European Stability Mechanism

LEANING AGAINST PERSISTENT FINANCIAL CYCLES WITH OCCASIONAL CRISES

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POLICYMAKING IN THE ERA OF FINANCIAL IMBALANCES

- Financial vulnerabilities associated with elevated credit growth and high house prices could hamper future economic growth in many advanced economies.
- As we are facing an episode of tightening financial conditions, a sudden unwinding of financial imbalances could significantly damage economic activity.

Policy questions:

1. Should policymakers use monetary policy to lean against the wind (LAW) by reacting to house prices in normal times?
    - RBNZ is tasked to explicitly consider house prices in its decisions effective from March 1, 2021.

2. Should they LAW with macroprudential policy through capital regulation (CCyB or long-term capital requirements)? **(TODAY)**

THESE POLICY QUESTIONS REQUIRE A REALISTIC FRAMEWORK

- Should capture **costs and benefits of LAW,** properly including a **reasonable** description of **boom-bust episodes** and **the persistence of financial cycles:**

1. Financial cycles are **more prolonged** than business cycles.
   - Household debt and house prices are **more persistent** than standard macro variables like output and **expectations** play a crucial role in driving **prolonged** financial cycles.

2. Financial crises are **rare, nonlinear events** with **long-lasting effects** on the macroeconomy and are mainly triggered by **accumulated financial imbalances.**
   - Financial conditions are **linked** to **downside risks** to GDP.

3. **Policy** (monetary or macroprudential) can **affect financial fragility**.

WHAT WE DO: A MODEL OF MULTIPLE NONLINEARITIES

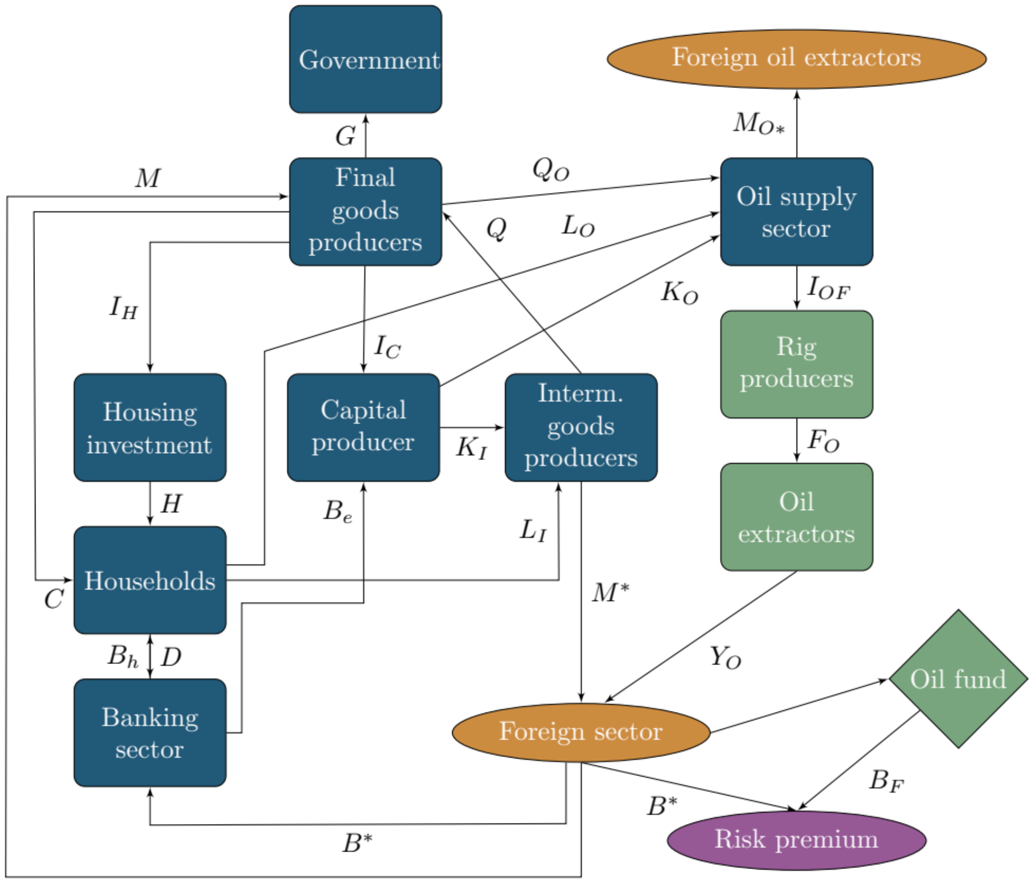
- Endogenous Markov **regime-switching** (RS) version of an estimated DSGE model with explicit modelling of **banking and housing sectors**.
  - Financial crises are **endogenously** triggered by the evolution of **5-year cumulative** real household **credit growth** and are **calibrated based on previous crises** (or macropru. stress-testing scenarios)**.**
  - We embed a reduced-from empirical function relating **credit growth to crisis severity and probability**.
  - **Effective lower bound** (ELB) on the policy rate **binds whenever** implied rate falls below the ELB.
  - **Asymmetric LAW-type** monetary policy (responding to house prices **only when its gap is positive**).
  - **Release of** CCyB **from 2.5% to zero during crises** whenever they occur.
  - **Empirically plausible persistent** financial cycles via **partly backward-looking house price expectations**.
- We use RISE toolbox developed by Junior Maih (Norges Bank).

BRIEF SUMMARY OF THE MAIN RESULTS

- Our findings **do not support systematic LAW by mon. pol.** under persistent financial cycles.
  - Although LAW **reduces crisis probability and severity** to a certain extent (lowering output volatility),
  - it **raises the volatility of inflation** as it **amplifies the effects** of supply shocks on inflation.
  - It also leads to a **lower average inflation** resulting in **more frequent episodes of binding ELB**.
- LAW by **long-run capital requirements is better suited** to address risks to financial stability.
  - Although long-run higher capital requirements **slightly reduce mean output** in normal times,
  - they reduce the fluctuations in inflation and output considerably **by reducing both the frequency of effective lower bound episodes and the severity of crises**.
  - They also raise the mean inflation rate towards the target but don’t significantly affect the crisis probability.

THEORETICAL FRAMEWORK

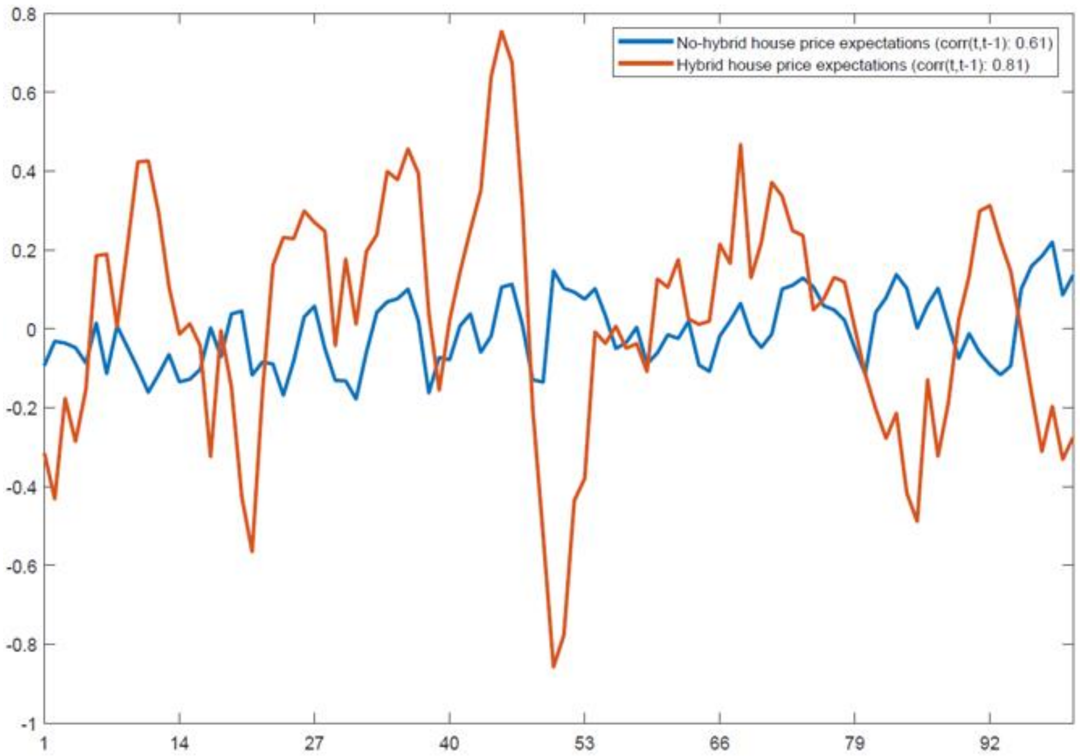
MAIN FEATURES OF THE MODEL



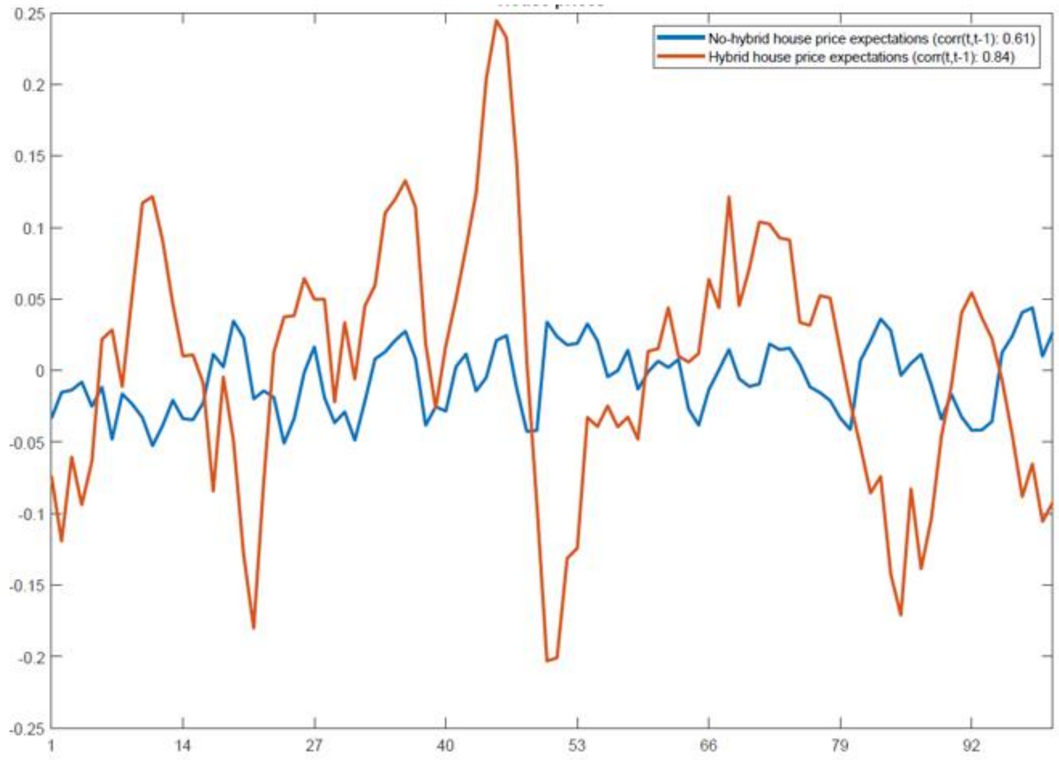
- NEMO is a medium/large scale New Keynesian DSGE model of a small open economy.
- Real and nominal rigidities: Habit formation, investment adjustment costs, variable capacity utilisation, capital requirements, sticky prices and wages.
- Housing and banking sectors as in Iacoviello (2005) and Gerali (2010).
- The model is estimated based on the Norwegian data using Bayesian methods (Kravik and Mimir, 2019).
- Model-consistent expectations with respect to all prices and quantities (**except for households' house price expectations as in Gelain et al., 2013**).
- **Households engage in long-term mortgage debt contracts as in Gelain et al. (2017).**

