Monetary and Macroprudential Policy Mix: An Institution-Design Approach

(Work in Progress, Preliminary Results)

Julio A. Carrillo Victoria Nuguer Jessica Roldán-Peña

Banco de México

BIS Office for the Americas, Mexico City

January 29, 2015

The views expressed herein are those of the authors and do not necessarily reflect those of Banco de México

Introduction

- 6 years after Lehman, we still debate about **how to design macroprudential policy**

- The debate has led to create or reform institutions
  - Basel III,
  - European Systemic Risk Board (ESRB),
  - Financial Stability Oversight Council (FSOC), or
  - Financial Policy Committee at Bank of England (FPC/BoE),...

- The common objective is to monitor systemic risk that threatens **financial stability**

- Instruments, goals, and powers of those institutions vary

- Most of new regulation aims at increasing resilience
  - Stress tests, liquidity coverage ratio, issue warnings, ...

Introduction

- Others measures focus on **dynamic reactions** to the cycle
  - FPC/BoE: Counter-cyclical capital buffer, sectorial capital requirements
- The DSGE literature on dynamic macroprudential policies is booming (See Angelini et al., 2014, Kannan et al., 2012, Quint and Rabanal, 2014, among others)
  - Instruments studied are bank capital requirements, loan-to-value ratios
  - The macroprudential authority sets a rule in order to attain an objective
- Best rule would be the one that **maximizes consumers' welfare**
- But welfare is too ambiguous to become an operational, transparent target of macroprudential policy

This paper

Which operational targets should a dynamic macroprudential policy follow?

- First best would be to implement Ramsey rules, however
  - They are model dependent and not robust across models
  - Too complex to explain to the public (or practitioners)
- We are looking for objectives that are clear, transparent, accountable, and compatible with welfare maximization
- Organized through simple rules that can be easily understood
- We aim to describe a framework similar to the best practices in monetary policy

This paper

- In a NK-DSGE model, for a closed and small open economy, with a banking sector and borrowing constraints
- We setup a game among policymakers
  - **First**, a central banker picks its policy rule to min $(\pi_t - \bar{\pi})^2$
  - **Then**, the macroprudential authority selects its rule focusing on 1 out of 3 rival and mutually exclusive targets
    - Output growth volatility
    - Credit growth volatility
    - Credit spread volatility
- The best objective for macroprudential policy is the one with the lowest welfare cost
- We compare this solution with the one obtained by a social planner setting the two rules simultaneously

Results

- So far, we have three main findings (but we are still working with other experiments)

  1. The welfare gains of adding a dynamic macroprudential rule are small
     - New: For the LTV ratios, gains are larger than with a bank capital requirement
  2. Given our setting, the best performing macroprudential mandate is to minimize the volatility of **output growth**
  3. In the open economy, the three macroprudential objectives might not be welfare enhancing, so alternative objectives are warranted

Contribution

- Close papers to our analysis are:
- Angelini, Neri and Panetta (2014)
  - Macroprudential targets are given
  - Focus on the interaction between monetary and macroprudential pol.
  - Look at the volatility of certain variables, but no welfare
- Quint and Rabanal (2014)
  - A generic MPP instrument reacts to credit volume indicators
  - Examine the welfare gains in a two-country monetary union framework
- This papers starts one step before
  - We compare <u>implementable</u> targets and instruments for MPP
  - And evaluate their convenience in terms of welfare
  - For a closed and open economy setup with borrowing constraints

Main building blocks of the model

- The banking sector is similar to Gerali et al. (2010)
  - Patient households consume, work, and deposit savings at banks
  - Impatient entrepreneurs consume, buy capital, and borrow from banks
  - Entrepreneurs face a collateral constraint on domestic borrowing
  - Deviations from bank capital requirement are costly
- The small open economy part is similar to Adolfson et al. (2007)
  - Imperfect exchange rate pass-through
- We fix the functional form of policy rules
  - Central bank follows Taylor-type rule
  - Macroprudential follows a rule that depends on output and loans
- Other NK features are
  - Nominal rigidities, adjustment costs in investment, variable capital utilization, habits

