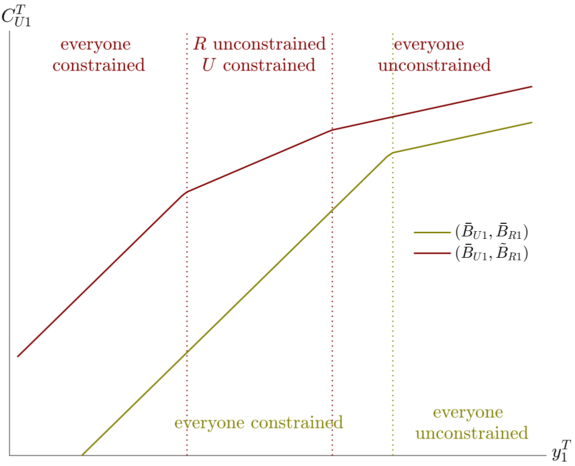

Figure: Unregulated agents' date 1 consumption function for given savings pairs $(\bar{B}_{U1}, \bar{B}_{R1})$ and $(\bar{B}_{U1}, \tilde{B}_{R1})$, with $\bar{B}_{U1} = \bar{B}_{R1} < \tilde{B}_{R1}$.

Preliminaries: Local results

- Positive effect of small tax: Starting from unregulated equilibrium, small positive tax leads to
  - less borrowing by R agents,
  - more borowing by U agents, and
  - unambiguously larger borrowing capacity at date 1.
- Welfare effects of small tax: If credit constraint binds with positive probability in unregulated equilibrium, small positive tax is welfare improving for all agents.

Optimal Macroprudential Policy Without Leakages

Planner's optimal bond choice on behalf of regulated agents

$$1 = \beta(1+r)\mathbb{E}_0\left[\frac{\omega}{c_{R1}^T}\right] + \underbrace{\beta\mathbb{E}_0\left[\left(\overset{+}{\mu}_{R1}\right)\kappa\left(\frac{\partial \overset{+}{p_1^N}}{\partial b_{R1}}\right)\right]}_{\text{credit constraint relaxation}}$$

Optimal Macroprudential Policy

Planner's optimal bond choice on behalf of regulated agents

$$1 \;=\; \beta\,(1+r)\,\mathbb{E}_0\left[\frac{\omega}{c^T_{R1}}\right] + \underbrace{\beta\mathbb{E}_0\left[\left(\overset{+}{\mu}_{R1} + \frac{\gamma}{1-\gamma}\;\overset{+}{\mu}_{U1}\right)\kappa\left(\frac{\overset{+}{\partial p^N_1}}{\partial b_{R1}} + \frac{\overset{+}{\partial p^N_1}}{\partial b_{U1}}\,\frac{\overset{-}{\partial b_{U1}}}{\partial b_{R1}}\right)\right]}_{\text{credit constraint relaxation}}$$

Optimal Macroprudential Policy

Planner's optimal bond choice on behalf of regulated agents

$$1 \;=\; \beta\,(1+r)\,\mathbb{E}_0\left[\frac{\omega}{c^T_{R1}}\right] + \underbrace{\beta\mathbb{E}_0\left[\left(\overset{+}{\mu}_{R1} + \frac{\gamma}{1-\gamma}\,\overset{+}{\mu}_{U1}\right)\kappa\left(\frac{\overset{+}{\partial p^N_1}}{\partial b_{R1}} + \frac{\overset{+}{\partial p^N_1}}{\partial b_{U1}}\frac{\overset{-}{\partial b_{U1}}}{\partial b_{R1}}\right)\right]}_{\text{credit constraint relaxation}}$$

Two opposite forces of shadow sector ($\gamma > 0$):

