Macroprudential Policy and Housing

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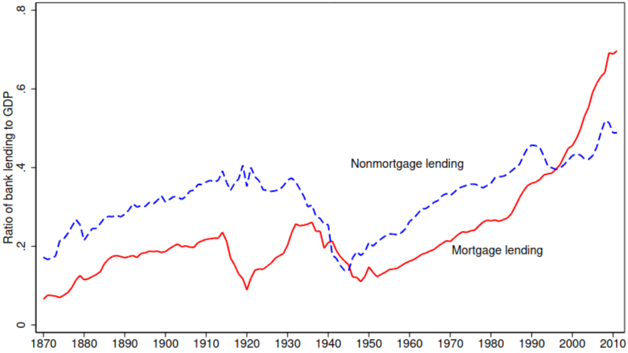
Motivation

Macroprudential Policy and Housing

Bank mortgage and non-mortgage lending to GDP, 1870–2011: Average ratio to GDP by year for 17 countries

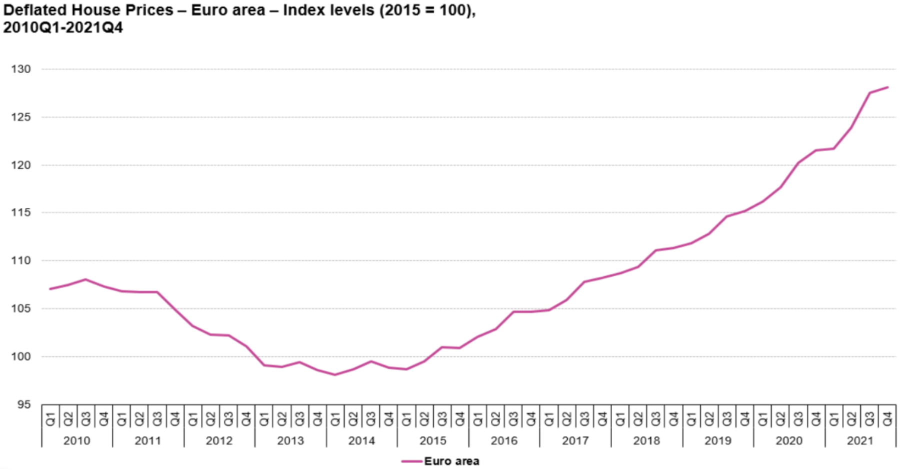


Notes: Mortgage (residential and commercial) and non-mortgage lending to the business and household sectors. Average across 17 countries.

Òscar Jordà & Moritz Schularick & Alan M. Taylor, 2016

Motivation

Macropudential Policy and Housing



Brief literature review

Macroprudential Policy and Housing

- Occasionally-binding collateral constraints on credit:
  - Fisher (1933)
  - Auernheimer and Garcia-Saltos (2000)
  - Caballero and Krishnamurthy (2001)
  - Kiyotaki and Moore (2007)
  - Lorenzoni (2008) and Korinek (2009)
  - **Bianchi (2011)**

- Studies that built on Bianchi's model:
  - Bianchi et al. (2012)
  - Benigno et al.(2013)
  - Bengui and Bianchi (2014)
  - **Bianchi and Mendoza (2016)**

  - In general: no housing
  - Housing as capital

Research questions

Q1: I extend Bianchi and Mendoza's 2016 model in order to provide a quantitative assessment of the optimal macroprudential policy in a framework for small open economies that considers news shocks, shifts in global liquidity **and housing**.

Q2: I use the aformentioned model in order to study how an **exogenous rise in external demand** for housing changes the optimal macroprudential policy.