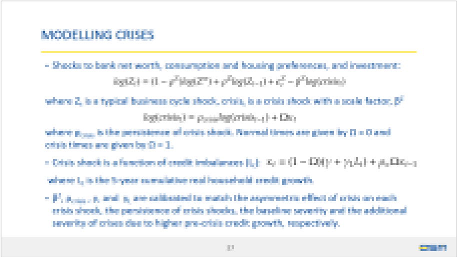
FINANCIAL CYCLES ARE MORE PERSISTENT UNDER HYBRID HOUSE PRICE EXPECTATIONS

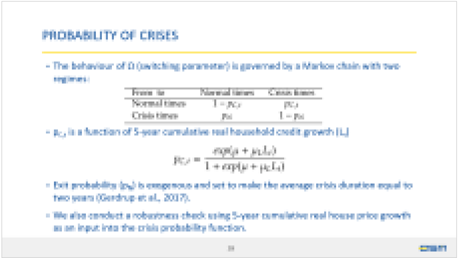
Real household debt



Real house prices



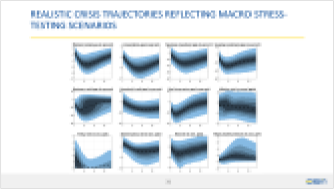

MODELLING CRISES


PROBABILITY OF CRISES

FINANCIAL CRISES

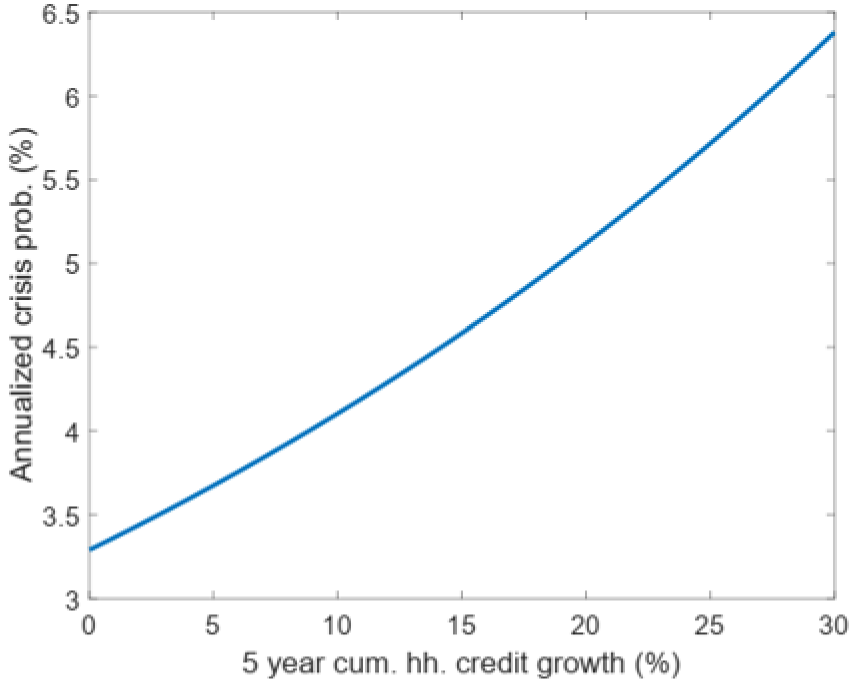
- Crisis can occur **endogenously** at any point in time governed by a Markov process.
  - **Adverse shocks** hit the economy and some **structural** model parameters change.
- **Structural changes in the economy during crises:**
  - Interbank **spreads** and external risk **premiums** become **sensitive** to changes in **bank capital**.
  - **Risk-weights** on household and business loans **increase**.
  - House prices and housing investment become **more sensitive to macro shocks**.
- **Asymmetrically large** shocks hitting the economy during crises.
  - **Bank net worth** (credit supply): loan losses and asset write-downs.
  - **Housing preferences** (credit demand): decline in house prices due to imbalances in HH debt.
  - **Consumption** (aggregate demand): motivated by large growth in consumer loans.
  - **Investment** (aggregate supply): productivity slowdown observed during financial crises.

HIGHER CREDIT IMBALANCES PRECEDING CRISES RAISE BOTH THE PROBABILITY AND THE SEVERITY OF FINANCIAL DOWNTURNS

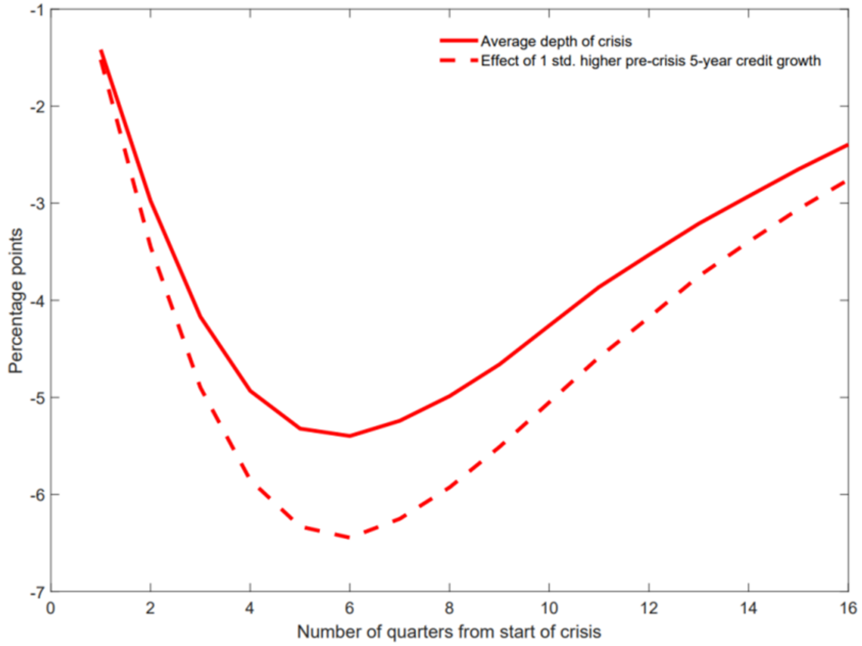


- The probability of crisis is estimated based on a sample of 20 OECD countries using a logistic regression (Gerdrup et al., 2017) while the severity is based on the Norwegian banking crisis.

Annualized crisis probability (%)



Dynamics of output gap during crises (%, on average)



FINANCIAL IMBALANCES LEAD TO **DOWNSIDE** RISKS TO GDP AND **MORE FREQUENT** BINDING **ELB** EPISODES

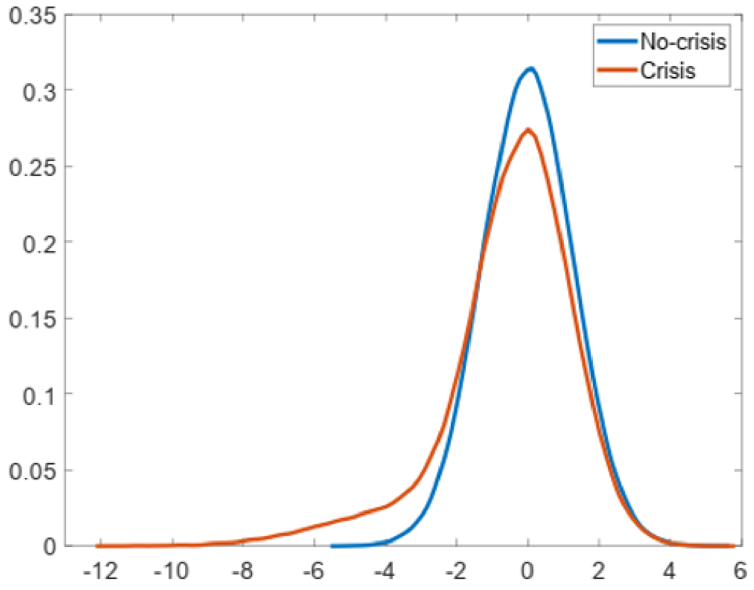
Frequency of different regimes over the business cycle:

- No-crisis, No-ELB regime: 72%
- Crisis, No-ELB regime: 3%

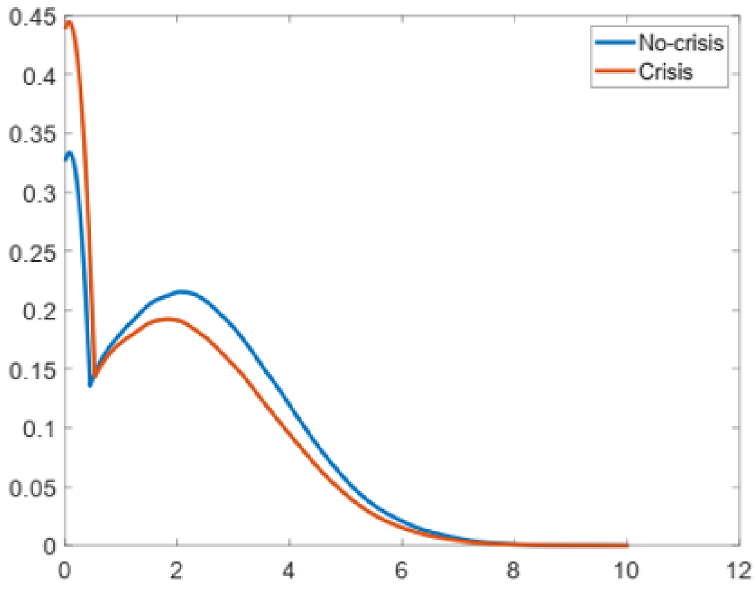
No-crisis, ELB regime: 21%

Crisis, ELB regime: 4%

Distribution of output gap (%)

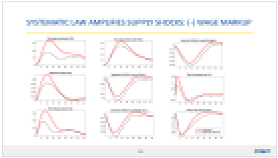


Distribution of policy rate (in ann. ppts)



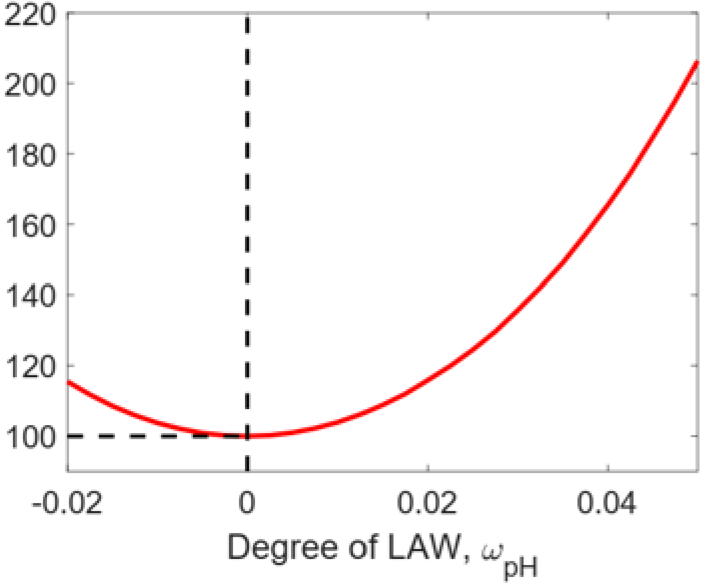
LAW by MONETARY POLICY

LAW BY MONETARY POLICY INCREASES INFLATION VOLATILITY WHILE REDUCING OUTPUT VOLATILITY

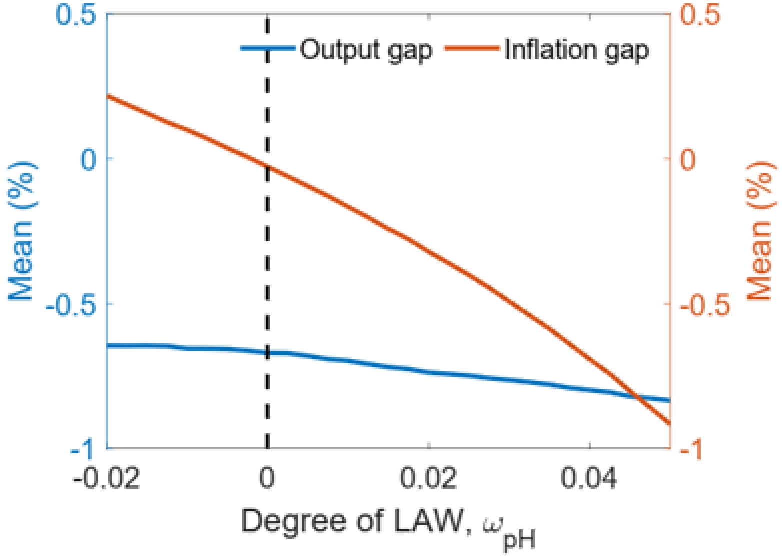


$$L_t = \left[\left(\mathbb{E}_t[\hat{\pi}_{pol,t}]\right)^2 + \lambda_y \left(\mathbb{E}_t[\hat{Y}_t]\right)^2 + \text{var}\left(\hat{\pi}_{pol,t}\right) + \lambda_y \text{var}\left(\hat{Y}_t\right) + \dots \right]$$

