The Transmission of Macroprudential Policy in the Tails: Evidence from a Narrative Approach

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Motivation

- Policymakers are worried about the impact of policies and economic conditions:
  - on the economy *on average*.
  - on the probability and magnitude of large harmful events ('tail events').
- Aim of macroprudential policy: reduce 'tail risks'—i.e., minimise potential economic costs of negative shocks.

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- Macroprudential policies can generate a trade-off:
  - Potential benefits: Increasing macroeconomic stability by reducing GDP-growth volatility.
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- Macroprudential policies can generate a trade-off:
  - Potential benefits: Increasing macroeconomic stability by reducing GDP-growth volatility.
  - Potential cost: negative impact on average economic growth.
- To gauge costs and benefits, important to estimate causal effects of macroprudential policies on entire distribution of potential macroeconomic outcomes.

What We Do

1. Construct a macroprudential policy index for 12 advanced economies (1990Q1-2017Q4) using MaPPED

2. Identify macroprudential policy 'shocks' using a narrative identification strategy

3. Estimate causal effects of macroprudential policies on entire GDP-growth distribution

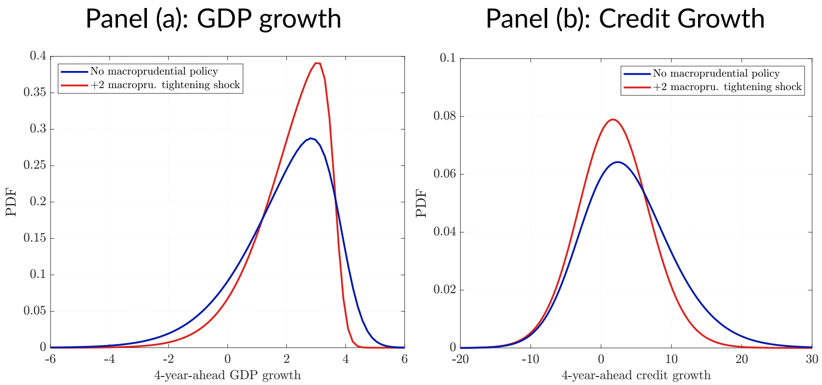
4. Explore different channels through which macroprudential policies can affect the GDP-growth distribution
    - Quantity of credit: 'credit-at-risk' channel
    - Composition of credit: household credit vs. corporate credit
    - House-price channels

Preview of Results

- Macroprudential policy has near-zero effects on centre of GDP-growth distribution
- Tighter macroprudential policy brings benefits by reducing variance of future GDP growth:
  - Improving left tail while simultaneously reducing right tail
- Macroprudential policy particularly operates through 'credit-at-risk':
  - Reduces right tail of future credit growth, dampening booms, in turn reducing likelihood of extreme GDP-growth outturns

Main Results

Figure: Effect of macroprudential tightening shock on distributions of 4-year-ahead GDP and credit growth



Distributions when all control variables set to cross-country and cross-time averages. *Blue lines*: macroprudential policy index is 0. *Red lines*: macroprudential policy index is $+2$ (two tightening activations). Distributions approximated by fitting skew-*t* to quantile-regression estimates at $\tau = [0.1, 0.25, 0.5, 0.75, 0.9]$.

Related Literature

- Quantile-regression techniques to assess the drivers of macroeconomic tail risks
  (Adrian et al., 2019, 2022; Lloyd et al., 2023; Aikman et al., 2019; Galán, 2020; Franta and Gambacorta, 2020; Gelos et al., 2022; Brandão-Marques et al., 2021)
- Macroprudential policy identification
  (Richter et al., 2019; Rojas et al., 2022; Fernández-Gallardo, 2023)
- Transmission channels of macroprudential policy to the macroeconomy through the financial system
  (Claessens et al., 2013; Cerutti et al., 2017; Forbes, 2021; Acharya et al., 2022)

Empirical Strategy

- Specify the following local-projection model for conditional quantile function Q of h-period-ahead annual average GDP growth:

$$Q_{\Delta^h y_{i,t+h}}(\tau | \Delta MaPP_{i,t}, \mathbf{x}_{i,t}) = \boldsymbol{\alpha}_i^h(\tau) + \Delta MaPP_{i,t}\beta^h(\tau) + \mathbf{x}'_{i,t}\boldsymbol{\theta}^h(\tau), \quad \tau \in (0,1)$$

  where $\Delta^h y_{i,t+h} \equiv (y_{i,t+h} - y_{i,t}) / (h/4)$ for $h = 1, ..., H$; $\boldsymbol{\alpha}_i^h(\tau)$ country- and quantile-specific fixed effects