Entrepreneurs

- The problem of entrepreneur $i \in [0,1]$ is

$$\max_{c_t^E(i),k_t,f_t,u_t} E_t \sum_{t=0}^{\infty} \beta_E^t \frac{\left[c_t^E - h^E c_{t-1}^E\right]^{1-\sigma_E}}{1-\sigma_E}.$$

subject to

$$c_t^E + \frac{1+r_{t-1}^b}{\pi_t} b_{t-1} + \frac{1+r_{t-1}^f}{\pi_t^*} q_t f_{t-1} + q_t^k k_t + \psi\left[u_t\right] k_{t-1} =$$
$$r_t^k u_t k_{t-1} + b_t + q_t f_t + q_t^k (1-\delta) k_{t-1}, \text{ and}$$

$$(1+r_t^b) b_t \leq m_t E_t \left[q_{t+1}^k \pi_{t+1} (1-\delta) k_t\right].$$

- In a future version, we will put a restriction on foreign borrowing f_t

Banking sector

- A representative bank $j \in [0,1]$ has 3 units: A wholesale unit, and 2 retail branches
- The wholesale unit receives fonds from the deposit branch, at rate r_t, and passes them on to the loan branch, at rate R_t^b
- The profit maximization by the wholesale unit yields

$$R_t^b - r_t = -\kappa_{Kb}\left(\frac{K_t^b}{B_t}\right)^2\left(\frac{K_t^b}{B_t} - \nu_{b,t}\right)$$

- $\nu_{b,t}$ is the bank capital req., a macroprudential policy instrument
- Bank capital is accumulated out of retained earnings

$$\pi_t K_t^b = (1-\delta^b)K_{t-1}^b + j_{t-1}^b$$

- The loan and deposit branches are monopolistic competitors ▸ Equations

Policy rules

- The central bank follows a Taylor-type rule

$$(1+r_t) = (1+r)^{1-\phi_r}(1+r_{t-1})^{\phi_r}\left(\frac{\pi_t}{\pi}\right)^{\phi_\pi(1-\phi_r)}\left(\frac{y_t}{y_{t-1}}\right)^{\phi_y(1-\phi_r)}\epsilon_t^r.$$

- For macroprudential policy, we use bank-capital-to-asset ratio rule

$$\nu_{b,t} = \nu_b^{1-\phi_\nu}\nu_{b,t-1}^{\phi_\nu}\left(\frac{y_t}{y_{t-1}}\right)^{\phi_{\nu,y}(1-\phi_\nu)}\left(\frac{b_t}{b_{t-1}}\right)^{\phi_{\nu,b}(1-\phi_\nu)}\epsilon_t^\nu.$$

- New: we try a macroprudential LTV ratio rule

$$m_t = m^{1-\phi_m}m_{t-1}^{\phi_m}\left(\frac{y_t}{y_{t-1}}\right)^{-\phi_{m,y}(1-\phi_m)}\left(\frac{b_t}{b_{t-1}}\right)^{-\phi_{m,b}(1-\phi_m)}\epsilon_t^m.$$

- In our exercises, we stick to these functional forms,
- and let each authority to pick the coefficients of its rule in order to attain its mandate

Market clearing and model solving

- The resource constraint of the (open) economy is

$$\frac{a_t \tilde{k}_t^{\alpha} l_t^{1-\alpha} - \phi}{\Delta} \quad = \quad c_{H,t}^P + c_t^E + i_{H,t} + g_t + y_{H,t}^*$$