- Preferences: $U_t = \mathbb{E}_t \left[\sum_{i=0}^{\infty} \beta^i \frac{c_{t+i}^{1-\sigma} - 1}{1-\sigma} \right]$

- Basket of consumption:
$$c_t = \left(\alpha \left[\omega \left(c_t^T \right)^{-\eta} + (1-\omega)\, c_t^N \right)^{-\eta} \right]^{\frac{\eta_D}{\eta}} + (1-\alpha)(A_t)^{-\eta_D} \right)^{-\frac{1}{\eta_D}}$$

- Budget constraint: $\frac{b_{t+1}}{R_t} + c_t^T + p_t^N c_t^N = b_t + y_t^T + p_t^N y_t^N$

- Markets clear: $c_t^N = y_t^N$

- Collateral constraint: $q_t b_{t+1} \geq -\kappa_Y \left(y_t^T + p_t^N y_t^N \right) - \kappa_A\, p_t^H A_t$

- Stochastic process for the production of tradable goods:
  $y_t^T = (1-\rho)\mu + \rho\, y_{t-1}^T + \epsilon_t^T$

- Assume $y_t^N = y^N = 1$, $A_t = A = 1$: land does not increase or depreciate.

- News are modeled as a noisy signal:
  $$p(s_t = i | y_{t+1}^T = l) = \begin{cases} \theta & , \quad i = l \\ \frac{1-\theta}{N-1} & , \quad i \neq l \end{cases}$$

- Regime changes in global liquidity:
  $$\begin{bmatrix} F_{hh} & F_{lh} \\ F_{hl} & F_{ll} \end{bmatrix} = \begin{bmatrix} p(R_{t+1} = R^h | R_t = R^h) & p(R_{t+1} = R^l | R_t = R^h) \\ p(R_{t+1} = R^h | R_t = R^l) & p(R_{t+1} = R^l | R_t = R^l) \end{bmatrix}$$

Model - Decentralized Equilibrium

- Budget constraint and market clearing: $q_t b_{t+1} + c_t^T = b_t + y_t^T$
- Dynamic programming problem of the agent:

$$V(b_t, A_t, y_t^T, y_t^N, s_t, q_t) =$$
$$\max_{c_t^T, c_t^N, A_t, b_{t+1}} \left[\frac{(c(c_t^T, c_t^N, A_t))^{1-\sigma} - 1}{1-\sigma} + \beta \mathbb{E}_t V(b_{t+1}, A_{t+1}, y_{t+1}^T, y_{t+1}^N, s_{t+1}, q_{t+1}) \right]$$

where:

$$q_t b_{t+1} + c_t^T = b_t + y_t^T$$
$$c^N = y^N$$
$$q_t b_{t+1} \geq -\kappa_Y \left(y_t^T + p_t^N y_t^N\right) - \kappa_A p_t^H A_t$$

Model - Decentralized Equilibrium Prices

- Prices denoted in tradables: $p_t^X = \frac{\frac{\partial U(X_t)}{\partial X_t}}{\frac{\partial u(c_t^T)}{\partial c_t}}$

- Price of non-tradables: $p_t^N = \left(\frac{1-\omega}{\omega}\right)\left(\frac{c_t^T}{c_t^N}\right)^{1+\eta}$

- Price of land:

$$p_t^H = \frac{1}{\alpha\omega} c_t^{\sigma-1-\eta_D} \left[\omega \left(c_t^T\right)^{-\eta} + (1-\omega)\, c_t^N\right)^{-\eta}\right]^{\eta_D-\eta} \left(c_t^T\right)^{\eta+1} \frac{\partial U_t}{\partial A_t}$$

- To obtain $\frac{\partial U_t}{\partial A_t}$, two disconnected states:
  - $A^+ = A + \epsilon$
  - $A^- = A - \epsilon.$

- Social planner: takes prices into account

$$\frac{\partial u(c_t)}{\partial c_t^T} + \mu_t \, \psi_t = \frac{\beta}{q_t} \mathbb{E}_t \left[\frac{\partial u(c_{t+1})}{\partial c_{t+1}^T} + \mu_{t+1} \ \psi_{t+1} \right] + \mu_t \ \psi_t = \kappa_Y \frac{\partial p_t^N}{\partial c_t^T} + \kappa_A \frac{\partial p_t^H}{\partial c_t^T}$$

