Capital requirements in light of monetary tightening

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Motivation

- Substantial increase in interest rates in 2022-2023 following the 2021 inflation surge
- Strong empirical link between monetary policy tightening and financial crises: Schularick and Taylor (2012); Jiménez et al. (2022); Boissay et al. (2023b)
- Compared to previous tightening, new prudential framework with higher capital requirements: from 8% to 10.5% of risk-weighted assets (RWA)
- In addition, macroprudential policy was not loosened during the tightening cycle

Research question

What is the role of capital requirements in the transmission of monetary tightening?

- May have a negative (possibly amplifying) impact on lending and economic activity
- But may limit the possibility of risk materialisation

What we do?

- Build a New-Keynesian model:
  - Two households and an explicit banking system
  - Banks, firms and borrowing households are subject to idiosyncratic shocks and can default (Bernanke et al., 1999)
- Estimate the model:
  - Bayesian estimation on Euro Area data (2002-2023)
  - Historical decomposition of the 2021-2023 interest rate hikes
- Counterfactual analysis of capital requirements in case of a monetary tightening:
  - Basel III (banks' capital $=$ 10.5% of RWA) vs Basel II (8%)
  - Some typical macroprudential policy: broad-based and sector-specific capital buffer

Main findings

- The post-Covid inflationary but expansionary context can partly be rationalized as a positive investment shock: the relative price of tangible assets fell, leading firms to invest.
- Although capital requirements reduced the post-Covid expansion, they preserved macroeconomic stability by reducing banks probability of default.
- Capital requirements do not need to be countercyclical to be effective: in an inflationary context, they act as automatic stabilizers, by limiting the amplitude of expansionary as well as recessionary shocks.

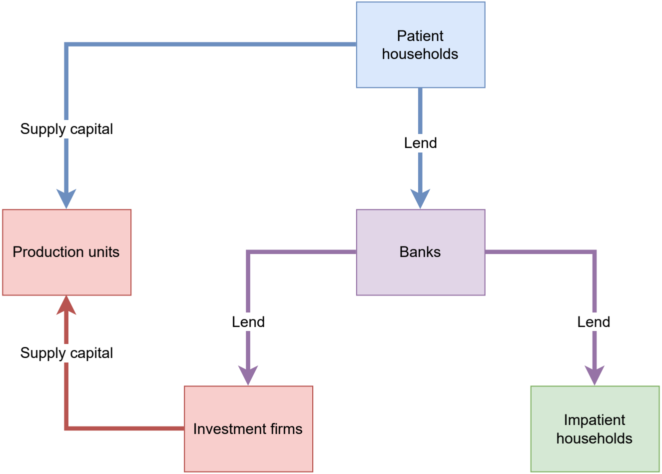
Literature

- Inflation, monetary policy and financial stability (Boissay et al., 2021; Jiménez et al., 2022; Boissay et al., 2023b)
  - **Contribution**: what is the role of capital requirements?
- Monetary and macroprudential policy (Mendicino et al., 2020; Revelo and Levieuge, 2022; Gasparini et al., 2023)
  - **Contribution**: resilience oriented capital requirements in times of monetary tightening (Boissay et al., 2023a)
- Counterfactual exercises using DSGE model with financial frictions (Jondeau and Sahuc, 2022)
  - **Contribution**: focus on post-Covid context

General structure (1)

- **Patient households** own all firms and save through housing, capital, and banks' deposits; there are three types in the households (workers, entrepreneurs and bankers)
- **Impatient households** work and borrow from banks to acquire housing units subject to *idiosyncratic shocks*
- **Production**: final good production, housing and capital good producers, intermediary good production with Calvo pricing. Intermediary producers rent capital from:
  - Capital management firms.
  - Investment firms: they borrow to acquire capital subject to *idiosyncratic shocks*

General structure - capital flows



General structure (2)

- **Banks**: collect deposits form patient households and grant loans to borrowing household and investment firms; their portfolios are subject to *idiosyncratic shocks*
- **Public authorities**:
  - Deposit insurance agency: reimburse partially depositors
  - Government: maintain a balanced budget to fund the deposit insurance agency
  - Monetary policy: set short-term rates following a Taylor rule
  - Financial stability authority: set minimum capital requirements for banks

Impatient households

- Borrow from banks and supply labour, subject to idiosyncratic housing quality shocks
- Default depends on collateral value: borrowers default when the value of their assets falls below their debt obligations
- The bank liquidates the value of the house but looses the cost of verification $\Longrightarrow$ costly state verification, participation constraint imposed by banks (Bernanke et al., 1999)
- Banks impose a participation constraint which depends on the the liquidation value of the housing portfolio and their overall balance sheet $\Longrightarrow$ credit, housing prices and banks' net worth are linked.