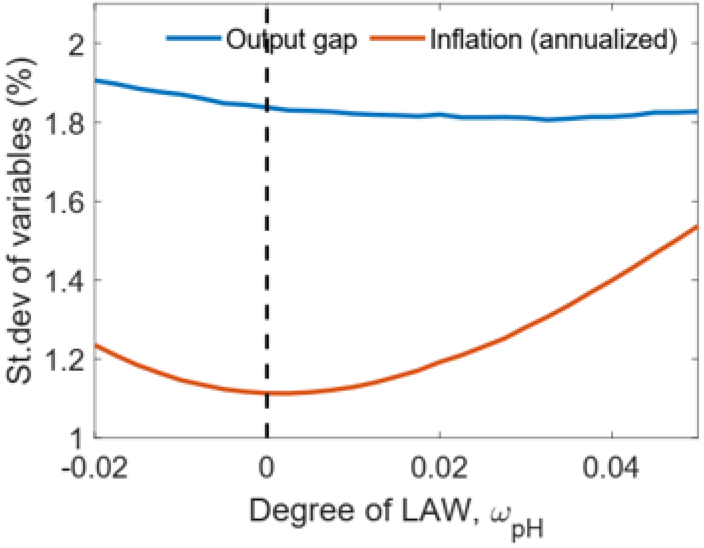
Relative loss values for different degrees of LAW



Expected gaps for different degrees of LAW (%)

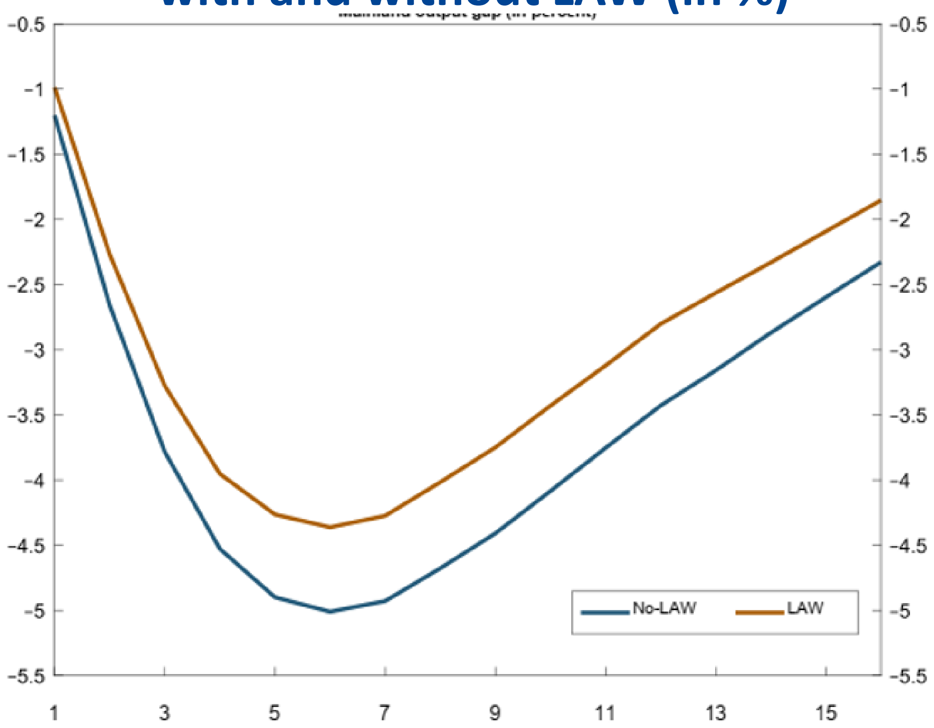


Volatilities for different degrees of LAW (%)

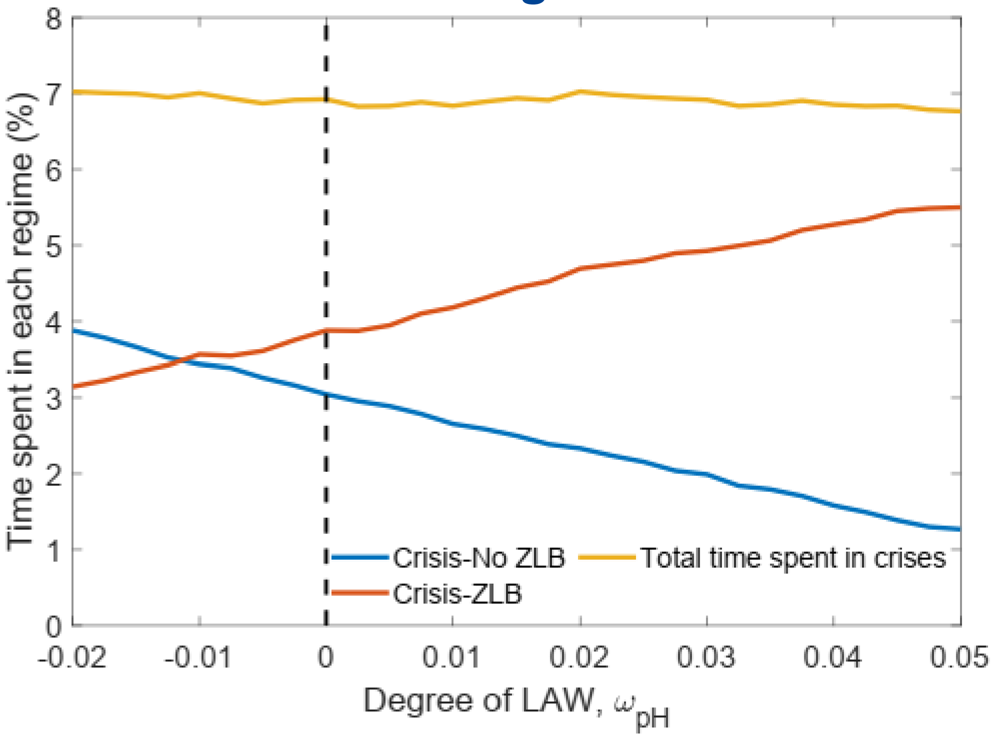


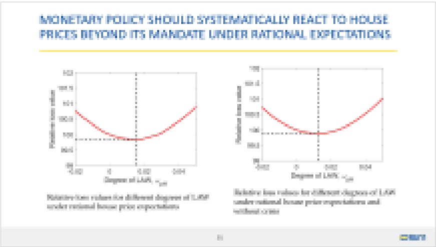
BENEFITS OF LAW: LESS SEVERE AND SLIGHTLY LESS LIKELY FINANCIAL CRISES

Output gap during crises with and without LAW (in %)



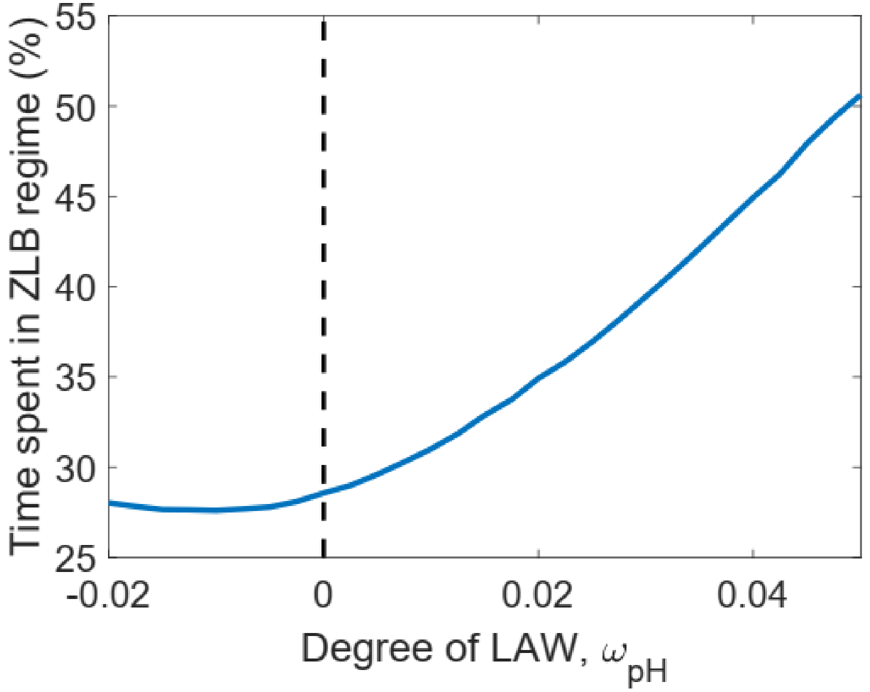
Time spent in crisis regimes for different degrees of LAW



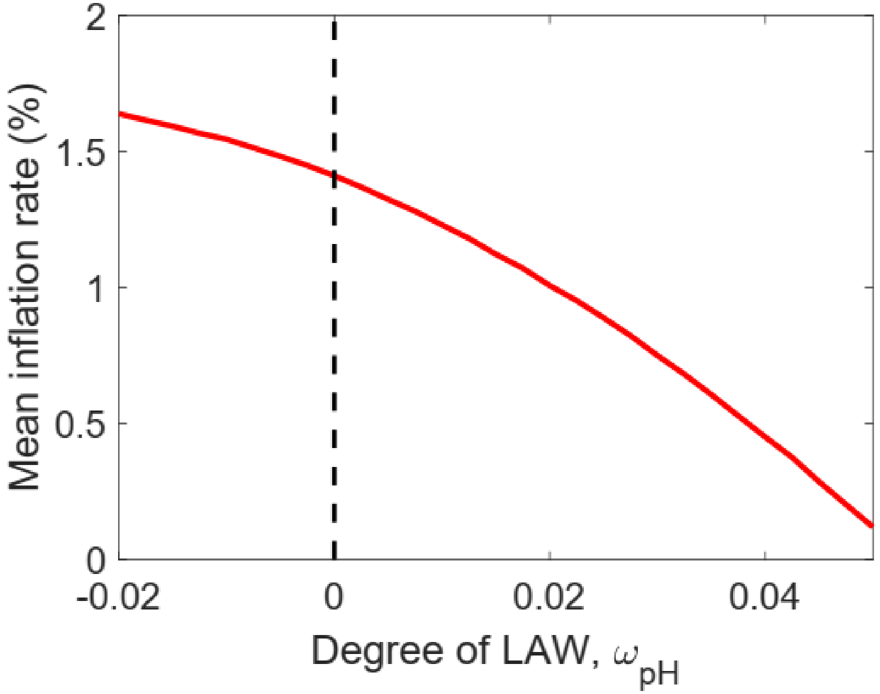


COSTS OF LAW: IT INCREASES TIME SPENT AT THE ELB

Time spent at ELB for different degrees of LAW (in %)



Average inflation rate for different degrees of LAW (in %)



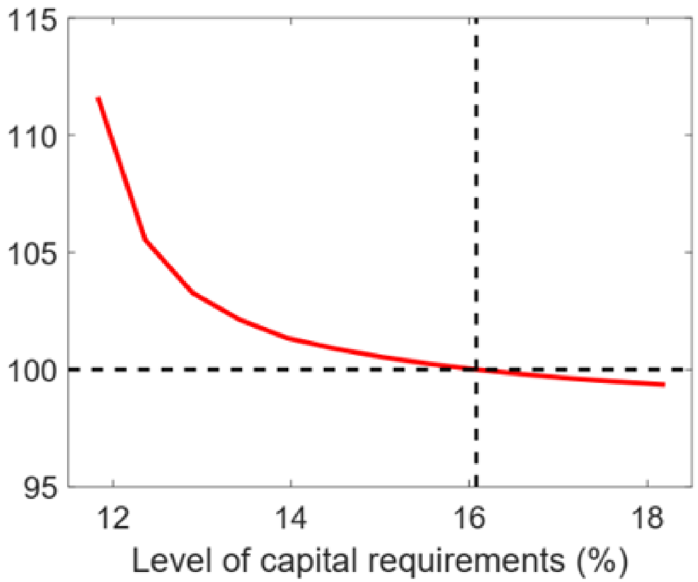
If LAW is incorporated into private sector expectations, it is like having a lower inflation target.