- Macroprudential policy: constraint does not bind today but may bind tomorrow

- Optimal tax: decentralize $\tau_t = \frac{\mathbb{E}_t[\mu_{t+1} \ \psi_{t+1}]}{\mathbb{E}_t\left[\frac{\partial u(c_{t+1})}{\partial c_{t+1}^T}\right]}$

Model - Numericl approach

- Global solution method necessary.
- Value function iteration method
  - interpolated decision rules (linear interpolation)
  - occasionally binding constraints
- With the policy function obtained: simulate the economy
  - unconditional moments
  - moments conditional on sudden stops
  - event analysis of sudden stops

Calibration - Argentina

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Table 1: Previous baseline model parameters

Parameter	Values
y^N	1
$\mathbb{E}\left[y^T\right]$	1
ρ_y^T	0.540
$Var\left[y^T\right]$	0.059
N_y^T	3
γ	2
η	0.205
ω	0.310
R^h	1.0145
R^l	0.9672
F^{hh}	0.9833
F^{ll}	0.90
θ	0.66

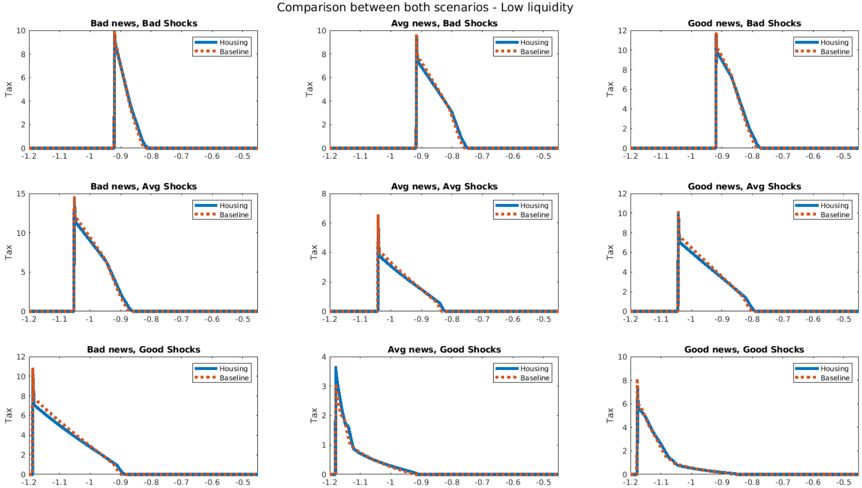
Table 2: Parameters for the baseline-housing comparison when $\kappa_A = 0$

Parameter	Baseline setting	Housing setting
α	1	0.595
η_D	0.282	0.282
β	0.910	0.910
κ_Y	0.320	0.320
κ_A	0	0

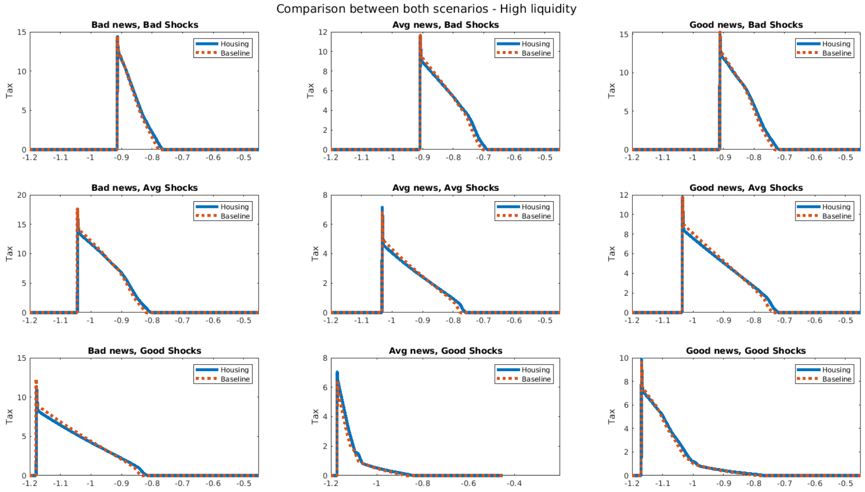
Table 3: Parameters for the full baseline-housing comparison