Bankers, banks and capital requirements

- Bankers inject equity in a continuum of banks:
- Banks collect (non contingent) one-period deposits from patient households, and are subject to idiosyncratic portfolio shocks.
- As borrowers, banks default when the value of their assets falls below their debt obligations, but...
- Savers are myopic to the individual risk profile of banks and a fraction of deposits is insured!
- $\Longrightarrow$ **Excessive risk taking justifies a regulatory capital constraint**:

$$E_t^j \geq \phi_t \gamma_t^j B_t^j$$

Banks

- Bank j takes equity E_t^j from bankers and borrows D_t^j to extend loans B_t^j.
- The portfolio is subject to a performance shock ω_{t+1}^j at $t+1$.
- The bank seeks to maximize the period net present value:

$$\mathbb{E}_t \left[\beta^p \frac{\Lambda_{t+1}^p}{\Lambda_t^p} (1-\theta^b+\theta^b v_{t+1}^b) \max \left\{ \omega_{t+1}^j R_{t+1}^j B_t^j - R_t D_t^j ; 0 \right\} \right] - v_t^b E_t^j .$$

$\Longrightarrow$ **Banks' participation constraint:**

$$\mathbb{E}_t \left[\beta^p \frac{\Lambda_{t+1}^p}{\Lambda_t^p} (1-\theta^b+\theta^b v_{t+1}^b) \frac{[1-\Gamma_{t+1}^j(\bar{\omega}_{t+1}^j)] R_{t+1}^j}{\phi_t \gamma_t^j} \right] \geq v_t^b .$$

The bank balance sheet channels

- *Net worth channel* (income flow to patient households) vs *credit channel* (tightness of constraints).
- Ex-post gross return on equity:

$$Z_t = \frac{1}{\phi} R_t^F \Upsilon(\bar{\omega}_t)$$

  $\Upsilon(\bar{\omega}_t)$ the expectation value of bank's portfolio shock conditional on not defaulting.
- Except banks' risk shocks:

$$\frac{\partial Z_t}{\partial \varepsilon_t} = \frac{\Upsilon(\bar{\omega}_t) - \bar{\omega}_t \Upsilon'(\bar{\omega}_t)}{\phi} \frac{\partial R_t^F}{\partial \varepsilon_t}$$

Direct channel: higher capital requirements, less loans, less amplification $\Longrightarrow$ capital requirements act as automatic stabilizers.
Indirect channel: high ϕ means higher portfolio returns by lowering the default threshold, thus amplifying shocks. Model

Estimation strategy

- Data: Euro Area, 2002-Q1 to 2023-Q2.
- We proceed in two steps:
  - Steady-state calibration by targeting long-run levels.
  - Bayesian estimation of shocks and parameters which only affect the dynamic behaviour of the model.
- 11 shocks: TFP, labour productivity, markup, time preference, government spending, monetary policy, capital and housing adjustment costs, risk shocks (banks, households, firms).

Observables

We match the model to ten series:

- Standard series: GDP implicit price index, real GDP, real household consumption, hours worked, real households' investment, real firms' investment, real credit to households, real credit to firms
- A measure of the short-term shadow interest rate (Krippner, 2013, 2015).
- Estimates of banks' default probabilities, based on the average CDS spread of a sample of EA banks.

Estimation results - structural parameters

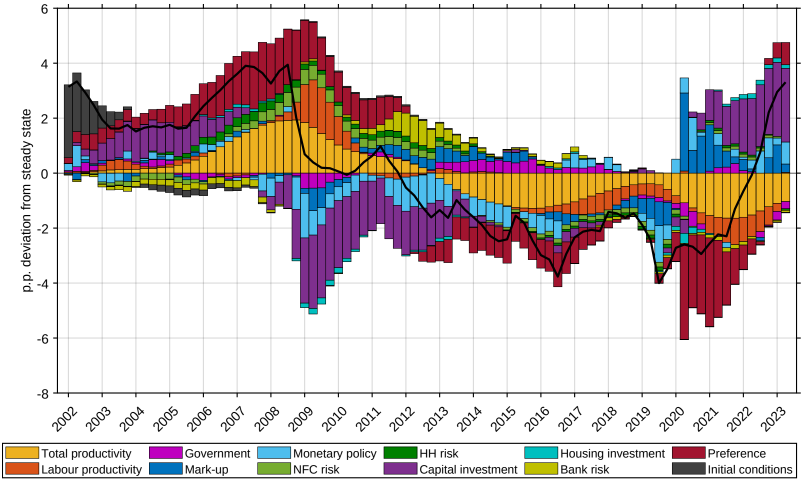
Table: Estimated parameters

		Prior distribution			Posterior distribution	
		Dist.	Mean	Std.	Mean	Std.
Endogenous taste shifter	ζ_J	Beta	0.5	0.2	0.0330	0.0677
Habits	ψ	Beta	0.4	0.1	0.1133	0.0409
Housing adjustment cost	ψ_H	Gamma	4	1	3.9328	0.8890
Capital adjustment cost	ψ_K	Normal	4	1	2.6607	0.5610
Price rigidity	ξ	Beta	0.75	0.025	0.8605	0.0122
Price indexation	ι	Beta	0.4	0.1	0.2619	0.0863
Monetary policy smoothing	ϱ_R	Beta	0.8	0.1	0.8422	0.0147
MP reaction to inflation	a_Π	Normal	1.7	0.1	2.0056	0.0958
MP reaction to GDP growth	a_y	Normal	0.125	0.05	0.1340	0.0361

Estimation

The anatomy of monetary tightening

Figure: Decomposition of short-term interest rate



The anatomy of monetary tightening

- The 2021-2023 rise in interest rate can is rationalized as the result of consumption catch-up after Covid, and an exogenous decrease in the relative price of capital goods.
- The price of capital goods has increased less than the price of consumption goods, pushing firms to invest, thus leading to higher demand for investment goods.
- On the contrary, a one-off mark-up shock cannot fully rationalize the 2021-2023 sequence, as it would have led to a temporary inflation spike, and a sizeable negative contribution to GDP.