LAW by MACROPRUDENTIAL POLICY

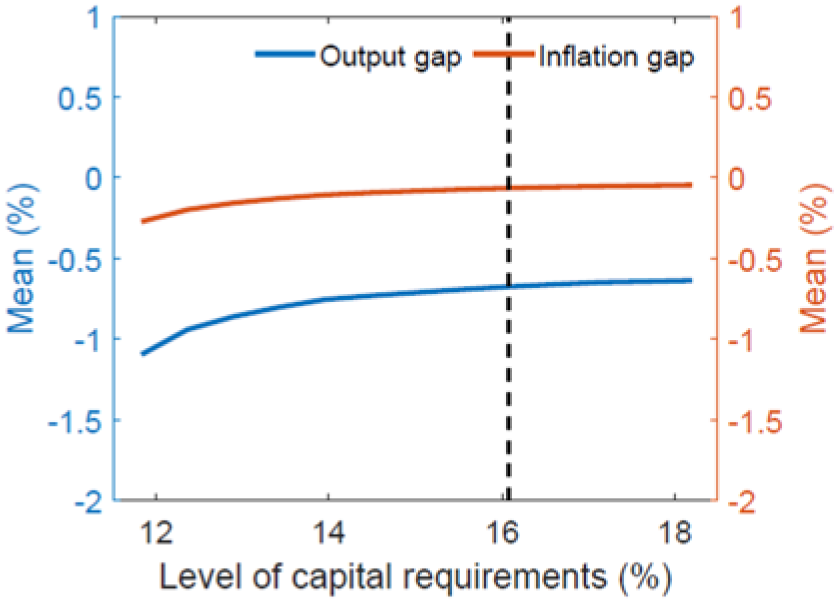
LONG-RUN INFLATION AND OUTPUT GAP INCREASE WHILE THEIR VOLATILITIES FALL UNDER HIGHER CAPITAL REQUIREMENTS

$$L_t = \left[\left(\mathbb{E}_t[\hat{\pi}_{pol,t}]\right)^2 + \lambda_y \left(\mathbb{E}_t[\hat{Y}_t]\right)^2 + \text{var}\left(\hat{\pi}_{pol,t}\right) + \lambda_y \text{var}\left(\hat{Y}_t\right) + \ldots \right]$$

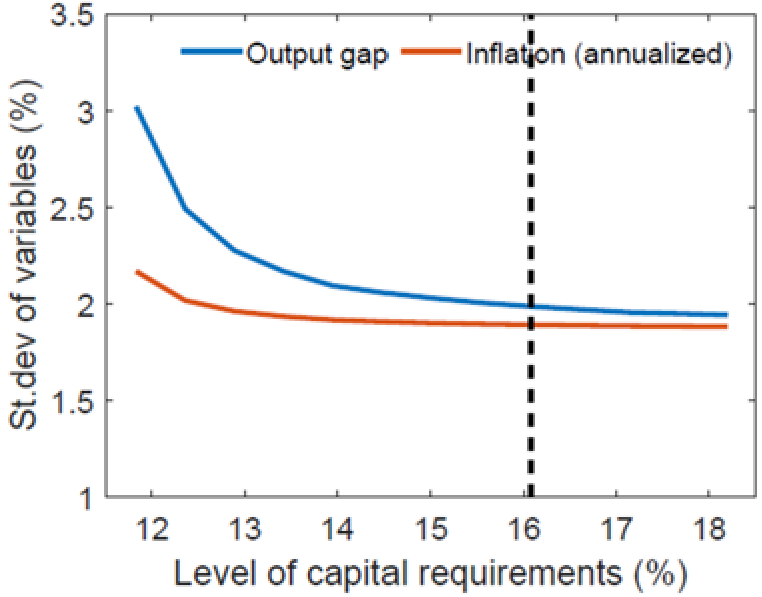
Relative loss values for different degrees of LAW



Expected gaps for different degrees of LAW (%)

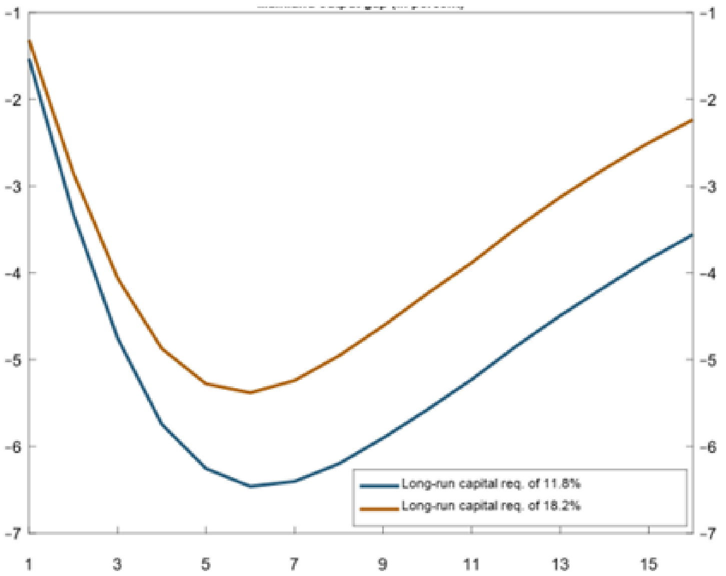


Volatilities for different degrees of LAW (%)

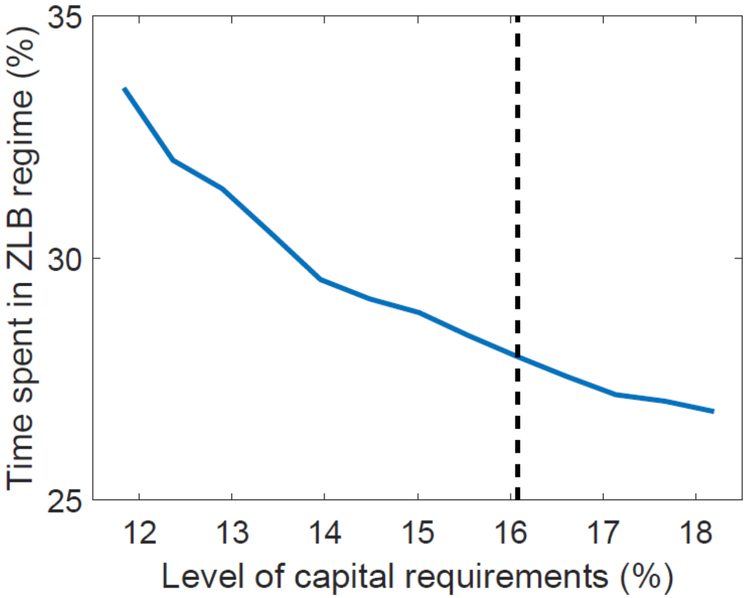


CRISES ARE LESS SEVERE AND ELB EPISODES ARE LESS FREQUENT UNDER HIGHER LONG-RUN CAPITAL REQUIREMENTS

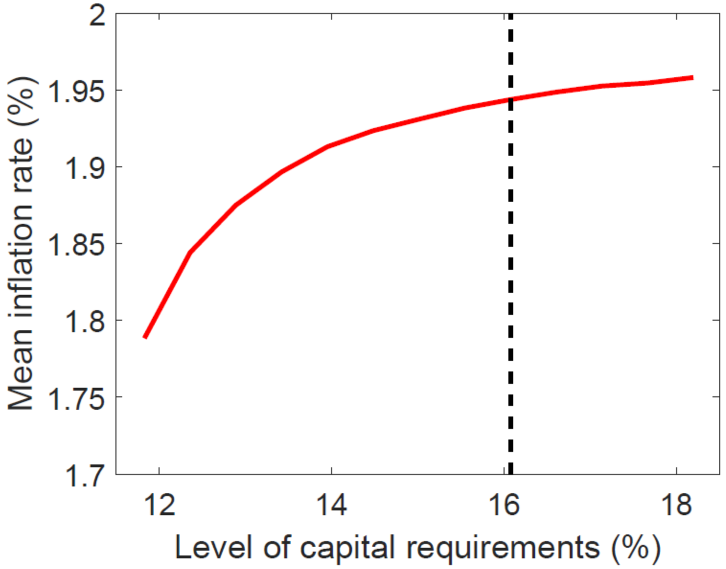
Output gap during crises for different level of capital req. (in %)



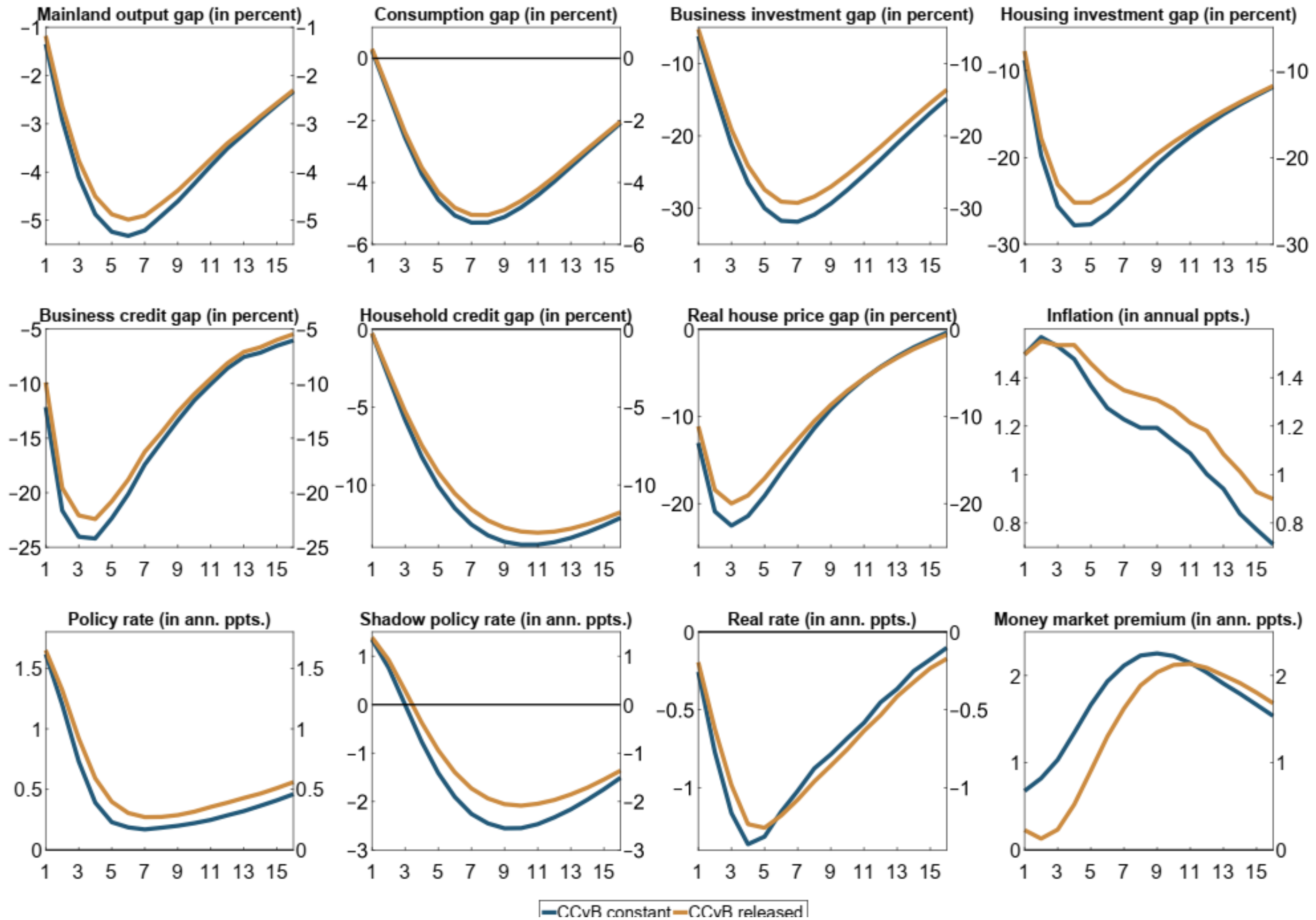
Time spent at ELB for different levels of capital req. (in %)