Macroprudential policy **less effective** but **more desirable**

Optimal Macroprudential Policy

Planner's optimal bond choice on behalf of regulated agents

$$1 = \beta(1+r)\mathbb{E}_0\left[\frac{\omega}{c_{R1}^T}\right] + \underbrace{\beta\mathbb{E}_0\left[\left(\overset{+}{\mu}_{R1} + \frac{\gamma}{1-\gamma}\overset{+}{\mu}_{U1}\right)\kappa\left(\frac{\overset{+}{\partial p_1^N}}{\partial b_{R1}} + \frac{\overset{+}{\partial p_1^N}}{\partial b_{U1}}\frac{\overset{-}{\partial b_{U1}}}{\partial b_{R1}}\right)\right]}_{\text{credit constraint relaxation}}$$

Two opposite forces of shadow sector ($\gamma > 0$):

Macroprudential policy **less effective** but **more desirable**

Optimal Macroprudential Policy

Planner's optimal bond choice on behalf of regulated agents

$$
1 \;=\; \beta\,(1+r)\,\mathbb{E}_0\left[\frac{\omega}{c^T_{R1}}\right] + \underbrace{\beta\mathbb{E}_0\left[\left(\overset{+}{\mu}_{R1} + \frac{\gamma}{1-\gamma}\,\overset{+}{\mu}_{U1}\right)\kappa\left(\frac{\overset{+}{\partial p^N_1}}{\partial b_{R1}} + \frac{\overset{+}{\partial p^N_1}}{\partial b_{U1}}\,\frac{\overset{-}{\partial b_{U1}}}{\partial b_{R1}}\right)\right]}_{\text{credit constraint relaxation}}
$$

$$
\underbrace{\gamma\sum_{t=1}^{2}\beta^t\mathbb{E}_0\left[\left(\frac{\omega}{c^T_{Ut}} \overset{+}{-} \frac{\omega}{c^T_{Rt}}\right)\left(c^N_{Rt} \overset{+}{-} c^N_{Ut}\right)\left(\frac{\overset{+}{\partial p^N_t}}{\partial b_{R1}} + \frac{\overset{+}{\partial p^N_t}}{\partial b_{U1}}\,\frac{\overset{-}{\partial b_{U1}}}{\partial b_{R1}}\right)\right]}_{\text{wealth redistribution}}
$$

Two opposite forces of shadow sector ($\gamma > 0$):

Macroprudential policy **less effective** but **more desirable**

Insights from 3-Period Model

- Macroprudential debt tax increases borrowing by unregulated sphere
- Debt tax still desirable (Pareto improvements)
- Size of optimal tax depends on two forces
  1. leakages make intervention less effective $\downarrow$
  2. leakages make intervention more desirable $\uparrow$
- Need quantitative model to assess magnitudes

Quantitative Model

- Infinite horizon model with CRRA utility and CES aggregator of T-NT goods
- Focus on optimal time consistent policy
  - Policies are a function of $X = \left(b_U, b_R, y^T\right)$
- Global (non-linear) solution
- Exploration with $\gamma \in [0, 0.5]$

Planner's problem with leakages

$$\mathcal{V}(X) = \max_{\{c_i^T, c_i^N, b_i'\}_{i\in\{U,R\}}, p^N} \gamma u\left(c\left(c_U^T, c_U^N\right)\right) + (1-\gamma) u\left(c\left(c_R^T, c_R^N\right)\right) + \beta \mathbb{E} \mathcal{V}(X')$$

subject to

$$\begin{aligned}
c_i^T + p^N c_i^N + b_i' &= b_i(1+r) + y^T + p^N y^N \qquad \text{for} \quad i \in \{U, R\} \\
b_i' &\geq -\left(\kappa^N p^N y^N + \kappa^T y^T\right) \text{ for} \quad i \in \{U, R\} \\
y^N &= \gamma c_U^N + (1-\gamma) c_R^N \\
p^N &= \left(\frac{1-\omega}{\omega}\right)\left(\frac{c_R^T}{c_R^N}\right)^{\eta+1} \qquad \text{for} \quad i \in \{U, R\} \\
u_T\left(c_U^T, c_U^N\right) &\geq \beta(1+r)\mathbb{E} u_T\left(\mathcal{C}_U^T(X'), \mathcal{C}_U^N(X')\right)
\end{aligned}$$