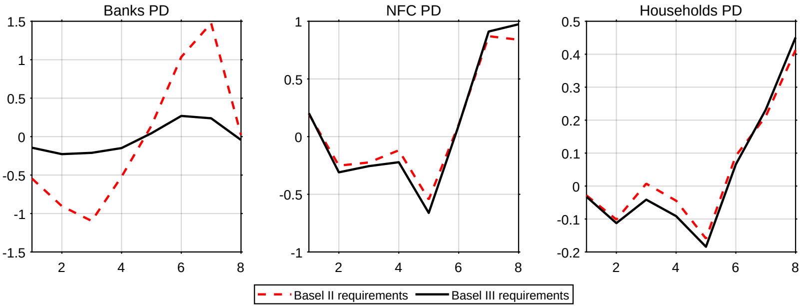
Counterfactual exercise

- We recover the estimated shocks from 2021-Q2 to 2023-Q2
- We compare dynamics under alternative scenarios:
  - A counterfactual low capital requirement scenario (Basel II)
  - The baseline high capital requirement scenario (Basel III)

Default probabilities

- Basel III capital requirements significantly smoothed banks PD between 2021-Q2 and 2023-Q2.
- They very slightly increased households' and firms' probabilities of default, as they supported credit.

Figure: Probabilities of default: Basel III vs Basel II capital requirements



Macroeconomic effects

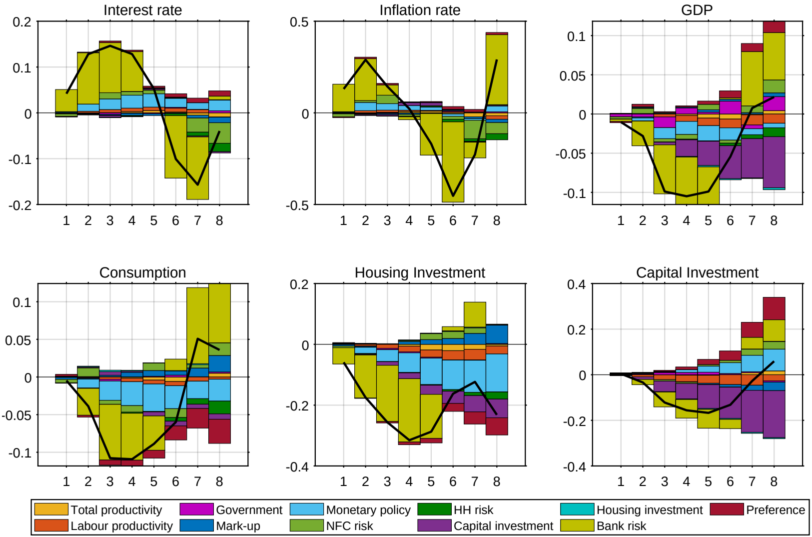


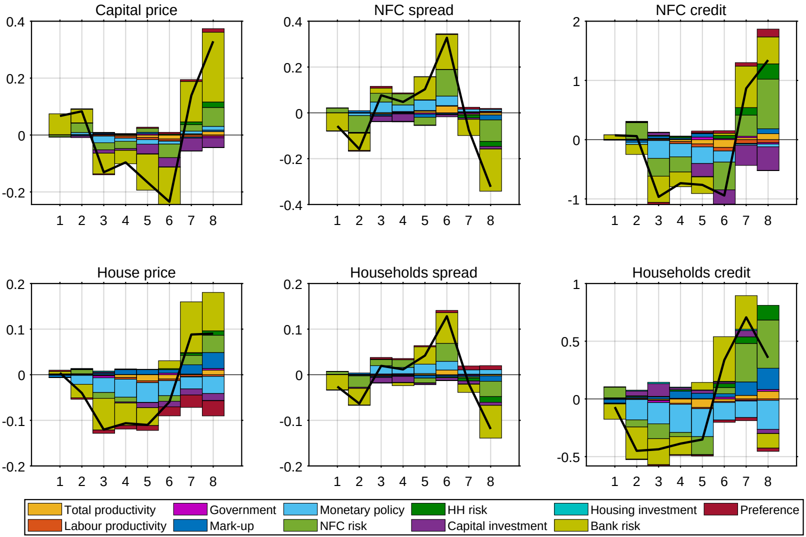
Figure: Impact of Basel III from 2021-Q2 to 2023-Q2 - Macroeconomic variables

Macroeconomic effects

- Basel III mitigated inflation and supported growth since the end of 2022, as it prevented bank risk shocks from materializing.
- However, it mitigated growth when it came to the post-Covid investment catch-up.
- Overall, capital buffers acted as automatic stabilizers over the period.