Average inflation rate for different levels of capital req. (in %)



IMPACT OF CCYB ON DYNAMICS OF FINANCIAL CRISES IS LIMITED



CONCLUSION

CONCLUDING REMARKS AND POLICY IMPLICATIONS

- LAW by monetary policy looks costly to implement given the limited benefits.
  - **Systematically higher-**than-”optimal policy rate in normal times” **does not reduce** the crisis prob. and crisis severity **enough to compensate for** lower inflation and output (and higher volatility in inflation) in normal times.
- Higher long-run capital requirements in normal times make the economy more resilient to shocks by reducing the severity of crises and the frequency of ELB.
  - The active use of the CCyB (within 2.5% range) seems to have **limited impact** on house prices and credit in normal times, and on the crisis dynamics.
- Given these results, keeping long-run capital buffers in the banking sector higher (around 18%) in normal times and widening the range of the CCyB that could be released during crises would make the economy more shock-prone, including against tightening of financial conditions.

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APPENDIX

RELATED LITERATURE

- **Nonsystematic LAW**: Svensson (2017) evaluates costs and benefits of LAW.
  - Does not explicitly take into account the persistence of financial cycles.
  - Does not consider systematic (rule-based) LAW.
- **Systematic LAW:** Gambacorta and Signoretti (2014), Pescatori and Laseen (2016), Alpanda and Ueberfeldt (2016), Curdia and Woodford (2016), Filardo and Rungcharoenkitkul (2016), Gerdrup et al. (2017), Guorio et al. (2017), Ajello et al. (2019), Caballero and Simsek (2020), Farhi and Werning (2021), Boissay et al. (2021), Adam and Woodford (2021). They either
  - **Abstract** from **key non-linearities** (financial crises, ELB, asymmetric policy) and **pers. financial cycles.**
  - Either **stylized, two (or three) period** models or calibrated **small-scale** DSGE models **without** explicit modelling of housing and financial sectors (not an estimated model matching key moments).
  - Do **not incorporate empirically realistic** dynamics of crises with long-lasting macro effects.
  - Do **not consider supply shocks** in business cycle fluctuations.

HOUSE PRICE EXPECTATIONS AND FINANCIAL CYCLES

- Hybrid house price expectations enable model to capture long cycles in house prices and household debt observed in the data → Gelain et al. (2013).
- A share b^{sa} of households expects house prices to follow a moving average process (i.e. partly backward-looking expectations), whereas a share $(1 - b^{sa})$ has rational expectations (in log-gap form):

$$\mathbb{E}_t\left[\widehat{P}^H_{t+1}\right] = b^{sa}\widehat{X}^H_t + (1 - b^{sa})\widehat{P}^H_{t+1}$$

where ^ denotes the gap form and the moving average process is defined as:

$$\widehat{X}^H_t = \lambda^{sa}\widehat{P}^H_{t-1} + (1 - \lambda^{sa})\widehat{X}^H_{t-1}.$$

MODELLING CRISES

- Shocks to bank net worth, consumption and housing preferences, and investment:

$$log(Z_t) = (1-\rho^Z)log(Z^{ss}) + \rho^Z log(Z_{t-1}) + \epsilon_t^Z - \beta^Z log(crisis_t)$$

where Z_t is a typical business cycle shock, $crisis_t$ is a crisis shock with a scale factor, β^Z

$$log(crisis_t) = \rho_{crisis} log(crisis_{t-1}) + \Omega\kappa_t$$

where ρ_{crisis} is the persistence of crisis shock. Normal times are given by $\Omega = 0$ and crisis times are given by $\Omega = 1$.

- Crisis shock is a function of credit imbalances (L_t): $\kappa_t = (1-\Omega)(\gamma + \gamma_L L_t) + \rho_\kappa \Omega \kappa_{t-1}$

where L_t is the 5-year cumulative real household credit growth.

- β^Z, ρ_{crisis} , γ, and γ_L are calibrated to match the asymmetric effect of crisis on each crisis shock, the persistence of crisis shocks, the baseline severity and the additional severity of crises due to higher pre-crisis credit growth, respectively.

PROBABILITY OF CRISES

- The behaviour of Ω (switching parameter) is governed by a Markov chain with two regimes:

From to	Normal times	Crisis times
Normal times	$1 - p_{C,t}$	$p_{C,t}$
Crisis times	p_N	$1 - p_N$

- $p_{C,t}$ is a function of 5-year cumulative real household credit growth (L_t)

$$p_{C,t} = \frac{exp(\mu + \mu_L L_t)}{1 + exp(\mu + \mu_L L_t)}$$

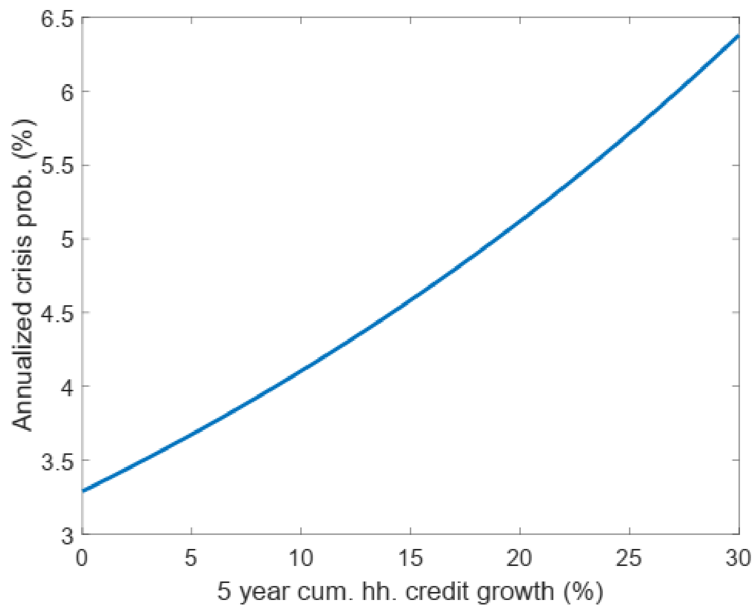
- Exit probability (p_N) is exogenous and set to make the average crisis duration equal to two years (Gerdrup et al., 2017).
- We also conduct a robustness check using 5-year cumulative real house price growth as an input into the crisis probability function.

HIGHER CREDIT IMBALANCES RAISE THE PROBABILITY OF CRISES

- Based on a sample of 20 OECD countries over the period 1975Q1 - 2014Q2, a logistic regression is estimated for the probability of crisis (Gerdrup et al., 2017):

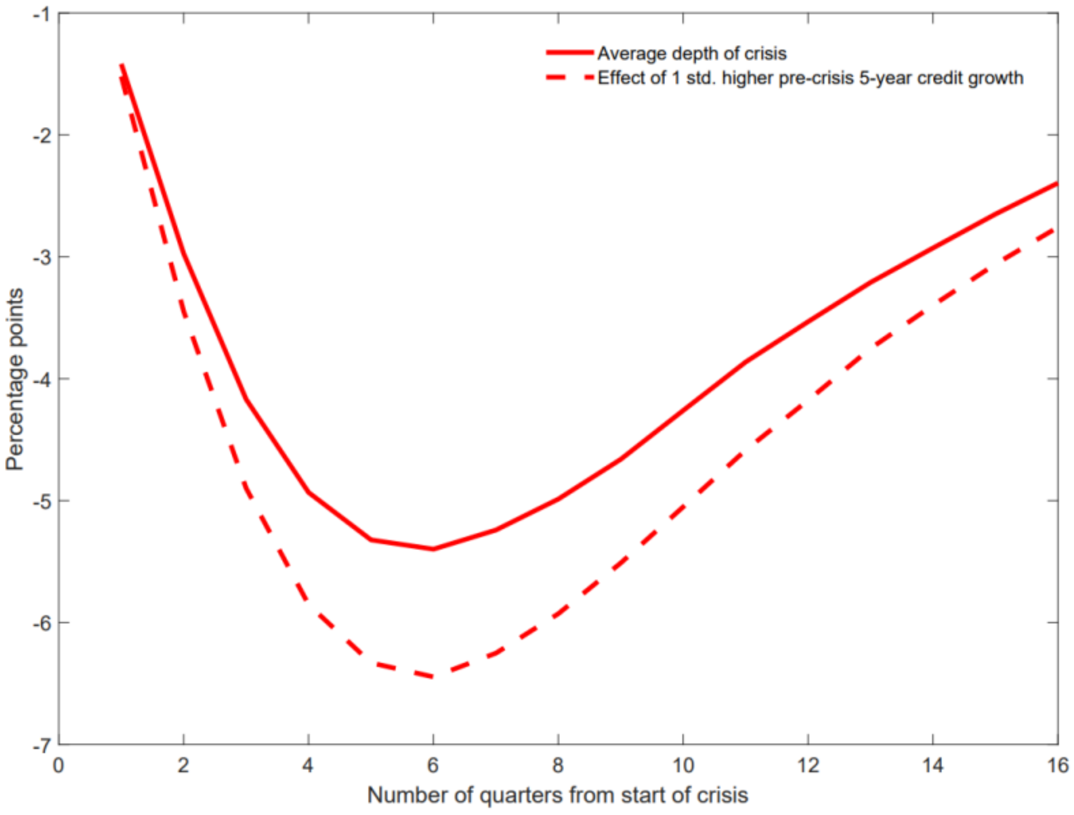
Variables	
5-year cum. growth in real household credit	2.232**
	(1.099)
Constant	-4.792***
	(1.026)
Country fixed effects	Yes
Pseudo R-Squared	0.0424
AUROC	0.666
Observations	1832