$$\left[b_U' + \left(\kappa^N p^N y^N + \kappa^T y^T\right)\right] \times \left[\beta(1+r)\mathbb{E} u_T\left(\mathcal{C}_U^T(X'), \mathcal{C}_U^N(X')\right) - u_T\left(c_U^T, c_U^N\right)\right] = 0$$

Markov Perf. Eq.: $\mathcal{B}_i(X) = b_i'(X), \mathcal{C}_i^T(X) = c_i^T(X), \mathcal{C}_i^N(X) = c_i^N(X)$

Quantitative Analysis

- Calibration largely follows Bianchi (2011) ▸ Calibration
- Experiments: role of size of unregulated sector γ for
  - Frequency of crises
  - Severity of crises
  - Welfare effects of macroprudential policy

Frequency of Crises

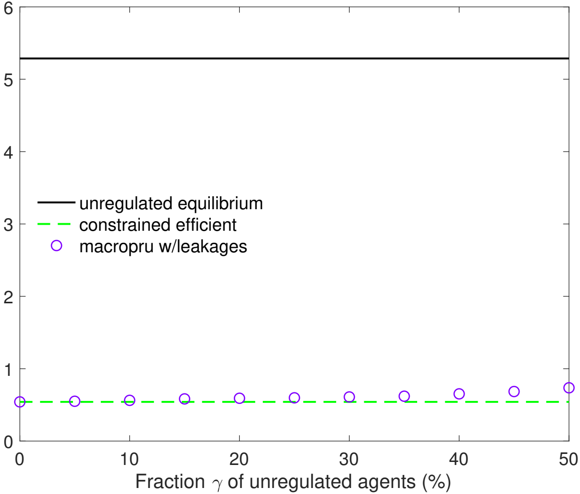

Figure: Long-run frequency of financial crises as a function of γ.

Severity of Crises

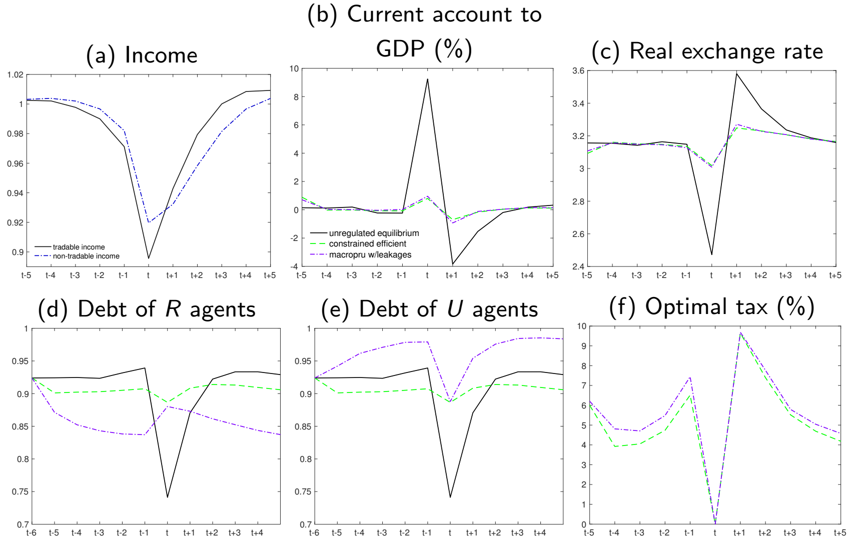

Figure: Event analysis, leakages at $\gamma = 0.5$.