Financial effects

Figure: Impact of Basel III from 2021-Q2 to 2023-Q2 - Financial variables

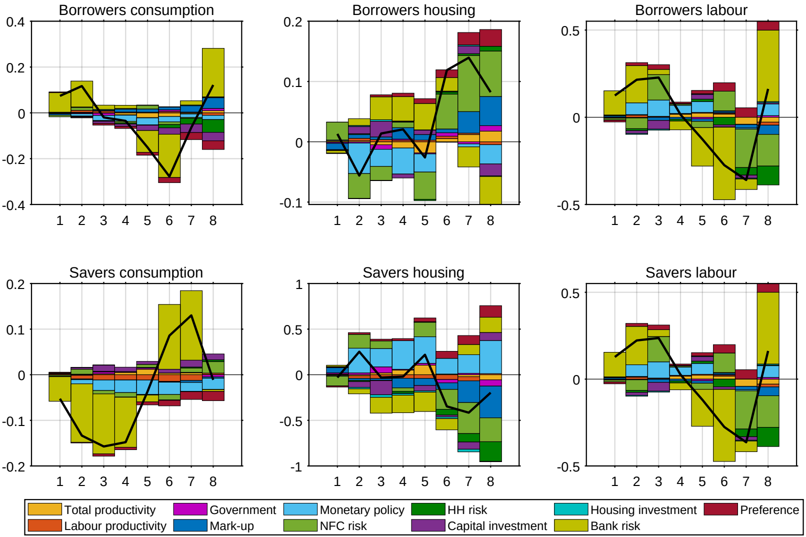


Financial effects

- Likewise for house and capital prices, as Basel III constrained lending in periods of expansion, but expanded it in periods of contraction.
- Effects are quantitatively higher for firms: higher risk weights, investment and firm risk shocks have a more direct impact.
- Basel III also affected house and capital prices through banks' profitability and thus savers' demand.

Redistributive effects

Figure: Impact of Basel III from 2021-Q2 to 2023-Q2 - Distributive effects



Redistributive effects

- Capital requirements had stark heterogeneous effects across households: they increased the consumption of savers, while decreasing it for borrowers at the end of 2022.
- This may partly explain the differences in macroprudential stances across EA countries: countries with a higher share of borrowers have less incentive to increase capital requirements above Basel III minima.

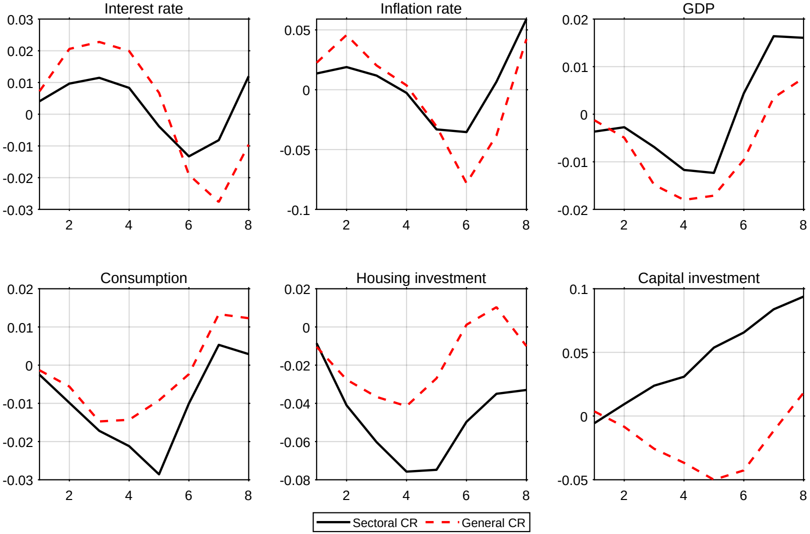
Macroprudential policy

- What is the effect of additional buffers to prevent higher risk levels as implemented in some EA countries?
- These buffers constrained capital investment even more, but this effect is quantitatively small.
- Their overall impact on GDP would have however been positive starting from the end of 2022.
- Higher risk weights on housing loans would have had a more beneficial impact, by sharing the capital requirement burden between firms and households.

Additional results

Macroprudential policy

Figure: Impact of macroprudential policies - Macroeconomic variables



Conclusion

- Capital requirement limited post-Covid growth but successfully prevented the materialization of risks when the ECB rose short-term interest rates.
- Capital requirements are complementary to monetary policy: by smoothing the reaction of banks' net worth to economic conditions they limited the probability of a hard landing and contributed to decrease inflation.
- Their impact is however heterogeneous between savers and borrowers, and hence between Euro Area member states.

Back **Final good production**. The final good is produced by perfectly competitive firms by combining a continuum of intermediate goods according to the constant-returns-to-scale CES production technology

$$y_t = \left(\int_0^1 y_t(f)^{\frac{\theta-1}{\theta}} df \right)^{\frac{\theta}{\theta-1}} \tag{1}$$

Let P_t denote the nominal price of the final good and let $P_t(f)$ denote the nominal price of good f. Firms are price takers and seek to maximize nominal profits

$$P_t y_t - \int_0^1 P_t(f) y_t(f) df$$

Price rigidity and monetary policy

- Firm f sets its price $P_t(f)$ so as to maximize the value to its shareholders, taking the demand function of the final good producers into account.
- In each period, firm f can reset its nominal price with probability $1 - \xi$.
- Otherwise, firm f rescales $P_t(f)$ according to $P_t(f) = (\Pi_*)^{1-\iota}(\Pi_{t-1})^{\iota} P_{t-1}(f)$, with Π_* the steady-state value of inflation.
- As in Mendicino et al. (2020), the central bank sets the gross nominal interest rate R_t according to the following monetary policy rule

$$\log\left(\frac{R_t}{R_*}\right) = \varrho_R \log\left(\frac{R_{t-1}}{R_*}\right) + (1-\varrho_R)\left[a_\Pi \log\left(\frac{\Pi_t}{\Pi_*}\right) + a_y \log\left(\frac{GDP_t}{GDP_{t-1}}\right)\right] + \zeta_{R,t}$$