- Q computes quantiles τ of the distribution of $\Delta^h y_{i,t+h}$ given covariates
- $\tau =$ 10th, 50th and 90th percentiles

Visual

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Visual

- **Key Question**: Can we interpret $\beta^h(\tau)$ as the *causal* effect of macroprudential policy on GDP-growth distribution? Two issues: measurement and identification.

Measurement of Macroprudential Policy

- Use Macroprudential Evaluation Database (MaPPED)
- **Data:** around 480 policy actions between 1990-2017 for 12 EU-advanced economies: Belgium, Denmark, Germany, Ireland, Spain, France, Italy, Netherlands, Finland, Sweden, Portugal and UK
- Why MaPPED? Advantages:
  - Life-cycle implementation of each policy instrument (different weights)
  - Rich set of information: announcement and enforcement date (anticipation effect), stance, countercyclical motivation/design (endogeneity)
  - Perfect comparability across countries (common criteria)

Measurement of Macroprudential Policy

- Construct an overall macroprudential policy index for each country in sample by combining all non-systematic policy actions
- Weighting scheme considers:
  - Date: Announcement (financial entities might respond to at the time of initial communication)
  - Stance: Tightening (+) vs. Loosening (-)
  - Different weights based on importance (Meuleman and Vander Vennet, 2020):
    - Higher weights to activations and deactivations
    - Second-tier actions, including changes in the existing level or scope of the policy, are given a lower weight

Weighting scheme - Detail Weighting scheme - In Practise

Identification of Macroprudential Policy Shocks

- Macroprudential policy not 'randomly assigned'
  - Simple quantile regression of GDP growth on $\Delta MaPP_{i,t}$ will not uncover causal effects
- Two empirical challenges to identify unanticipated macroprudential policy shocks:
  1. Some macroprudential policy actions are endogenous
     - Activated or adjusted in response to current or future economic conditions
  2. Some macroprudential policies are subject to implementation lags
     - Empirical challenge to extent that macroprudential policy changes are anticipated by agents

Identification of Macroprudential Policy Shocks

- Address endogeneity by using narrative-identification approach proposed by Fernández-Gallardo (2023) within our quantile-regression framework

- Use narrative information in MaPPED to identify systematic component of macroprudential policy actions $\Rightarrow \Delta MaPP_{i,t}^{narrative}$

- Exclude policy actions with a specific countercyclical design

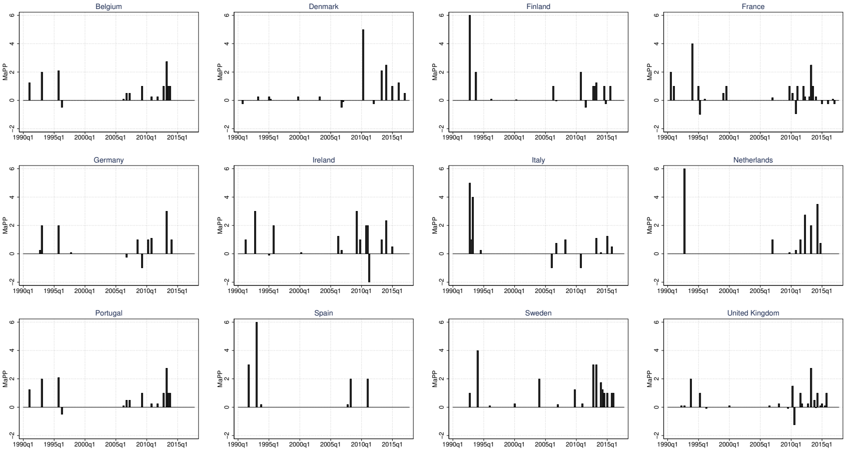
  - Countercyclical design: regularly revised along with judgements about the intensity of cyclical systemic risk

  - Interventions primarily aimed at short- to medium-term stabilisation (e.g., CCyB)

- Remaining actions unlikely to be systematically correlated with other underlying factors affecting GDP-growth distribution

Measurement of Macroprudential Policy

Figure: Changes in the Narrative-Based Macroprudential Policy Index over Time



Notes: Plot of narrative-based $\Delta MaPP_{i,t}$ over time for each advanced-economy in our sample. Period is 1990Q1-2017Q4.