Parameter	Baseline setting	Housing setting
α	1	0.595
η_D	0.282	0.282
β	0.9375	0.9375
κ_Y	0.29	0.29
κ_A	0.03	0.03

Results - Introducing Housing only with DTI condition, low liquidity



Results - Introducing Housing only with DTI condition, high liquidity



Results - Introducing Housing only with DTI condition

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Macroprudential policy effects ($\kappa_A = 0$)

Moment	Without housing	With housing	Variation
$P(SS)$	$-27.40\,\%$	$-25.76\,\%$	$-5.78\,\%$
$\sigma_{CA/Y}$	$-36.68\,\%$	$-36.16\,\%$	$-1.42\,\%$
$\Delta\epsilon$	$-33.49\,\%$	$-33.47\,\%$	$-0.06\,\%$
ΔY	$-22.27\,\%$	$-21.93\,\%$	$-1.51\,\%$
Δc	$-29.13\,\%$	$-28.94\,\%$	$-0.64\,\%$

↓ 6.64% →

Moment	Without housing	With housing
$\bar{\tau}$	$3.028\,\%$	$2.827\,\%$

Results - DTI and LTV, Low liquidity

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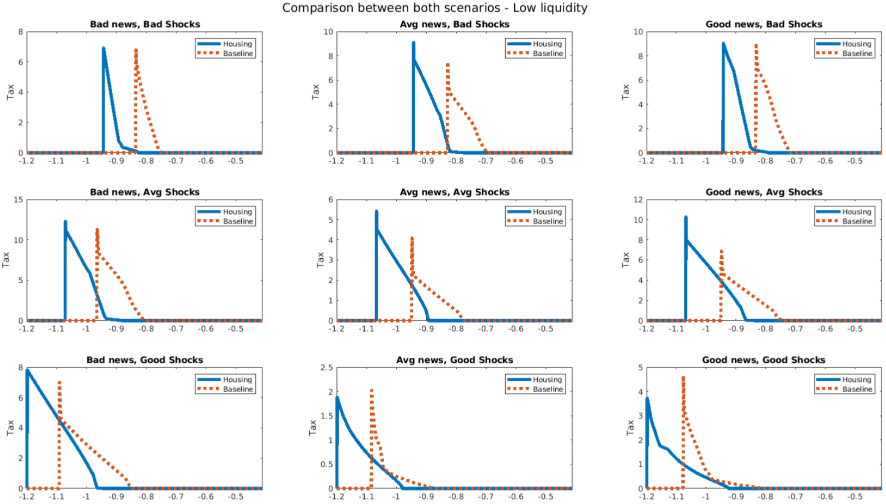
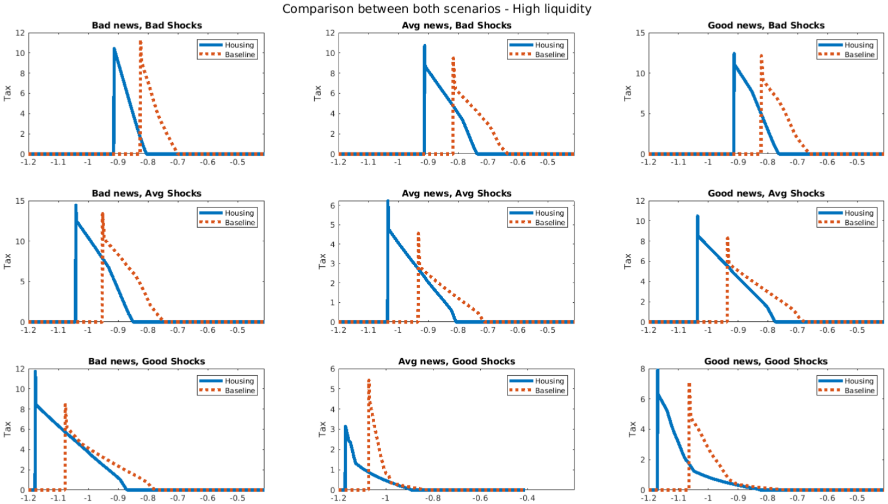