Impatient Households

The representative impatient households has instantaneous utility given by

$$\log(c^i_{t+s} - \psi \bar{c}^i_{t+s-1}) + \upsilon^i \log(h^i_{t+s}) - \frac{\varphi^i}{1+\eta}\Theta^i_{t+s}(\ell^i_{t+s})^{1+\eta}$$

Budget constraint:

$$P_t c^i_t + Q^H_t h^i_t \leq P_t w_t \ell^i_t + B^i_t + \int_0^\infty \max\{\omega^i(1-\delta^H)Q^H_{t+1}h^i_t - R^i_t B^i_t; 0\} f^i_{t+1}(\omega^i) d\omega^i.$$

The return on a diversified portfolio of housing loans affect banks' participation constraint:

$$R^M_t = (\Gamma^i_t(\bar{\omega}^i_t) - \mu^i G^i_t(\bar{\omega}^i_t))\frac{(1-\delta^H)Q^H_t h^i_{t-1}}{B^i_{t-1}}.$$

Patient Households

The representative patient households has utility given by

$$\mathbb{E}_t\Big[\sum_{s=0}^{\infty}(\beta^p)^s e^{\zeta_{c,t+s}}\Big(\log(c^p_{t+s}-\psi\bar{c}^p_{t+s-1}) + \upsilon^p\log(h^p_{t+s}) - \frac{\varphi^p}{1+\eta}e^{\zeta_{\ell,t+s}}\Theta^p_{t+s}(\ell^p_{t+s})^{1+\eta}\Big)\Big]$$

Budget constraint:

$$P_t c^p_t + D^p_t + Q^H_t h^p_t + (Q^K_t + P_t s^K_t)k^p_t + T^p_t \leq W_t\ell^p_t + \tilde{R}_t D^p_{t-1} + Q^H_t(1-\delta^H)h^p_{t-1} + (P_t r^K_t + (1-\delta^K)Q^K_t)k^P_{t-1} + \frac{1}{m^p}P_t\mathrm{Div}_t$$

Endogenous taste shifter

Θ_t^j an endogenous taste shifter mitigating the strong wealth effect on labor supply (Galí et al., 2011) :

$$\Theta_t^j = \frac{J_t^j}{\bar{c}_t^j - \psi \bar{c}_{t-1}^j},$$

where

$$J_t^j = (J_{t-1}^j)^{1-\zeta_J}[(\bar{c}_t^j - \psi \bar{c}_{t-1}^j)]^{\zeta_J}.$$

In a symmetric equilibrium, with endogenous taste shifter:

$$-\frac{\mathcal{U}_n}{\mathcal{U}_c} = \varphi^j J_t^j (\ell_t^j)^\eta$$

While without endogenous taste shifter:

$$-\frac{\mathcal{U}_n}{\mathcal{U}_c} = \varphi^j (c_t^j - \psi \bar{c}_{t-1}^j)(\ell_t^j)^\eta$$

A lower ζ_J means a lower short-run wealth effect than baseline.

Capital producers and capital managers

Capital producers. Adjustment costs:

$$\left(1 + S_J\left(\frac{i_t^J}{i_{t-1}^J}\right)\right) i_t^J e^{\zeta_{i_J,t}}$$

Where

$$S_J(X) = \frac{\psi_J}{2}(X-1)^2$$

Capital managers. Profits: firms seek to maximize profits:

$$\text{Div}_t^c = s_t^K m^p k_t^p - z(m^p k_t^p).$$

Where

$$z(x) = \frac{\xi_s}{2}(x)^2$$

Investment firms

Expected discounted net profits:

$$\mathbb{E}_t\left[\beta^p \frac{\Lambda^p_{t+1}}{\Lambda^p_t}(1-\theta^e+\theta^e v^e_{t+1}) \max\left\{\omega^e_{t+1} R^K_{t+1} Q^K_t k^e_t(j) - R^e_t B^e_t(j); 0\right\}\right] - v^e_t E^e_t(j)$$

Denoting v^e_t the Lagrange multiplier associated to entrepreneurs' balance sheet constraint and

$$R^K_{t+1} = \frac{P_{t+1} r^K_{t+1} + (1-\delta) Q^K_{t+1}}{Q^K_t}.$$

Subject to banks' participation constraint.

Bankers

An individual banker starts period t with net worth N_t^b, which is invested as equity (i) in a continuum of investment projects and (ii) a continuum of housing projects. The period $t+1$ aggregate gross nominal return on these projects is Z_{t+1}^b. The individual banker seeks to solve the program

$$V_t^b = \max_{\widetilde{\text{Div}}_t^b, E_t^M, E_t^F} \left\{ \widetilde{\text{Div}}_t^b + \mathbb{E}_t \left[\beta^p \frac{\Lambda_{t+1}^p}{\Lambda_t^p} [(1-\theta^b) N_{t+1}^b + \theta^b V_{t+1}^b] \right] \right\}$$

$$\text{s.t.} \quad \widetilde{\text{Div}}_t^b + E_t^M + E_t^F \leq N_t^b,$$

$$N_{t+1}^b = Z_{t+1}^M E_t^M + Z_{t+1}^F E_t^F,$$

$$\widetilde{\text{Div}}_t^b \geq 0.$$

Deposit insurance agency

In case of default, the DIA recovers the assets of the defaulting bank, net of a fraction μ^j due to recovery costs. The average default loss per unit of bank debt in sector j is thus

$$\Omega_t^j = \left(\int_0^{\bar{\omega}_t^j} f_{t+1}^j(\omega^j) d\omega^j \right) R_{t-1} - (1-\mu^j) \left(\int_0^{\bar{\omega}_t^j} \omega^j f_t^j(\omega^j) d\omega^j \right) R_t^j \frac{B_{t-1}^j}{D_{t-1}^j}.$$