Summary Stats

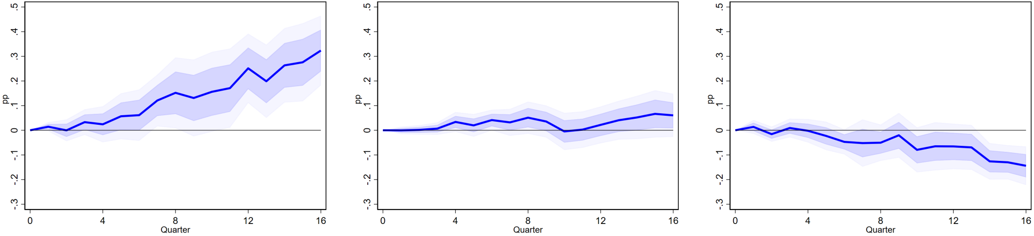
Narrative Identification In Practice: A Capital Buffers Example

1. Netherlands 2014Q4: announced implementation of a tightening Systemic risk buffer
   - MaPPED classification: Non-countercyclical
   - ESRB definition: Systemic risk buffer (SyRB) aims to address systemic risks of a long-term, non-cyclical nature
   - Include these type of policies because are less likely to be correlated with (unobservable) short- to medium term economic conditions
2. Sweden 2014Q3: announced implementation of a tightening CCyB.
   - MaPPED classification: Countercyclical
   - ESRB definition: The countercyclical capital buffer (CCyB) is designed to counter procyclicality in the financial system
   - Exclude these type of policies because are very likely correlated with (unobservable) short- to medium term economic conditions

Empirical Results: Macroprudential Policy and GDP Growth

Figure: IRF of Quantiles of GDP-Growth Distribution to Macroprudential Policy Tightenings

Panel (a): 10th Percentile | Panel (b): 50th Percentile | Panel (c): 90th Percentile



Notes: Estimated change in the τ-th percentile of annual average real GDP growth at horizon $h = 1, 2, ..., 16$, following a tightening macroprudential policy activation. Sample period is 1990Q1-2017Q4, for 12 advanced economies. Shaded areas denote the 90% (light blue) and 68% (dark blue) confidence intervals based on bootstrap with 500 replications.

Heterogeneity: Borrower vs. Lender

Robustness Analysis

1. Accounting for Macroeconomic Expectations
   - Include changes in expected output growth over the following two quarters
   - Account for info available to policymakers at announcement (Romer and Romer, 2004)
2. Lags in Policy Implementation
   - Exclude potentially anticipated policies (implementation lag $>$ 90 days)
3. Alternative Macroprudential Policy Index
   - Unweighted and discretised indexes
4. Alternative Controls
   - FCI (Adrian et al., 2019, 2022)
   - Monetary Policy Instrument (Loria et al., 2022)
5. Sample Stability: Exclude Post-GFC
6. Alternative Country Fixed Effects
   - Baseline: Kato et al. (2012); Robustness: Machado and Santos Silva (2019)

Robustness

Exploring the Channels: Credit-at-Risk

- **Quantity of Credit**: financial booms, particularly credit booms, often precede financial crises (Schularick and Taylor, 2012; Jordá et al., 2015; Richter et al., 2021)
- Two steps to our approach for **quantity of credit**:
  1. Tighter macroprudential policy particularly effective at mitigating excessive credit growth
     - Pushes down 90th percentile of the credit distribution in particular
  2. Upper tail of the credit-growth distribution especially impacts tails of GDP growth

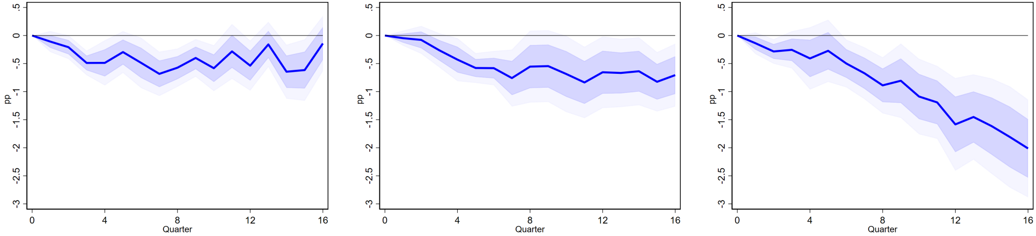
Also explore:

- **Composition of Credit**: tighter macroprudential policy appears to be equally effective at preventing household and business credit booms ▸ Link
- **House Prices**: limited evidence of transmission through house prices ▸ Link

#1. Causal Effects of Macroprudential Policy on Credit-at-Risk

Figure: IRF of Quantiles of Credit-Growth Distribution to Macroprudential Policy Tightenings

Panel (a): 10th Percentile   Panel (b): 50th Percentile   Panel (c): 90th Percentile



Notes: Estimated change in the τ-th percentile of annual average real credit growth at horizon $h = 1, 2, \ldots, 16$, following a tightening macroprudential policy activation.

Sample period is 1990Q1-2017Q4. Shaded areas denote the 90% (light blue) and 68% (dark blue) confidence intervals based on bootstrap with 500 replications.

#2. Effects of Credit-at-Risk on GDP-at-Risk

- Formally explore the role that credit-at-risk plays in shaping both downside and upside risks to the GDP growth:

$$Q_{\Delta y_{i,t+h}}(\tau | \Delta Credit_{i,t}, \mathbb{1}^{Boom}_{i,t}, X_{i,t}) = \boldsymbol{\alpha}^h_i(\tau) + \Delta Credit_{i,t}\beta^h(\tau) + \Delta Credit_{i,t} \times \mathbb{1}^{Boom}_{i,t}\gamma^h(\tau) + \mathbf{x}'_{i,t}\boldsymbol{\vartheta}^h(\tau), \quad \tau \in (0,1)$$

- **Outcome variable**: GDP growth and $\tau = 0.1, 0.5, 0.9$

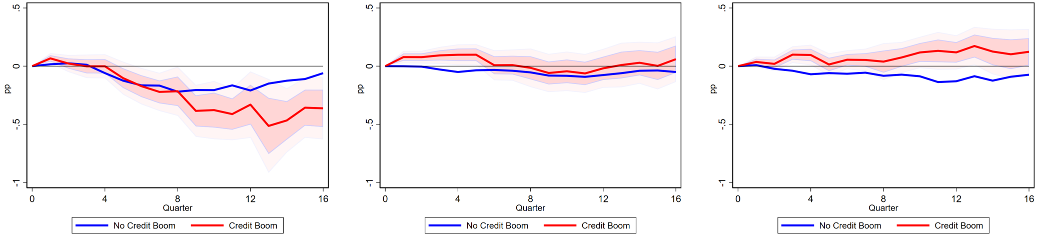
- Indicator for credit booms $\mathbb{1}^{Boom}_{i,t}$ based on 2-year credit-growth distribution:

$$\mathbb{1}^{Boom}_{i,t} = \begin{cases} 1 & \text{if} \quad \Delta_8 Credit_{i,t} > \Delta_8 Credit_{i,90th} \\ 0 & \text{otherwise} \end{cases}$$

#2. Effects of Credit-at-Risk on GDP-at-Risk

Figure: IRF of Quantiles of GDP-Growth Distribution to $+1$std in Credit Growth

Panel (a): 10th Percentile | Panel (b): 50th Percentile | Panel (c): 90th Percentile



Notes: Estimated change in the τ-th percentile of annual average real GDP growth at horizon $h = 1, 2, \ldots, 16$, following a +1 standard deviation increase in credit growth. Non-linearity: credit booms versus non-credit booms periods. Sample period is 1990Q1-2017Q4. Shaded areas denote the 68% (dark red) and 90% (light red) confidence interval based on bootstrap with 500 replications.

Main Takeaways

- Our paper provides novel evidence on the causal effects of macroprudential policies on the entire distribution of potential macroeconomic outcomes.