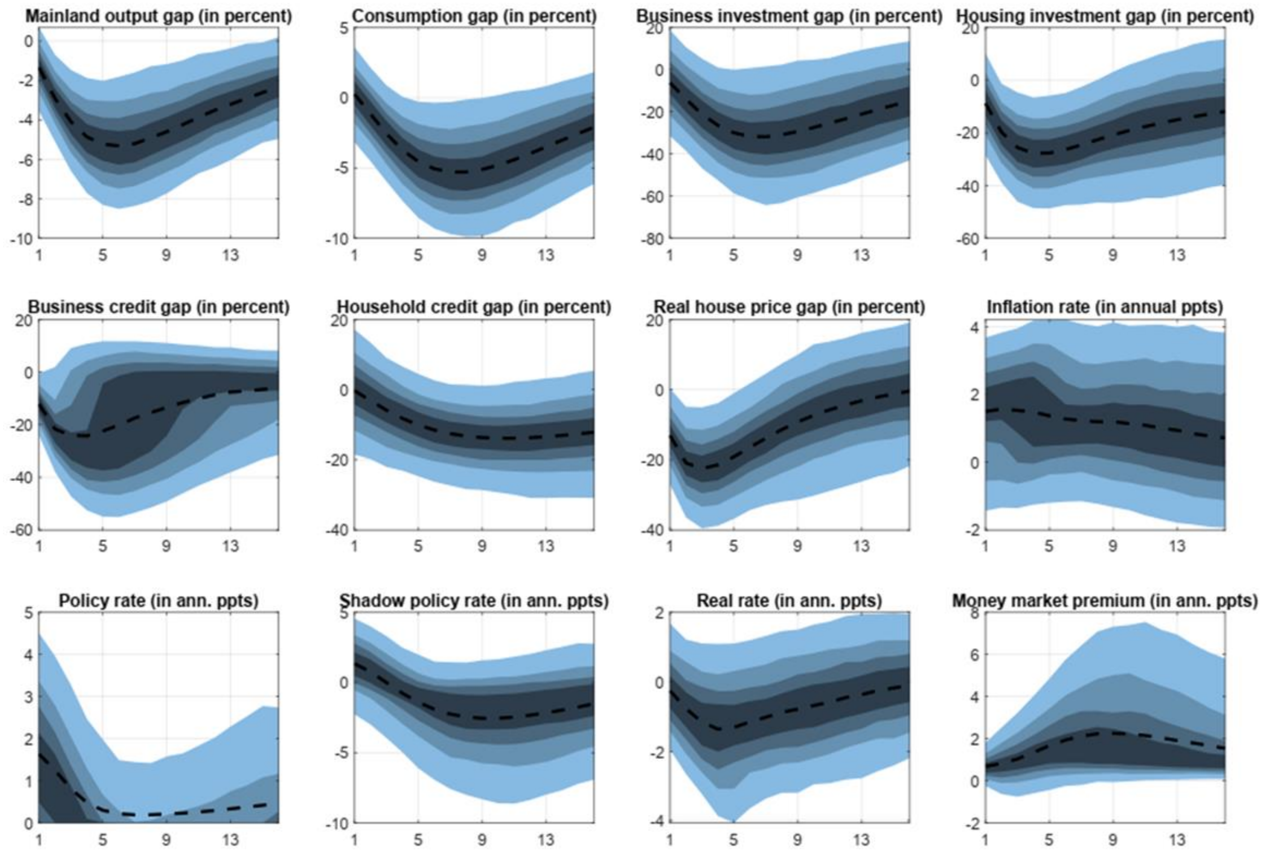
Notes: Significance levels: *10%, **5%, ***1%.



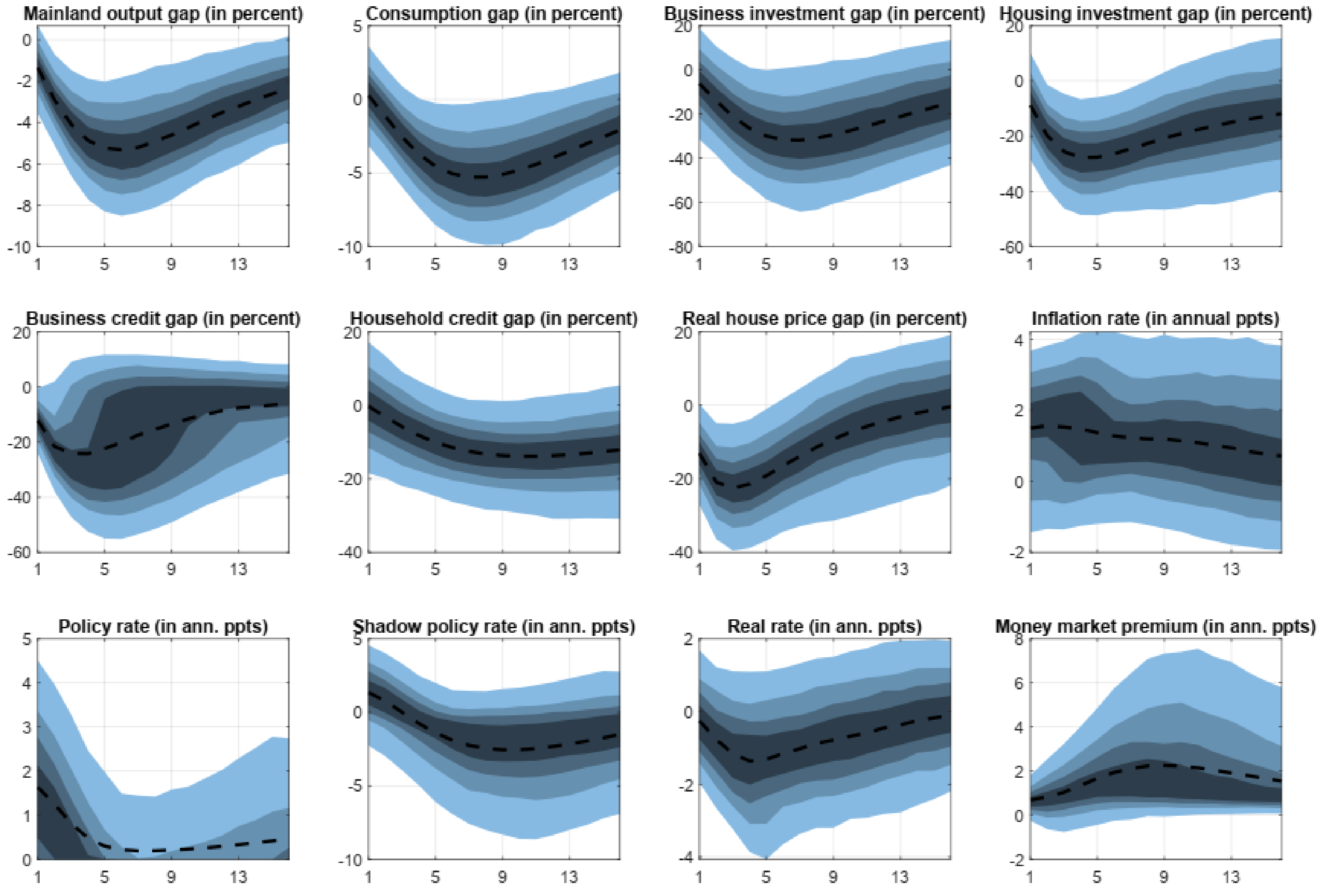
MORE RAPID CREDIT GROWTH PRECEDING CRISES LEADS TO LARGER OUTPUT DECLINES DURING FINANCIAL CRISES

Dynamics of output gap during crises (%)





REALISTIC CRISIS TRAJECTORIES REFLECTING MACRO STRESS-TESTING SCENARIOS



POLICY ASYMMETRICALLY RESPONDS TO HOUSE PRICES IN NORMAL TIMES

- Optimal policy is represented as a simple interest rate rule.

$$\hat{R}_{P,t} = \omega_R \hat{R}_{P,t-1} + (1-\omega_R)\left(\omega_P \hat{\pi}_t + \omega_{P1}\hat{\pi}_{t+1} + \omega_W \hat{\pi}_t^W + \omega_Y \hat{Y}_t\right.$$
$$\left.+\omega_S \hat{S}_t + \omega_{PREM}\hat{Z}_{prem,t} + \omega_{RF}\hat{R}_t^*\right) + \mathbb{1}_{\hat{P}_t^H>0,normal\ times}\,\omega_{P^H}\hat{P}_t^H + Z_{RN3M,t}.$$

- The response coefficients in the Taylor rule (except the response to house prices, ω_P^H) are chosen to replicate optimal policy (in the model with no-crisis) to minimize

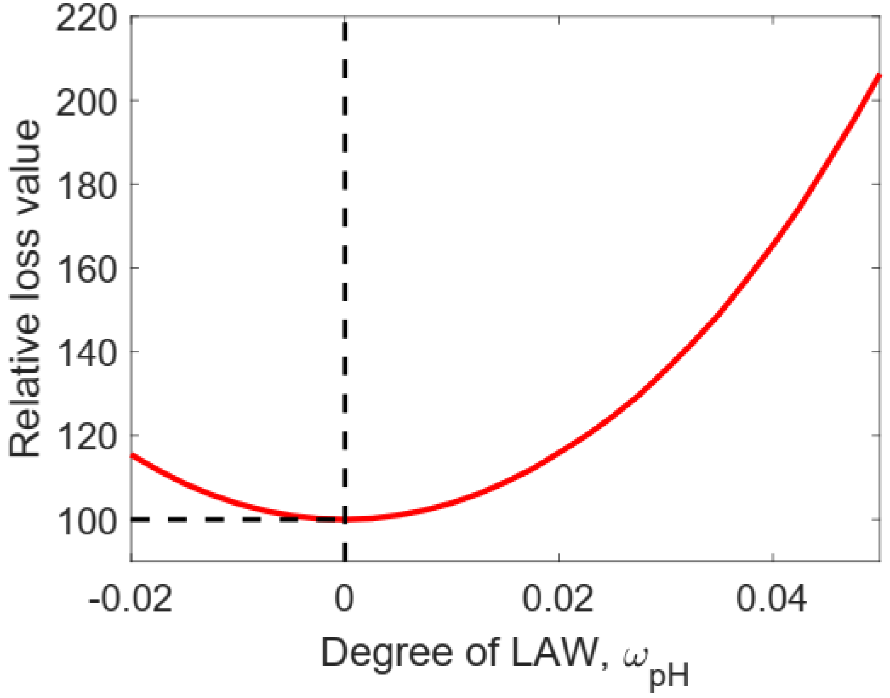
$$\min_{\{\hat{R}_{P,t}\}}\left[\left(\hat{\pi}_{pol,t}\right)^2 + \lambda_y\left(\hat{Y}_t\right)^2 + \lambda_{dr}\left(\Delta R_{P,t}\right)^2\right]$$

$\lambda_y = 0.30$ and $\lambda_{dr} = 0.40$.

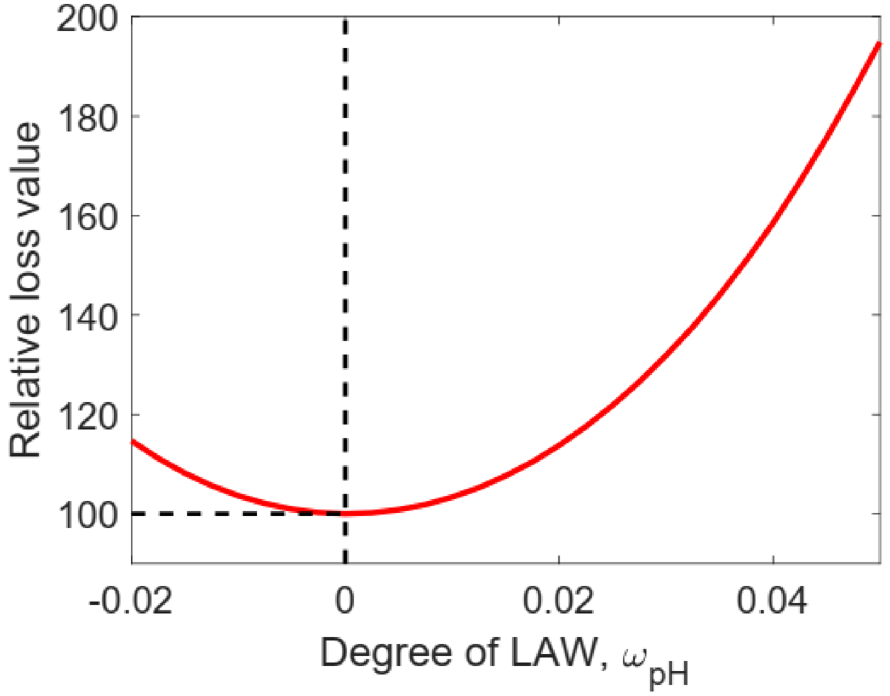
- We then choose ω_P^H to minimize the loss function in the model with crises, holding all other response coefficients fixed at their previously optimized levels.