Welfare Gains

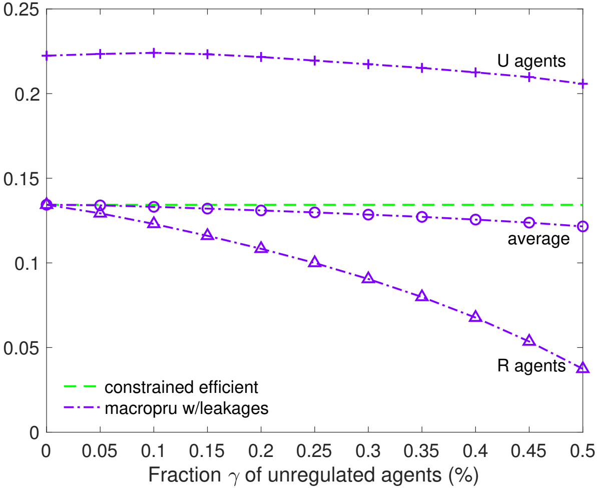

Figure: Unconditional welfare gains as a function of γ.

Note: Welfare gains are computed in consumption equivalence terms and expressed in percentages.

Conclusion

- Provide theory of macroprudential policy with leakages
- Unregulated agents respond to macroprudential policy by taking more risk, undermining policy effectiveness
- Macroprudential policy appear to be effective at limiting frequency and severity of crises despite large leakages
- Optimal macroprudential taxes are not necessarily smaller with leakages
- Average welfare gains barely affected by leakages, but significant distributional effects

Households

Unregulated Agents' Full Problem

Agent maximizes

$$c_{U0}^{T} + \mathbb{E}_0 \left[\beta \ln \left(c_{U1} \right) + \beta^2 \ln \left(c_{i2} \right) \right]$$

with $c_{Ut} = \left(c_{Ut}^{T} \right)^{\omega} \left(c_{Ut}^{N} \right)^{1-\omega}$ subject to

$$\begin{aligned} c_{U0}^{T} &= -b_{U1} \\ c_{U1}^{T} + p_1^N c_{U1}^{N} + b_{U2} &= (1+r)\, b_{U1} + y_1^T + p_1^N y_1^N \\ c_{U2}^{T} + p_2^N c_{U2}^{N} &= (1+r)\, b_{U2} + y_2^T + p_2^N y_2^N \\ b_{U2} &\geq -\kappa \left(y_1^T + p_1^N y_1^N \right) \end{aligned}$$

▸ Back

Households

Regulated Agents' Full Problem

Agent maximizes

$$c_{R0}^{T} + \mathbb{E}_0 \left[\beta \ln \left(c_{R1} \right) + \beta^2 \ln \left(c_{R2} \right) \right]$$

with $c_{Rt} = \left(c_{Rt}^{T} \right)^{\omega} \left(c_{Rt}^{N} \right)^{1-\omega}$ subject to

$$\begin{aligned} c_{R0}^{T} &= -b_{R1} \\ c_{R1}^{T} + p_1^N c_{R1}^N + b_{R2} &= (1+r)(1+\tau) b_{R1} + y_1^T + p_1^N y_1^N + T \\ c_{R2}^{T} + p_2^N c_{R2}^N &= (1+r)\, b_{R2} + y_2^T + p_2^N y_2^N \\ b_{R2} &\geq -\kappa \left(y_1^T + p_1^N y_1^N \right) \end{aligned}$$

Back

Calibration ▸ Back

	Value	Source
Interest rate	$r = 0.04$	Standard value
Risk aversion	$\sigma = 2$	Standard value
Elasticity of substitution	$1/(1+\eta) = 0.83$	Conservative value
Weight on tradables in CES	$\omega = 0.31$	Share of tradable output=32%
Discount factor	$\beta = 0.91$	Average NFA-GDP $= -29\%$
Credit coefficient	$\kappa = 0.32$	Frequency of crises=5.5%
Size of unregulated sector	$\gamma = [0, 0.5]$	Baseline range