1. We identify unanticipated and exogenous macroprudential policy ‘shocks’.

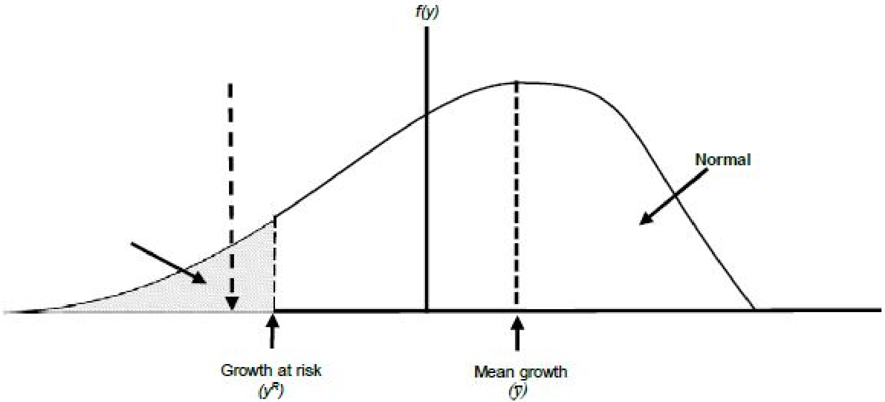
2. We estimate the causal effects of macroprudential policies on the entire distribution of GDP growth.

    - Macroprudential policy reduces the likelihood of extreme GDP-growth outturns without significant costs at the mean.

3. We show that by defusing upside credit-growth risk, tighter macroprudential policy can be effective in reducing the variance of GDP-growth.

Appendix

Visualising GDP-at-Risk



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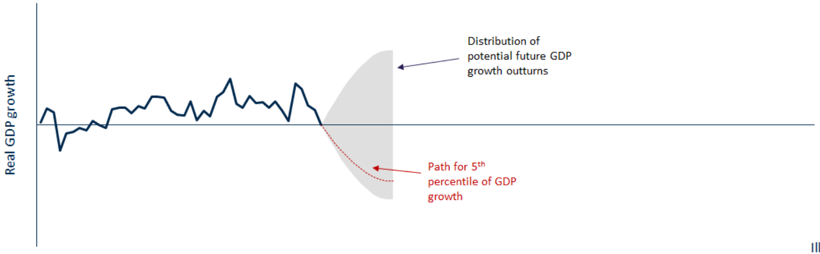
Evolution of GDP-at-Risk Over Time



Illustrative figure

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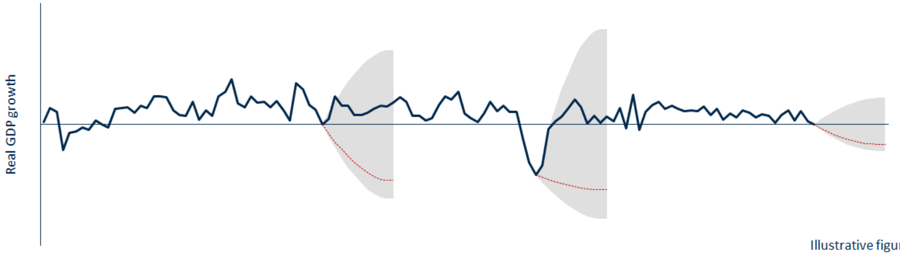

Illustrative figure

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Weighting Scheme

Type of Policy Action	Weight	Strengthening / Loosening	Sign	Final Weight
Activation	1	Tightening	+	1
		Other/ambiguous impact		0
		Loosening	-	-1
Change in the Level	0.25	Tightening	+	0.25
		Other/ambiguous impact		0
		Loosening	-	-0.25
Change in the Scope	0.10	Tightening	+	0.10
		Other/ambiguous impact		0
		Loosening	-	-0.10
Maintaning the Existing Level and Scope	0.05	Tightening	+	0.05
		Other/ambiguous impact		0
		Loosening	-	-0.05
Deactivation	Dependent on the life-cycle of the tool (cumulative index drops to zero)			

Notes: Description of the weights used to construct the cumulative index for each policy instrument based on Meuleman and Vander Vennet (2020).