And

$$\Omega_t = \frac{d_{t-1}^M}{d_{t-1}} \Omega_t^M + \frac{d_{t-1}^F}{d_{t-1}} \Omega_t^F.$$

The DIA insures a fraction κ of deposits and then redistributes the recovered net assets to the depositors, so that

$$\tilde{R}_t = \kappa R_{t-1} + (1-\kappa)(R_{t-1} - \Omega_t) = R_{t-1} - (1-\kappa)\Omega_t.$$

Thus the total amount of lump-sum taxes, is

$$T_t^{DIA} = \kappa \Omega_t d_{t-1}.$$

Back

Table: Preset and calibrated parameters

Preset parameters		
Description	Parameter	Value
Inverse Frisch elasticity	η	4
Patient disutility of labor	φ^p	1
Impatient disutility of labor	φ^i	1
Bank M bankruptcy cost	μ_M	0.3
Bank F bankruptcy cost	μ_F	0.3
NFC bankruptcy cost	μ_e	0.3
HH bankruptcy cost	μ_i	0.3
Share of insured deposits in bank debt	κ	0.54
Consumption smoothing	ψ	0.5
Productivity	A	1
Capital share in production	α	0.3
Depreciation rate of capital	δ_K	0.03
Survival rate of entrepreneurs	θ_e	0.975
Capital requirements for bank F	ϕ_F	0.105

Calibrated parameters		
Description	Parameter	Value
Impatient household discount rate	β_i	0.983
Patient household discount rate	β_p	0.997
Housing depreciation rate	δ_h	0.008
Patient housing scale factor	υ_p	0.049
Impatient housing scale factor	υ_i	0.590
Management cost	ξ_s	0.004
Survival rate of bankers	θ_B	0.873
Std. idiosyncratic shocks, bankers M	$\bar{\sigma}_M$	0.013
Std. idiosyncratic shocks, bankers F	$\bar{\sigma}_F$	0.043
Std. idiosyncratic shocks, entrepreneurs	$\bar{\sigma}_e$	0.361
Std. idiosyncratic shocks, HH	$\bar{\sigma}_i$	0.353
Banker's endowment	χ_b	0.81
Entrepreneur's endowment	χ_e	0.377
Capital requirements for bank M	ϕ_M	0.037

Table: Calibration targets

Description	Target	Model
Indebted households share m_i	0.44	0.44
Final gov. consumption exp. s_g	0.21	0.21
Risk free rate $\bar{r}$	1.16 %	1.20 %
Yearly inflation rate	1.72%	1.72 %
Return on asset equity	11.42 %	11.42 %
Housing investment as a share of GDP	0.06	0.06
HH loans to (quarterly) GDP	1.98	2.00
Housing among households capital	0.61	0.58
NFC loans to (quarterly) GDP	1.68	1.81
Banks default rate	1.28 %	1.27 %
Price to book ratio μ_b	1.15	1.19
Loan to value	37.3 %	37.7 %
Capital share of households	0.15	0.16
Spread NFC loans	1.34	1.46
Spread Households loans	1.07	1.05
NFC default rate (untargeted)	2.5 %	1.6 %
HH default rate (untargeted)	1 %	2 %

Table: Estimated shocks

		Prior distribution			Posterior distribution	
		Dist.	Mean	Std.	Mean	Std.
Panel A: shocks standard deviation						
Total productivity	σ_a	Inv. Gam.	0.5	2	3.1446	0.8709
Labour productivity	σ_z	Inv. Gam.	0.5	2	0.8122	0.0625
Mark-up	σ_μ	Inv. Gam.	0.5	2	22.4343	3.3160
Housing adjustment	σ_{i_H}	Inv. Gam.	0.5	2	3.2059	0.2625
Capital adjustment	σ_{i_K}	Inv. Gam.	0.5	2	4.6598	0.4511
Monetary policy	σ_R	Inv. Gam.	0.5	2	0.1452	0.0133
Government spending	σ_g	Inv. Gam.	0.5	2	1.9221	0.1511
Preference	σ_c	Inv. Gam.	0.5	2	2.3103	0.2455
NFC risk	σ_e	Inv. Gam.	0.5	2	2.1963	0.2585
HH risk	σ_i	Inv. Gam.	0.5	2	1.2645	0.1559
Bank risk	σ_B	Inv. Gam.	0.5	2	4.0536	0.3170
Panel B: shocks autocorrelation						
Total productivity	ρ_a	Beta	0.5	0.2	0.9050	0.0340
Labour productivity	ρ_a	Beta	0.5	0.2	0.9374	0.0217
Mark-up shock	ρ_μ	Beta	0.5	0.2	0.0680	0.0519
Housing adjustment shock	ρ_{i_H}	Beta	0.5	0.2	0.5832	0.0567
Capital adjustment shock	ρ_{i_K}	Beta	0.5	0.2	0.7336	0.0415
Government spending shock	ρ_g	Beta	0.5	0.2	0.5646	0.0833
Time preference shock	ρ_c	Beta	0.5	0.2	0.4024	0.0982
NFC risk shock	ρ_e	Beta	0.5	0.2	0.9563	0.0250
HH risk shock	ρ_i	Beta	0.5	0.2	0.9733	0.0216
Bank risk shock	ρ_B	Beta	0.5	0.2	0.8974	0.0366