Results - DTI and LTV, High liquidity
Macroprudential Policy and Housing



Comparison between model moments ($\kappa_A > 0$)

Moment	Without housing	With housing
$P_{DE}(SS)$	3.764 %	3.897 %
$P_{SP}(SS)$	2.160 %	2.341 %
$P(\tau \neq 0)$	75.89 %	82.54 %
$\bar{B/Y}_{DE}$	−26.61 %	−29.34 %
$\bar{B/Y}_{SP}$	−26.46 %	−29.36 %
$\sigma_{CA/Y\,DE}$	2.03 %	2.49 %
$\sigma_{CA/Y\,SP}$	1.32 %	1.54 %
$\Delta\epsilon_{DE}$	−31.29 %	−38.29 %
$\Delta\epsilon_{SP}$	−21.62 %	−23.72 %
ΔY_{DE}	−25.91 %	−29.30 %
ΔY_{SP}	−20.27 %	−21.46 %
Δc_{DE}	−10.04 %	−11.89 %
Δc_{SP}	−7.23 %	−7.83 %
$\bar{\tau}$	1.550 %	2.150 %

↑ 38.7% →

Q1's Conclusions

- No assets in the collateral condition: housing decreases the need for macroprudential policy (-6.64% in the average tax).
- With assets in the collateral condition: housing increases the need for macroprudential policy, and significantly so (+38.7% in the average tax).
- With assets in the collateral condition: housing eases implementation.

Model - The surge in House prices

- Comparative statics

- e proportion of land rented to foreign buyers
  - 10% increase in prices
  - increase in income: $e\frac{l}{P}p_t^H A_t$

- The effect of the surge in prices is, *a priori*, ambiguous.

Calibration - Spain

Macroprudential Policy and Housing

Table 1: Baseline model parameters

Parameter	Values	Source
y^N	1	Normalization
$\mathbb{E}\left[y^T\right]$	1	Normalization
ρ_y^T	0.3478	Spain 1970-2008, Martín-Moreno et al. (2014)
$Var\left[y^T\right]$	1.369×10^{-2}	Spain 1970-2008, Martín-Moreno et al. (2014)
N_y^T	3	
σ	2	Standard DGSE literature
η	0.205	Empirical estimates: 0.40 - 0.83
η_D	0.51	Davis and Martin (2005)
β	0.9617	Spain 1970-2008, Martín-Moreno et al. (2014)
ω	0.3213	Spain, IMF data
α	0.933	Davis and Martin (2005)
R^h	1.00194	ECB, real interest rates
R^l	0.98406	ECB, real interest rates
F^{hh}	0.7465	ECB, real interest rates
F^{ll}	0.7755	ECB, real interest rates
θ	0.75	ECB, GDP growth forecasts vs GDP growth

Parameters matched

Parameter	Values
κ_Y	0.110
κ_A	0.010
α	0.69

Probability of crisis: 2.5% - Betrán et al. (2012), 150 years
Price to income Ratio, Banco de Espana
Rent to Price Ratio: 25, Banco de Espana