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Baseline weighting scheme in practise

- UK 1993Q4: Index takes value **+2**:
    - New limit on banks' aggregate large exposure to clients: Tightening + Activation (+1)
    - New limit on interbank exposures: Tightening + Activation (+1)
- UK 2010Q3: Index takes value **-1.25**:
    - Deactivation of the October 1993 banks' aggregate large exposure to clients: Loosening + Deactivation (-1)
    - Looser interbank exposure limits: Loosening + Recalibration of an existing tool (-0.25)

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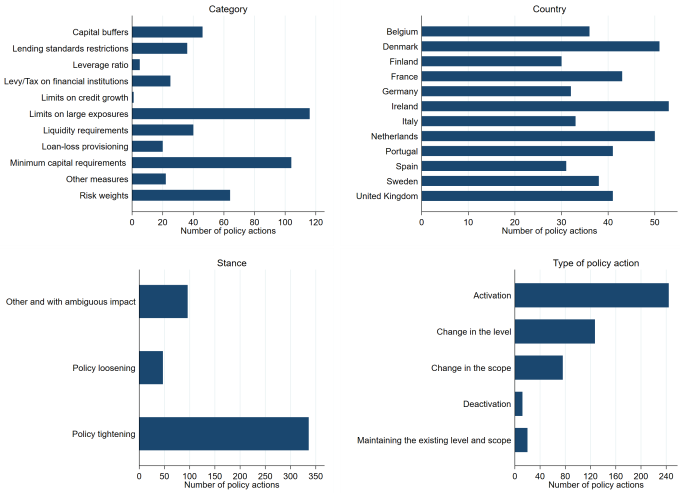
Summary Statistics: # Actions by Stance, Category, Type, Country



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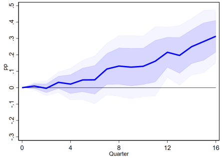
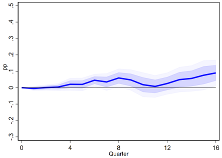
Heterogeneity: Lender- versus Borrower-based policies

Figure: Response of GDP-Growth Quantiles to Lender- and Borrower-Based Macroprudential Policy Tightenings

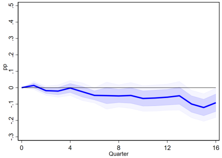
Panel (a): Lender-based 10th Percentile



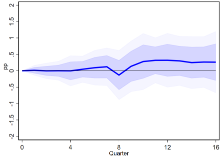
Panel (b): Lender-based 50th Percentile



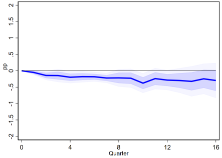
Panel (c): Lender-based 90th Percentile



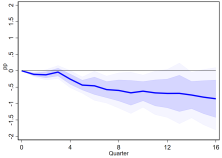
Panel (a): Borrower-based 10th Percentile



Panel (b): Borrower-based 50th Percentile



Panel (c): Borrower-based 90th Percentile



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Sensitivity Checks

Figure: Baseline and Robustness estimation results: GDP-growth distribution

	$\tau = 0.1$							
	Baseline	No Implementation Lag	Expectation Data	Alternative Macroprudential Index	Control-augmented: FCI	Control-augmented: Monetary Policy	Subsample: Excluding GFC	Alternative CFE
$h = 4$	0.02	0.01	0.04	0.02	0.01	0.01	0.03	0.01
	(0.04)	(0.07)	(0.04)	(0.06)	(0.06)	(0.04)	(0.06)	(0.04)
$h = 8$	0.15**	-0.08	0.15**	-0.03	0.14**	0.11**	0.02	0.10^
	(0.08)	(0.17)	(0.08)	(0.12)	(0.07)	(0.06)	(0.16)	(0.08)
$h = 12$	0.25***	0.21^	0.24**	0.18**	0.18**	0.20***	0.18^	0.21**
	(0.09)	(0.13)	(0.10)	(0.11)	(0.07)	(0.06)	(0.12)	(0.11)
$h = 16$	0.32***	0.31**	0.31***	0.27**	0.19**	0.25***	0.22**	0.25**
	(0.08)	(0.13)	(0.08)	(0.12)	(0.08)	(0.08)	(0.10)	(0.14)
	$\tau = 0.5$							
	Baseline	No Implementation Lag	Expectation Data	Alternative Macroprudential Index	Control-augmented: FCI	Control-augmented: Monetary Policy	Subsample: Excluding GFC	Alternative CFE
$h = 4$	0.03^	0.01	0.04**	0.02	0.00	0.01	-0.00	0.02
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
$h = 8$	0.05^	0.05^	0.06**	0.03	0.01	0.03	0.00	0.02
	(0.04)	(0.05)	(0.04)	(0.06)	(0.04)	(0.03)	(0.04)	(0.05)
$h = 12$	0.02	0.00	0.03	-0.04	-0.01	-0.01	-0.00	0.01
	(0.05)	(0.09)	(0.04)	(0.06)	(0.05)	(0.04)	(0.05)	(0.05)
$h = 16$	0.06^	0.09	0.05	0.00	0.05	0.02	0.09**	0.04
	(0.06)	(0.11)	(0.05)	(0.07)	(0.06)	(0.05)	(0.06)	(0.07)
	$\tau = 0.9$							
	Baseline	No Implementation Lag	Expectation Data	Alternative Macroprudential Index	Control-augmented: FCI	Control-augmented: Monetary Policy	Subsample: Excluding GFC	Alternative CFE
$h = 4$	-0.00	-0.00	-0.00	-0.00	0.01	-0.01	-0.01	0.03
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.07)
$h = 8$	-0.05^	-0.08^	-0.06^	-0.08^	-0.02	-0.05^	-0.05^	-0.04
	(0.04)	(0.07)	(0.04)	(0.07)	(0.05)	(0.04)	(0.04)	(0.05)
$h = 12$	-0.07^	-0.06^	-0.07^	-0.15**	-0.14**	-0.09^	-0.13**	-0.11**
	(0.05)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)
$h = 16$	-0.14***	-0.05	-0.09^	-0.19**	-0.13***	-0.12**	-0.12^	-0.11**
	(0.05)	(0.08)	(0.07)	(0.08)	0.05	(0.06)	(0.09)	(0.06)