Table: Variance decomposition, in percent

	σ_a	σ_z	σ_μ	σ_{i_K}	σ_{i_H}	σ_R	σ_g	σ_c	σ_e	σ_i	σ_B
GDP	4.25	4.47	8.02	14.81	1.21	4.69	6.96	55.44	0.06	0.05	0.05
Consumption	0.45	3.01	6.26	1.22	0.08	4.43	0.22	84.18	0.05	0.07	0.03
Hours worked	3.96	5.24	8.07	13.34	1.19	4.08	7.12	56.32	0.13	0.01	0.53
Policy rate	25.17	6.75	11.98	27.04	0.3	7.59	1.89	15.95	1.09	0.39	1.86
Inflation rate	6.85	4.72	41.79	13	0.19	12.63	1.62	18.02	0.31	0.11	0.78
NFC investment	14.14	1.81	3.15	78.11	0.05	1.23	0.06	0.55	0.86	0.02	0.02
HH investment	4.5	6.25	1.56	9.54	75.12	0.6	0.1	1.12	0.65	0.41	0.15
NFC credit	8.52	0.59	6.94	9.74	0.15	2.37	0.19	5.95	59.91	4.3	1.33
HH credit	5.71	1.02	16.43	2.71	0.72	7.9	0.09	2.1	11.53	51.16	0.64
PD banks	0.22	0.01	0.05	0.05	0	0.17	0	0.03	0.99	0.11	98.36

Table: Data and model moments

	Data	Model		
		Mean	90% CI	
Panel A: variance				
GDP	3.85	2.54	1.99	3.06
Consumption	5.08	5.54	3.95	7.22
Hours worked	5.03	4.84	3.74	5.84
MP rate	5.13	4.07	2.75	5.16
Inflation	0.17	0.41	0.3	0.5
NFC investment	12.04	17.91	13.07	23.07
HH investment	10.8	11.94	9.45	14.61
NFC credit	1.76	2.51	2.09	3.04
HH credit	0.92	3.4	2.75	4.01
PD banks	1.39	1.09	0.51	1.66
Panel B: covariance with GDP				
Consumption	4.22	3.09	2.18	3.98
Hours worked	4.26	3.24	2.47	3.98
MP rate	-0.11	-0.24	-0.42	-0.03
Inflation	-0.35	0.04	-0.08	0.17
NFC investment	5.23	3.22	2.43	4.03
HH investment	5.3	0.93	0.73	1.12
NFC credit	0.04	-0.27	-0.49	-0.08
HH credit	0.75	0.91	0.7	1.12
PD banks	-0.25	-0.03	-0.04	-0.02

	Data	Model		
		Mean	90% CI	
Panel C: first-order autocorrelation				
GDP	-0.22	-0.13	-0.2	-0.07
Consumption	-0.31	-0.2	-0.26	-0.13
Hours worked	-0.28	-0.18	-0.24	-0.13
MP rate	0.97	0.89	0.86	0.93
Inflation	0.35	0.45	0.36	0.54
NFC investment	-0.2	0.17	0.04	0.3
HH investment	-0.06	0.14	0.01	0.28
NFC credit	0.64	0.5	0.46	0.54
HH credit	0.5	-0.01	-0.03	0.02
PD banks	0.93	0.89	0.84	0.95