- The current account, in real terms, is

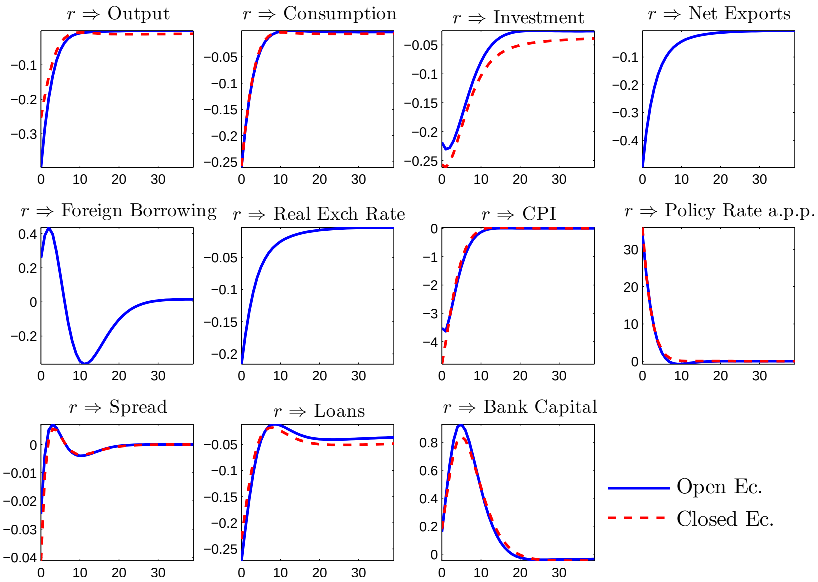
$$f_t q_t = \left(\frac{1 + r_{t-1}^f}{\pi_t^*} \right) f_{t-1} q_t + q_t p_{H,t}^* \Delta_{H,t}^* y_{H,t}^* - \left(q_t \Delta_t^{f,c} c_{F,t}^P + \Delta_t^{f,i} i_{F,t} \right)$$

where the Δ's refer to distortions caused by price dispersion

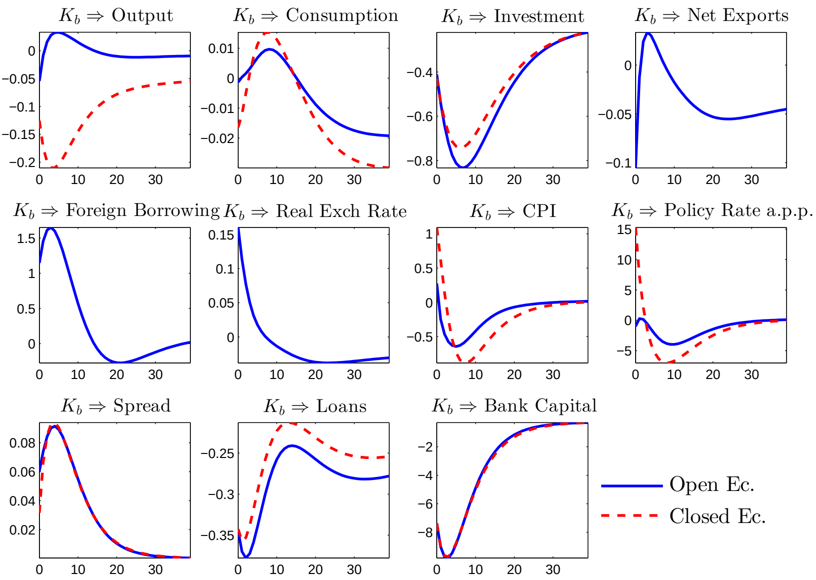
- For this version, we calibrate the banking sector as in Gerali et al. (2010), and the open-economy part as in the BIS Joint Project (2015), parameters for Mexico

- We solve the model to the second order, to capture differences in welfare from different policy rules

IRF Monetary Policy Shock (no macroprudential rule)



IRF Bank Capital Shock (no macroprudential rule)



Monetary policy objective

- For this version, we assume a single mandate for the central bank
- Monetary policy should be chosen to attain the objective

$$\min_{\{\phi_\pi,\phi_y\}|_{\phi_r=.75}} L_\pi,$$

$$\text{where } L_\pi \quad = \quad E\left\{\sum_{i=0}^{\infty}\left(\beta^P\right)^i(\pi_{t+i}-\bar{\pi})^2\right\}.$$

- We restrict policy inertia to be high, since it is known to attain a higher consumer welfare (See Williams, 2003)

  (We are currently working with other objectives, like those that include output and interest-rate smoothing)

Macroprudential policy candidate objectives

- Macroprudential policy should be chosen to attain one of the following objectives

$$\min_{\phi_v,\phi_{v,y},\phi_{v,b}} L_{\Delta y}, \quad \text{or} \quad \min_{\phi_v,\phi_{v,y},\phi_{v,b}} L_{\Delta b}, \quad \text{or} \quad \min_{\phi_v,\phi_{v,y},\phi_{v,b}} L_{\Delta (r_e - r)},$$

where $L_{\Delta \upsilon} = E\left\{\sum_{i=0}^{\infty} \left(\beta^P\right)^i \left(\Delta \upsilon_{t+i}\right)^2\right\}$ for $\upsilon \in \{y, b, (r_e - r)\}$