Notes: This table presents coefficient estimates reflecting the change in the τ-th percentile of annual average real output growth at horizon $h = 4, 8, 12$ and 16, following a tightening macroprudential policy activation. Coefficient estimates of fixed effects and controls not reported. Sample period is 1990Q1-2017Q4. Standard errors are based on bootstrap with 500 replications and show in parenthesis. $^{\wedge}$ $p < 0.32$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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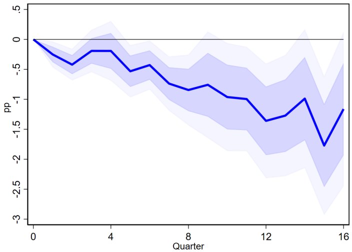
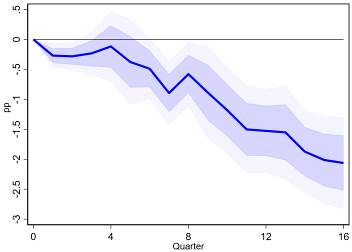
Other Channels: Composition of Credit

Figure: IRF of 90th percentile of Credit-Growth Distribution to Macroprudential Policy Tightenings

Panel (a): Household Credit   Panel (b): Business Credit





Notes: Estimated change in the 90th percentile of annual average real household and business credit at horizon $h = 1, 2, \ldots, 16$, following a tightening macroprudential policy activation. Sample period is 1990Q1-2017Q4. Shaded areas denote the 90% (light blue) and 68% (dark blue) confidence interval based on bootstrap with 1000 replications.

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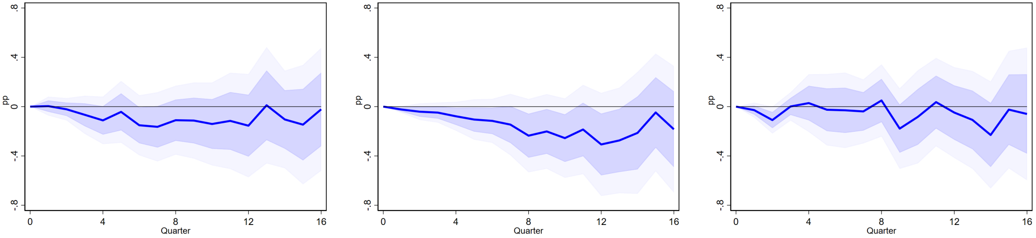
Other Channels: House Prices

Figure: IRF of Quantiles of House-Price Distribution to Macroprudential Policy Tightenings

Panel (a): 10th Percentile Panel (b): 50th Percentile Panel (c): 90th Percentile



Notes: Estimated change in the τ-th percentile of annual average real house prices growth at horizon $h = 1, 2, ..., 16$, following a tightening macroprudential policy activation. Sample period is 1990Q1-2017Q4. Shaded areas denote the 90% (light blue) and 68% (dark blue) confidence intervals based on bootstrap with 1000 replications.

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