Results - Low liquidity
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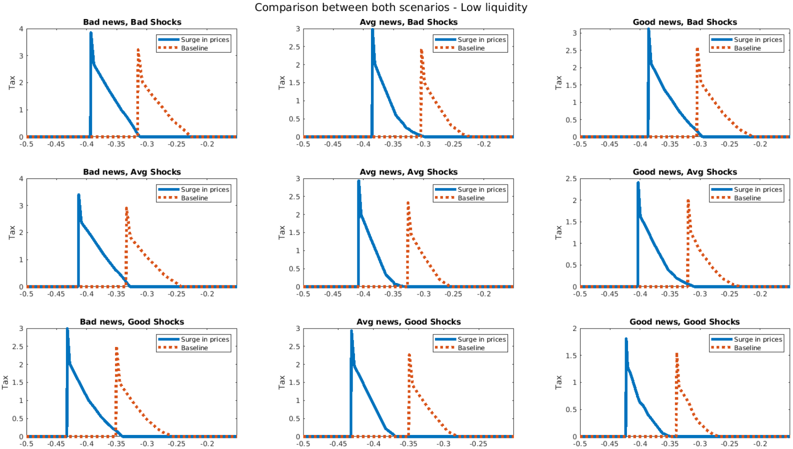

Results - High liquidity

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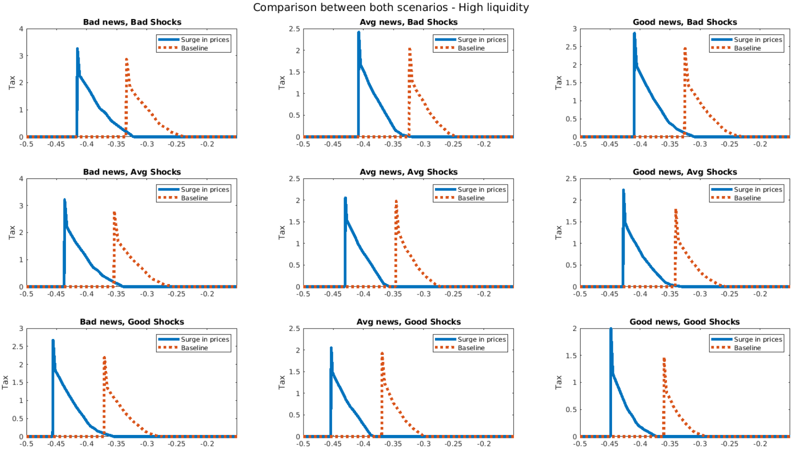

Table 6: Increase in taxes as a result of the high external demand

Liquidity Regime	Shock to y^T	News	Increase (%)
Low liquidity	Bad Shock	Bad News	35.88
		Avg News	48.81
		Good news	49.45
	Avg Shock	Bad News	38.72
		Avg News	42.67
		Good news	59.59
	Good Shock	Bad News	52.88
		Avg News	41.91
		Good news	66.16
High liquidity	Bad Shock	Bad News	39.08
		Avg News	40.30
		Good news	49.18
	Avg Shock	Bad News	41.87
		Avg News	40.69
		Good news	55.11
	Good Shock	Bad News	47.10
		Avg News	43.62
		Good news	48.83

→ **45.27%**

Table 5: Comparison between the effect of macroprudential policy in both settings

Effect of policy	Baseline	Price Surge
$\Delta P(SS)$	87.5 %	64.0 %
$\Delta\sigma_{CA/Y}$	21.2 %	18.2 %
$\Delta(\Delta\epsilon)$	14.2 %	17.2 %
$\Delta(\Delta Y)$	12.2 %	14.9 %
$\Delta(\Delta c)$	14.0 %	16.9 %

$\bar{\tau}$	0.6211 %

↓ **45.42%**

$\bar{\tau}$	0.9032 %

- Even when - by construction - the increase in average land prices was completely exogenous and permanent, macroprudential policy should lean against the wind. This is a novel result when using the pecuniary externality approach.
- The strengthening of optimal macroprudential policy should be commensurate with the average increase in prices (45.4% increase for a 10% increase in prices).
- Implementation eases with the increase in prices (and vice-versa)