MONETARY POLICY SHOULD NOT SYSTEMATICALLY REACT TO HOUSE PRICES BEYOND ITS MANDATE

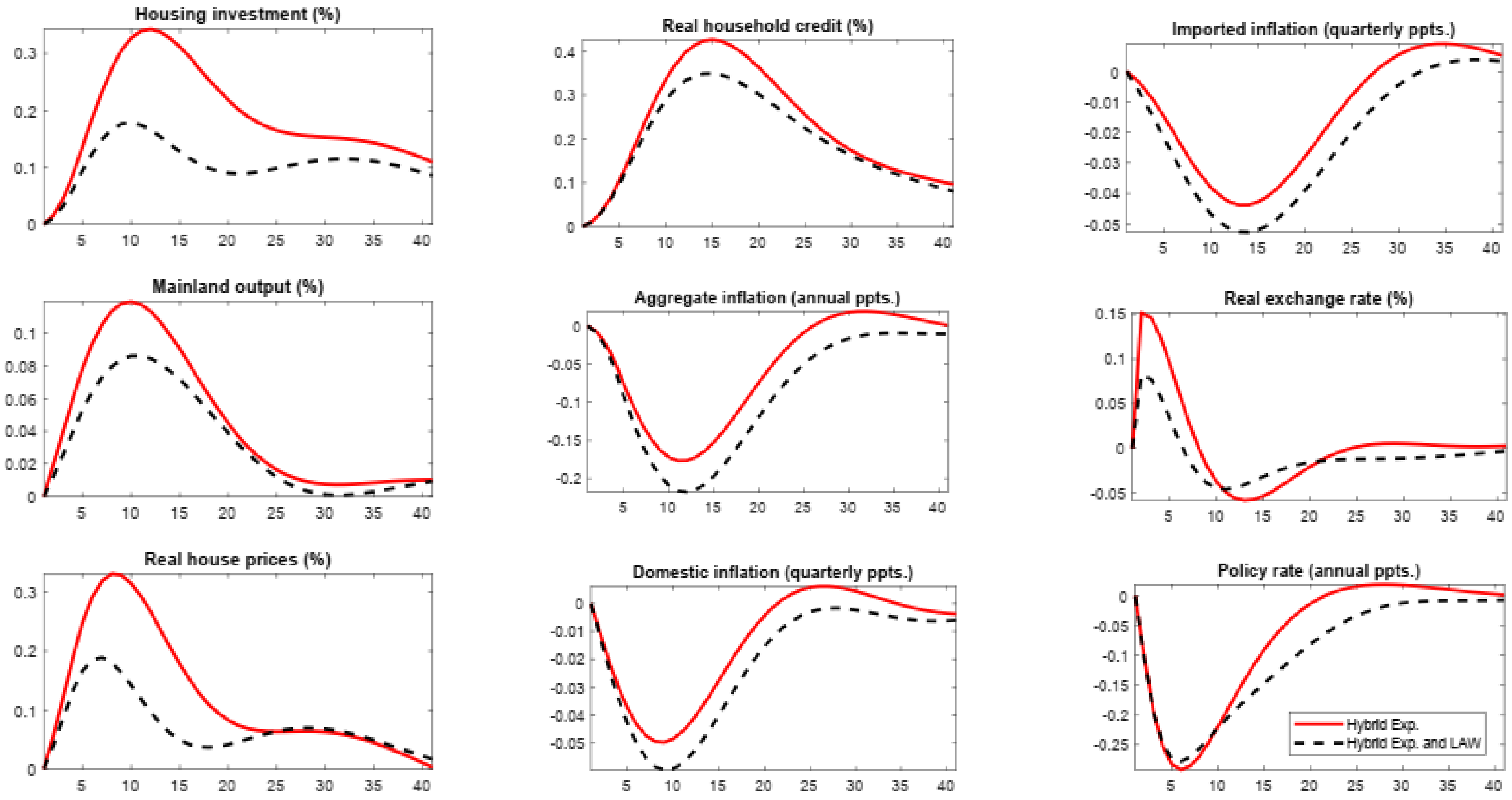
Relative loss values for different degrees of LAW



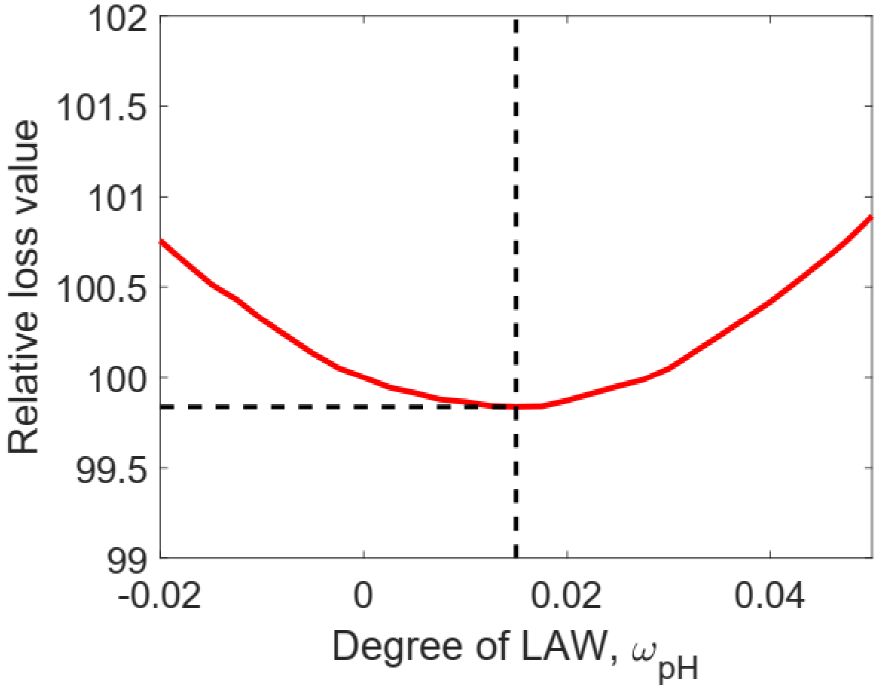
Relative loss values for different degrees of LAW in the model without crisis



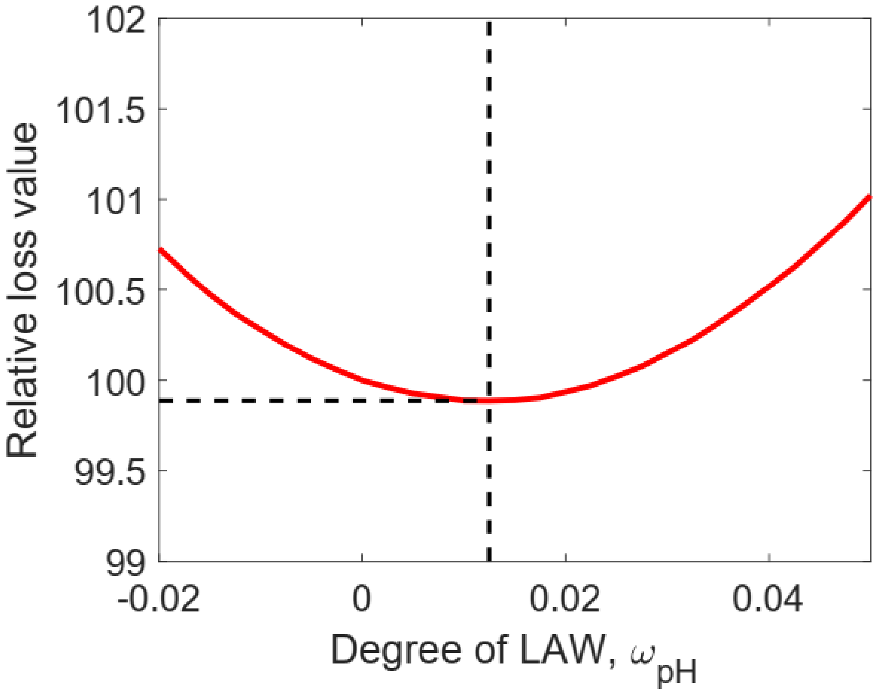
SYSTEMATIC LAW AMPLIFIES SUPPLY SHOCKS: (-) WAGE MARKUP



MONETARY POLICY SHOULD SYSTEMATICALLY REACT TO HOUSE PRICES BEYOND ITS MANDATE UNDER RATIONAL EXPECTATIONS

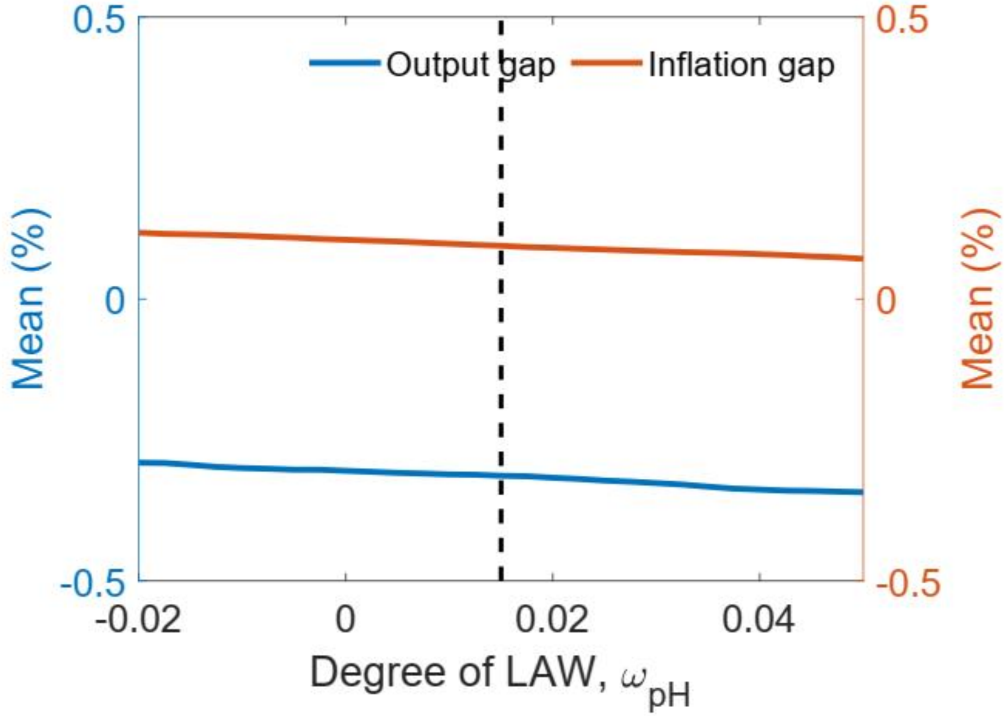


Relative loss values for different degrees of LAW under rational house price expectations