Figure: Impulse response to macroeconomic shocks

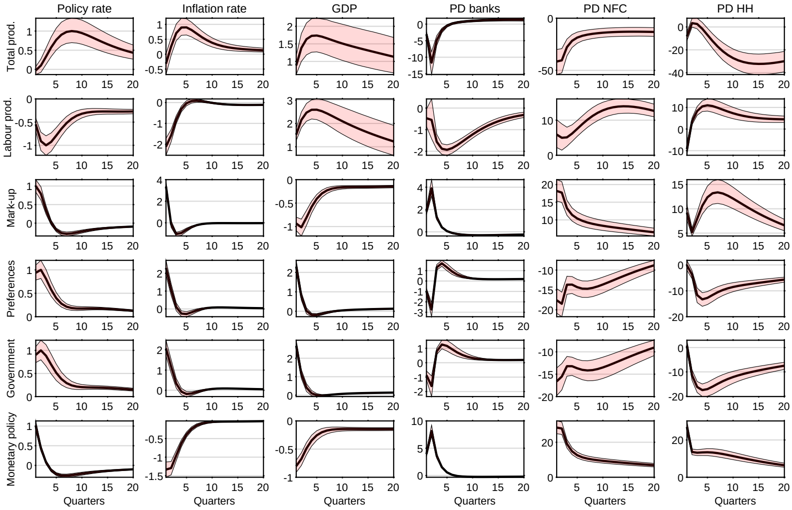


Figure: Impulse response to sectoral shocks

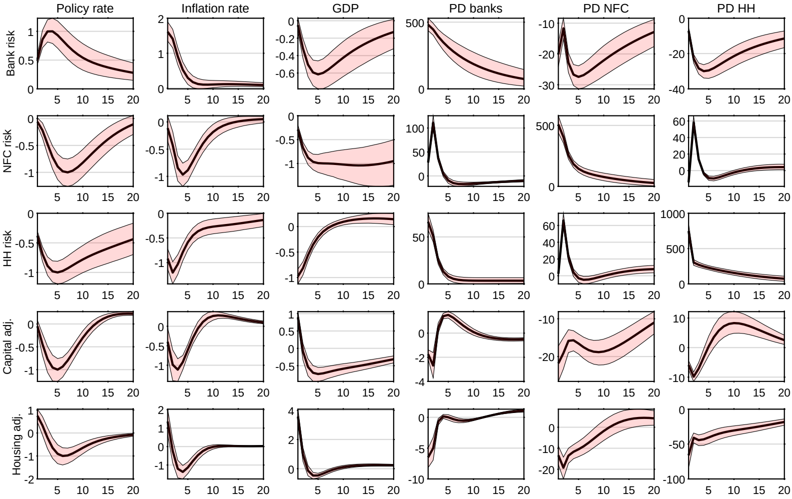


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Figure: Decomposition of year-on-year inflation rate

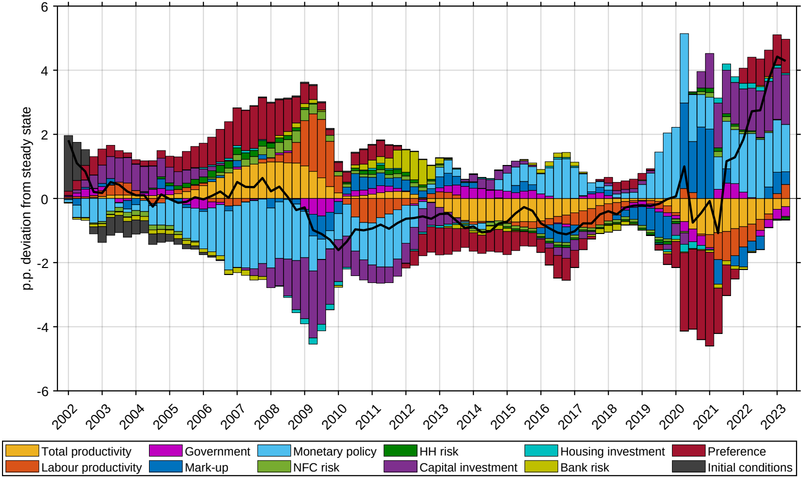


Figure: Decomposition of year-on-year GDP growth rate

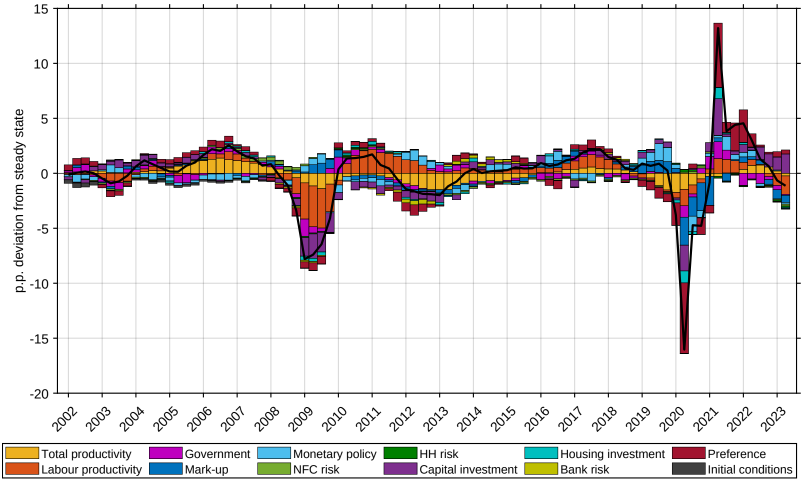
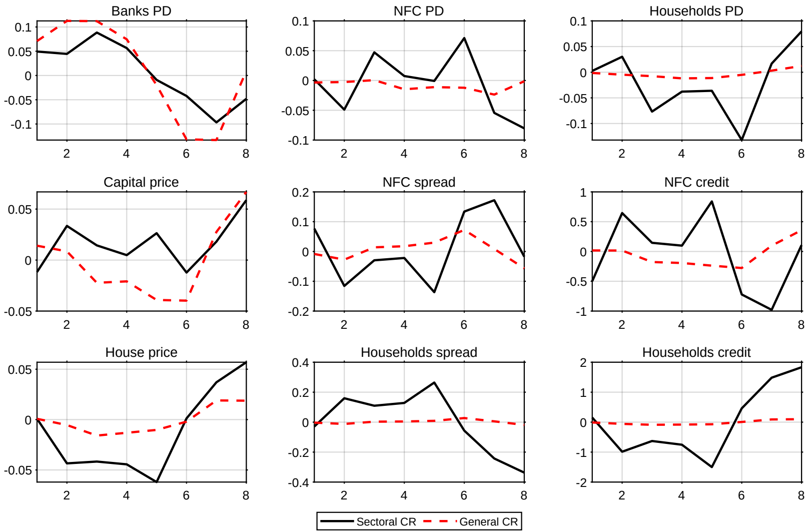


Figure: Impact of macroprudential policies - Financial variables



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