(We are expanding the candidate objectives to those that include a credit-to-output ratio, like the FPC/BoE)

- Each one of these mandates may draw a different set of coefficients (ϕ_v, $\phi_{v,y}$, and $\phi_{v,b}$) and a stochastic steady state level for welfare

- The best performing mandate is the one achieving the lowest welfare cost

Consumption-equivalent welfare costs

- Consumers' welfare can be written as

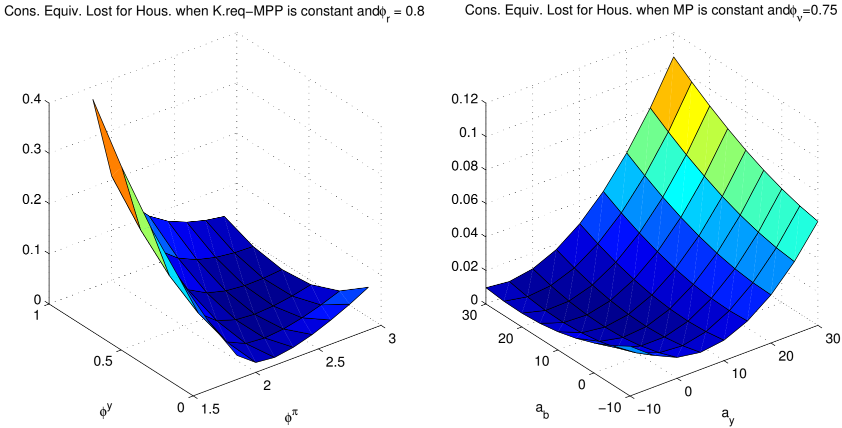
$$V_t^P = U^P\left(c_t^P, l_t\right) + \beta^P E_t\{V_{t+1}^P\},$$

- We measure welfare costs through consumption-equivalent terms
  - how much consumption you have to give to the households under the different policy rules to reach the welfare level that a benevolent planner would get
- In our reference environment, a benevolent planner picks coefficient set ϱ_{osr} that maximizes V_t^P
- We call this solution as Optimal Simple Rules (OSR)

Equations

Welfare costs

- Example of welfare function in the closed economy



More Graphs

Timing of policymakers' game

- Our exercise has the following timing
  1. The central bank chooses first, when there is no dynamic macroprudential policy ($\nu_{b,t} = \nu_b$)
  2. Taken as given CB's rule, the macroprudential authority picks its coefficients to attain one of the candidate mandates
  3. In a third and final stage, we let the CB to re-optimize his choice, taken as given the new macroprudential rule
- We measure the welfare costs of all the three stages with respect to the OSR solution
- For these exercises, we explored more than 100,000 combinations of policy parameters in a grid search

Candidate mandates in closed economy: capital requirement

Table 1. Welfare costs comparison: closed economy.

Case	Welfare cost	ρ_r	ϕ_π	ϕ_y	ρ_{ν^b}	a_y	a_b
Welfare-based Optimal Simple Rules (OSR)	-	0.75	2.30	0.30	0.60	0.00	0.50
Welfare-based OSR, without Macropru.	**0.001**	0.75	2.30	0.30	-	-	-
CB, π objective, without Macropru.	**0.139**	0.75	2.90	0.00	-	-	-
Macropru., Δy objective, cond. on CB	**0.137**	0.75	2.90	0.00	0.75	0.50	0.50
Macropru., Δb objective, cond. on CB	0.139	0.75	2.90	0.00	0.00	0.00	0.00
Macropru., $\Delta(r_b - r)$ objective, cond. on CB	0.139	0.75	2.90	0.00	0.00	0.00	0.00
CB, π objective, cond. on optimal Macropru.	0.137	0.75	2.90	0.00	0.75	0.50	0.50

- Welfare gains are quite small when adding a dynamic macroprudential policy rule in a closed economy
- Output growth outperforms the other candidates

Candidate mandates in open economy: capital requirement

Table 2. Welfare costs comparison: open economy.