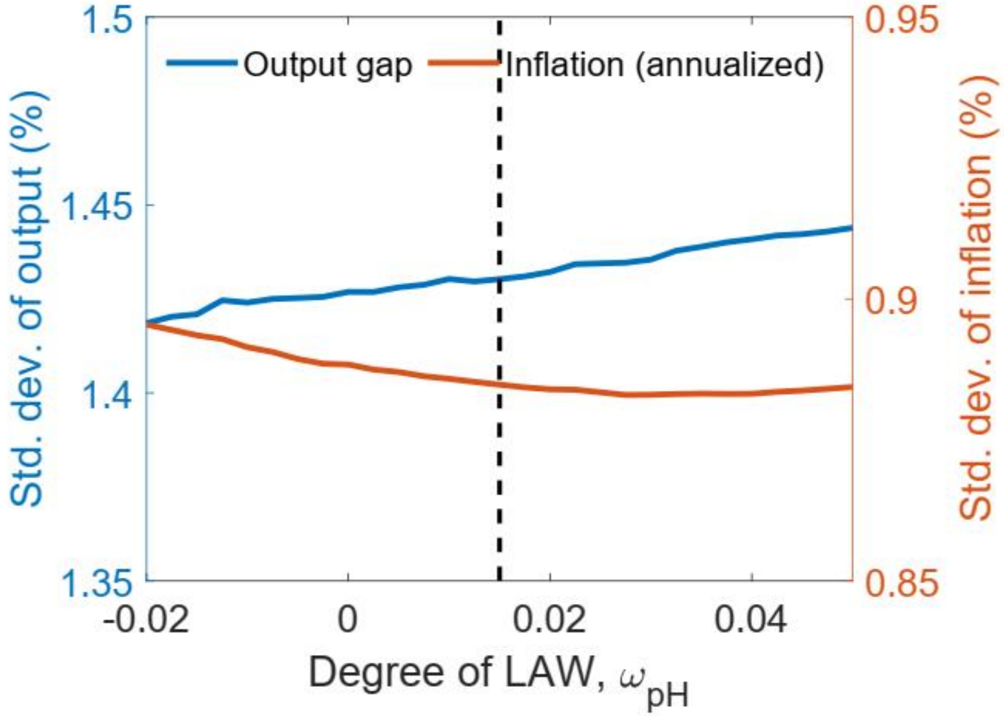


Relative loss values for different degrees of LAW under rational house price expectations and without crisis

LAW REDUCES INFLATION VOLATILITY WHILE RAISING OUTPUT VOLATILITY UNDER RATIONAL EXPECTATIONS

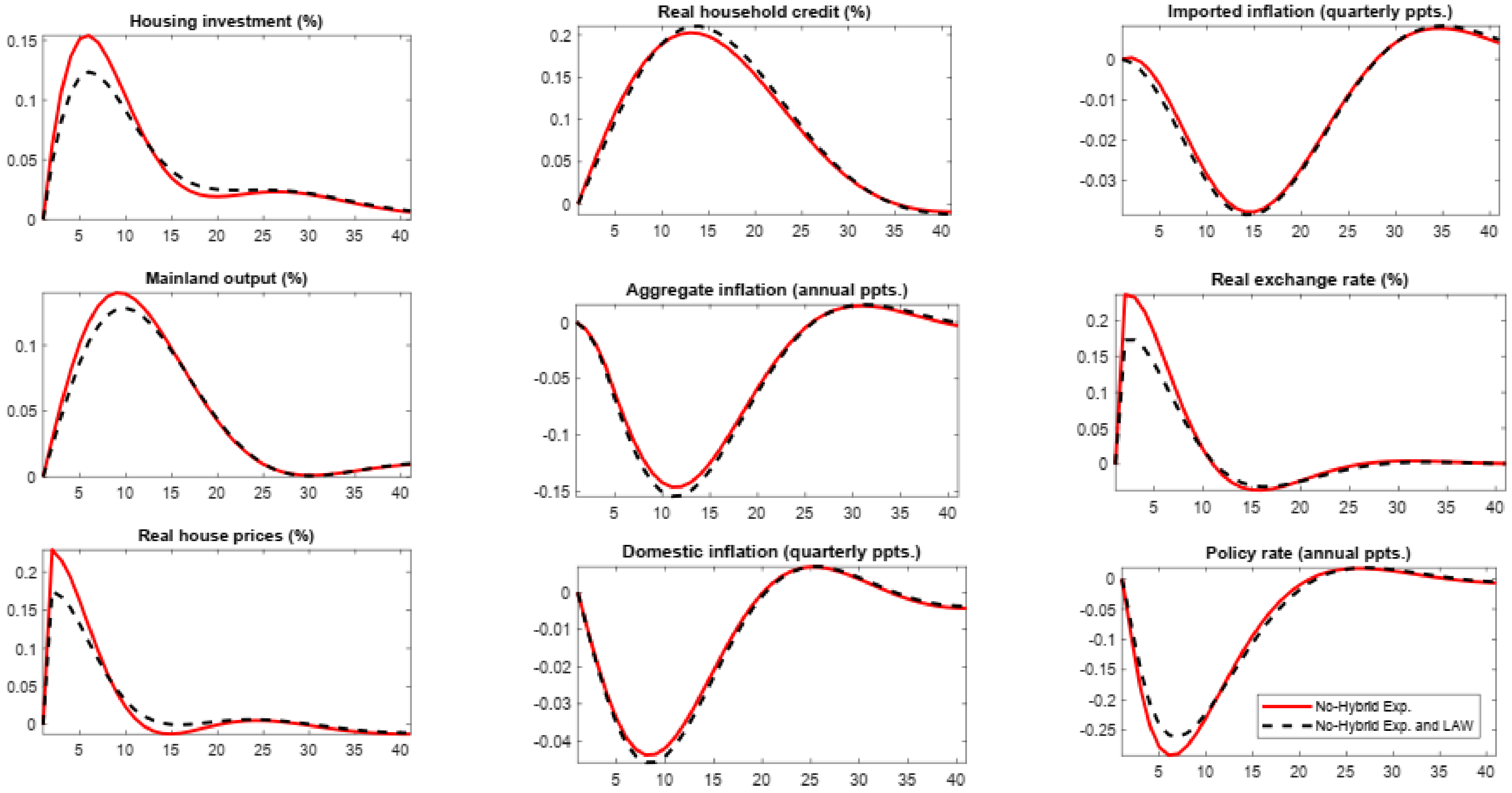


Expected gaps under different degrees of LAW

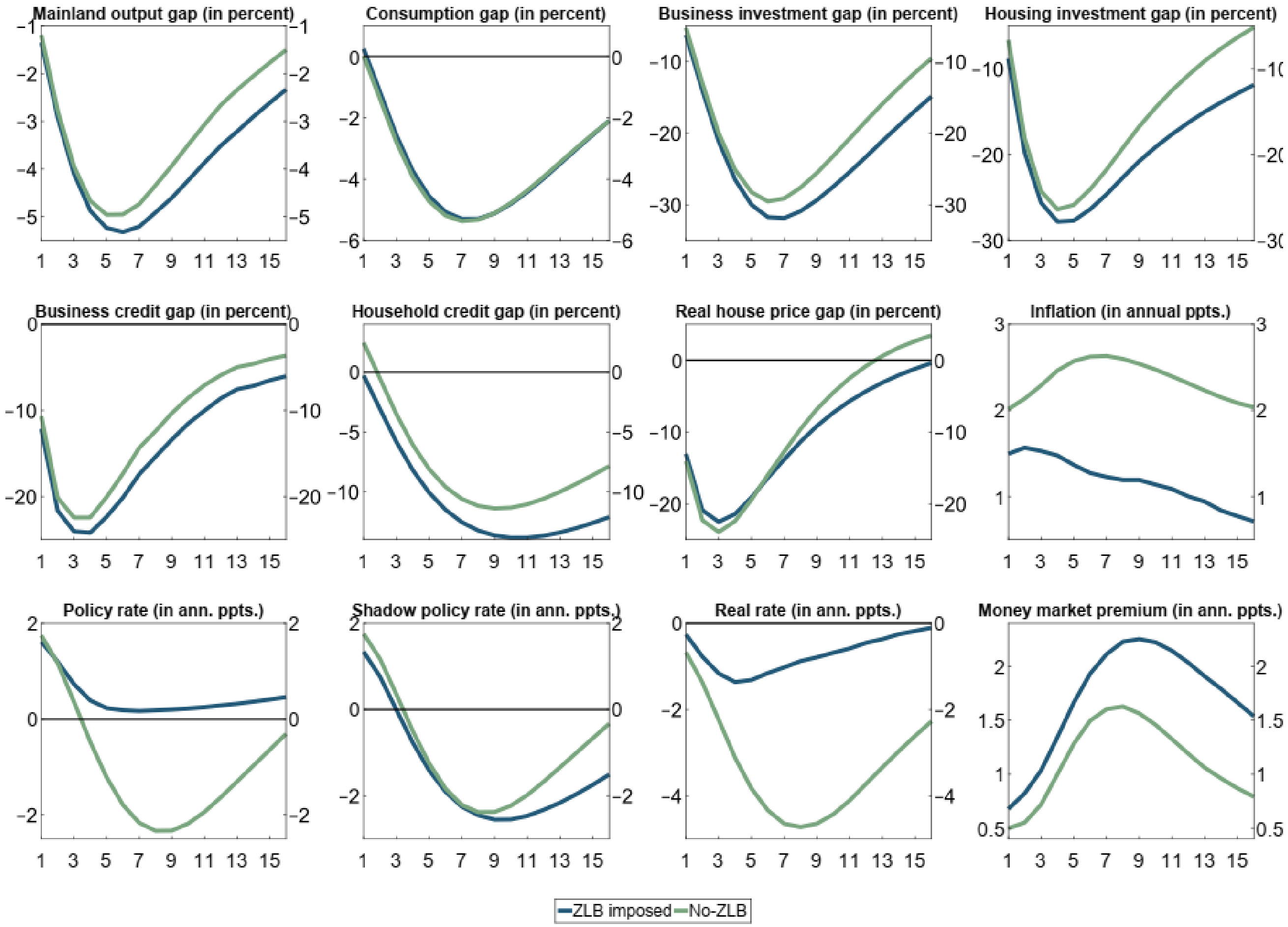


SDs under different degrees of LAW

SYSTEMATIC LAW DOES NOT AMPLIFY SUPPLY SHOCKS UNDER RATIONAL EXPECTATIONS: WAGE MARKUP



IMPACT OF ELB ON DYNAMICS OF FINANCIAL CRISES



NET BENEFITS OF HIGHER CAPITAL REQUIREMENTS DEPEND ON BOTH THE PROBABILITY AND THE SEVERITY OF CRISES

Approximate benefits and costs of capital requirements — Table 20

	Crisis scenarios	Baseline crisis scenario		Severe crisis scenario (with a higher crisis prob.)	
	Changes in capital requirements	+2.5% pts	+5% pts	+2.5% pts	+5% pts
Benefits	Reduced crisis probability (annual, % pts dev.)[1]	0.07	0.16	0.05	1.63
	Cost of crisis (% of annual GDP)[2]	0.65	0.85	2.13	4.39
Costs	Increase in weighted average loan spreads (bp)[3]	19	59	19	59
	Cost of higher spreads (% of post-Basel III GDP)[4]	-0.21	-0.44	-0.21	-0.44
Macro variables (% deviation from post-Basel III levels)[5]	Real GDP	-0.14	-0.18	0.007	2.1
	Consumption	0.29	0.57	0.21	0.28
	Investment	-1.77	-2.96	-0.68	12.4
	Total lending	-1.88	-3.18	-0.8	12.9

[1] Computed as the percentage point difference between the crisis probability under the respective pre-Basel III regime and that under the post-Basel III regime. [2] Computed as the percent difference between the deterministic steady state and ergodic mean levels of real GDP under the respective Basel regime as a percentage of annual GDP. [3] Computed as the basis points difference between the deterministic steady-state level of a weighted-average loan spread under the post-Basel III regime and that under the respective pre-Basel III regime. [4] Computed as the percent difference between the deterministic steady-state level of real GDP under the post-Basel III regime and that under the respective pre-Basel III regime as a percentage of post-Basel III GDP. [5] Computed as the percent difference between the ergodic mean level of the relevant macroeconomic variable under the post-Basel III regime and that under the respective pre-Basel III regime as a percentage of post-Basel III levels.