Case	Welfare cost	ρ_r	ϕ_π	ϕ_y	ρ_{ν^b}	a_y	a_b
Welfare-based Optimal Simple Rules (OSR)	-	0.75	2.30	0.00	0.60	0.10	0.00
Welfare-based OSR, without Macropru.	**0.033**	0.75	2.30	0.15	-	-	-
CB, π objective, without Macropru.	**0.698**	0.75	1.70	0.90	-	-	-
Macropru., Δy objective, cond. on CB	**0.710**	0.75	1.70	0.90	0.00	0.50	0.20
Macropru., Δb objective, cond. on CB	0.790	0.75	1.70	0.90	0.75	0.10	0.50
Macropru., $\Delta(r_b - r)$ objective, cond. on CB	0.720	0.75	1.70	0.90	0.00	0.50	0.00
CB, π objective, cond. on optimal Macropru.	0.710	0.75	1.70	0.90	0.00	0.50	0.20

- Welfare gains of adding a dynamic macroprudential policy rule are bigger in an open economy
- Output growth outperforms the other candidates, but overall consumers are worse off

Candidate mandates in closed economy: LTV ratio New!

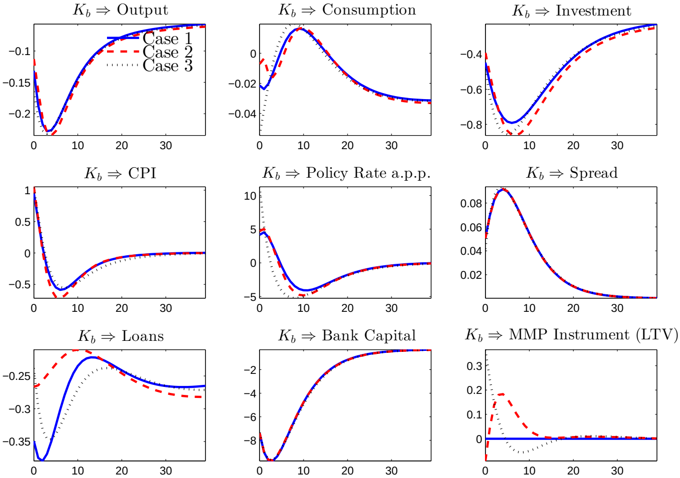
Table 3. Welfare costs comparison: closed economy and LTV.

Case	Welfare cost	ρ_r	ϕ_π	ϕ_y	ρ_{ν^b}	a_y	a_b
Welfare-based Optimal Simple Rules (OSR)	-	0.80	2.60	0.40	0.40	-0.50	4.00
Welfare-based OSR, without Macropru.	**0.030**	0.80	2.30	0.20	-	-	-
CB, π objective, without Macropru.	**0.115**	0.80	2.90	0.00	-	-	-
Macropru., Δy objective, cond. on CB	**0.086**	0.80	2.90	0.00	0.80	3.50	4.00
Macropru., Δb objective, cond. on CB	1.399	0.80	2.90	0.00	0.00	3.50	-1.00
Macropru., $\Delta(r_b - r)$ objective, cond. on CB	1.206	0.80	2.90	0.00	0.00	3.50	2.50
CB, π objective, cond. on optimal Macropru.	0.086	0.80	2.90	0.00	0.80	3.50	4.00

- LTV obtains bigger gains than the bank capital ratio
- Once again, the output growth mandate outperforms the other candidates

Dynamic macroprudential rule in action: LTV

- Negative shock in bank capital (**Case 1**: Only CB active; **Case 2**: CB and Macroprud actives; **Case 3**: OSR solution)



Conclusions

- This is still a work in progress, but so far our findings are
    1. The welfare gains of adding a dynamic macroprudential rule are small
    2. The best performing MPP mandate is output volatility, not credit
    3. In the open economy, the candidates are not welfare enhancing
    4. LTV ratios attain a higher welfare than bank capital requirements
- We still need to make a number of exercises
    - Define better objectives
    - Estimate the model for Mexico
    - Dig deeper on intuitions

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Banking sector II

- The loan and deposit branches are monopolistic competitors
- The loan branch resells the wholesale unit's funds to entrepreneurs, with a markup rate r_t^b, and demand $b_t(j) = b_t\left(r_t^b(j)/r_t^b\right)^{-\epsilon_t^b}$

$$\max_{r_t^b(j)} E_0 \sum_{t=0}^{\infty} \Lambda_{0,t}^P \left[r_t^b(j) b_t(j) - R_t^b B_t(j) - \frac{\kappa_{kb}}{2}\left(\frac{r_t^b(j)}{r_{t-1}^b(j)} - 1\right)^2 r_t^b b_t \right]$$

- The deposit branch receives funds from households, with a markdown rate r_t^d, and demand $d_t(j) = d_t\left(r_t^d(j)/r_t^d\right)^{-\epsilon_t^d}$

$$\max_{r_t^d(j)} E_0 \sum_{t=0}^{\infty} \Lambda_{0,t}^P \left[r_t d_t(j) - r_t^d(j) d_t(j) - \frac{\kappa_{kd}}{2}\left(\frac{r_t^d(j)}{r_{t-1}^d(j)} - 1\right)^2 r_t^d d_t \right]$$

Go back

Consumption-equivalent welfare costs

- Consumers' welfare can be written as

$$V_t^P = U^P\left(c_t^P, l_t\right) + \beta^P E_t\{V_{t+1}^P\},$$

- Let $\varrho_k \in \Phi$ denote a set of policy rules, and $V_{ss}^P(\varrho_k)$ the stochastic steady state welfare induced by this set as

$$V_{ss}^P(\varrho_k) = E\left\{V_t^P\left(c_t^P(\varrho_k), l_t(\varrho_k)\right)\right\}$$

- Let ω^P denote the consumption cost that makes households indifferent between a reference environment and the one induced by ϱ_k (See Schmitt-Grohé and Uribe, 2007)

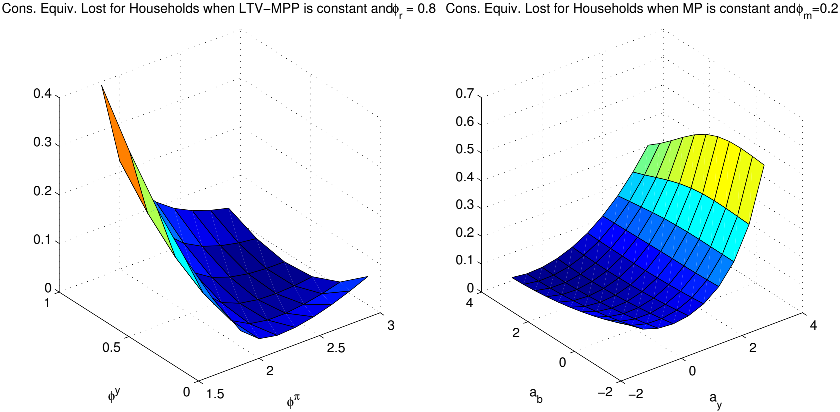
$$V_{ss}^P(\varrho_k) = V_{ref}^P\left(\left(1-\omega^P\right)c_{ref}^P, l_{ref}\right),$$

- In our reference environment, a benevolent planner picks set ϱ_{osr} that maximizes V_t^P

- We call this solution as Optimal Simple Rules (OSR) Go back

Welfare costs

- Example of welfare function in the closed economy with LTV



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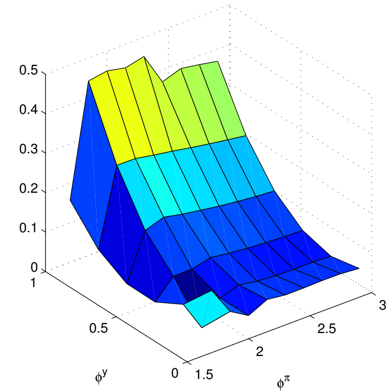
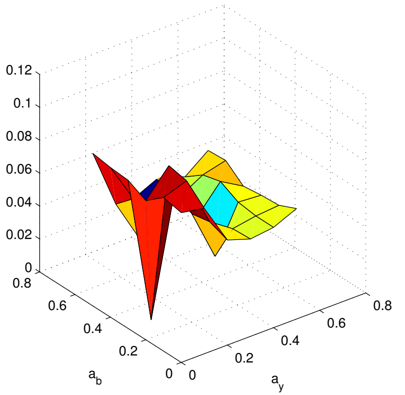
Welfare costs

- Example of welfare function in the open economy





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