Assessing Net Benefits of Macroprudential Policy: A Growth at Risk Approach

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- The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

Benefits and Costs

- Benefits of macroprudential policy: **reduction in tail-risks to future GDP**
- Benefits relate to main objectives (e.g., IMF 2013):

1. **Lean against build-up of systemic vulnerabilities**
   - Lean against increases in leverage and volatile funding against backdrop of easy financial conditions
2. **Increase resilience to adverse aggregate shocks**
   - Building financial buffers that blunt amplification of adverse shocks,
     - e.g., reduce credit crunch, borrower deleveraging.

- Use of macroprudential policy may also impart **costs to output,** at inception and through time.

New Approach: Assessing Net Benefits

Measure net benefits by assessing effect of policy on the whole distribution of output—both at the center and in the in the tail.

- Treating endogeneity of macroprudential policy by distilling policy shocks,
- Using quantile regressions to estimate effects on the distribution of output—across 19 quantiles,
- Using "loss functions" to evaluate distributions over a horizon of 14 quarters.

Conditional on an easing of financial conditions:

- capturing "leaning effects" of policy
- capturing "resilience building" effects

Improves on Existing Literature

- Goes beyond effects on credit and asset prices (as assessed in many papers, see Araujo and others 2020, Galati and Moessner, 2018)
  - By including the resilience benefit of macroprudential tools
- Goes beyond binary crisis/ non-crisis framework (Svensson 2016, Belkhir and others 2020)
  - Capturing amplification effects outside of full-blown crises
- Compares benefits of macroprudential policy with monetary policy.
  - Should countries “lean against the wind” with macroprudential policy or with monetary policy?

Overview

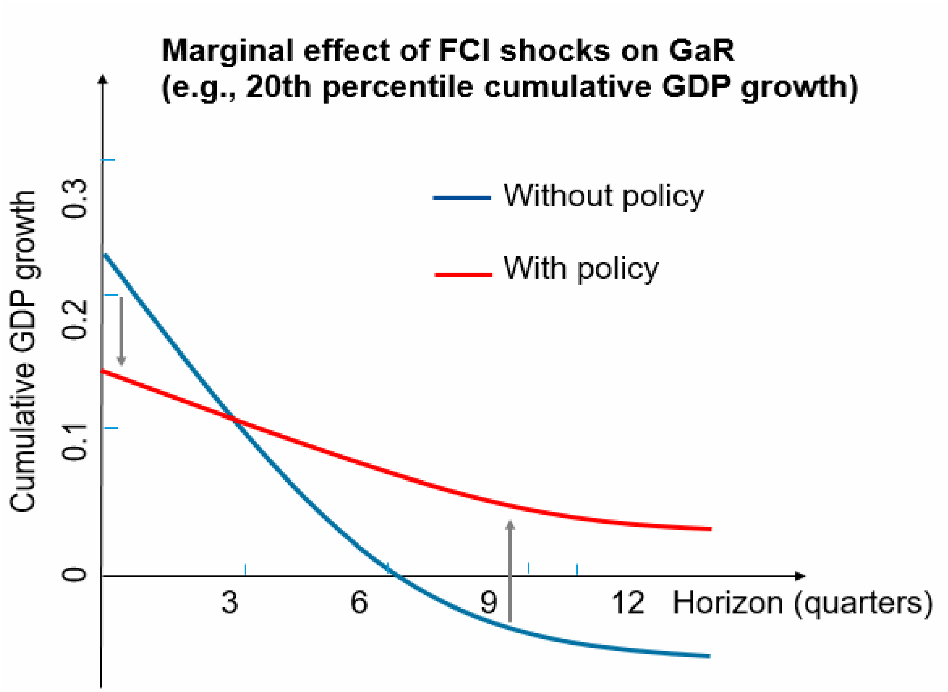
- Our new empirical approach—some detail.
- Main exercises:
  - Leaning against the wind with macroprudential versus monetary policy.
  - Comparing net benefits of borrower-based tools (e.g., LTV, LTI, DSTI) and financial institutions-based tools (e.g., capital and liquidity requirements).
  - Tracking net benefits of macroprudential tools over time.

Empirical Approach

Growth-at-Risk and Beyond

Starting Point: Growth-at-Risk Approach

- **Growth-at-risk (GaR) framework** forecasts the distribution of GDP growth
  - **conditional** on loose financial conditions (e.g., Adrian et al. 2018, 2019).



Loose **financial conditions** (FCI) today increase downside risks to GDP tomorrow.
(e.g., Adrian et al. 2018)

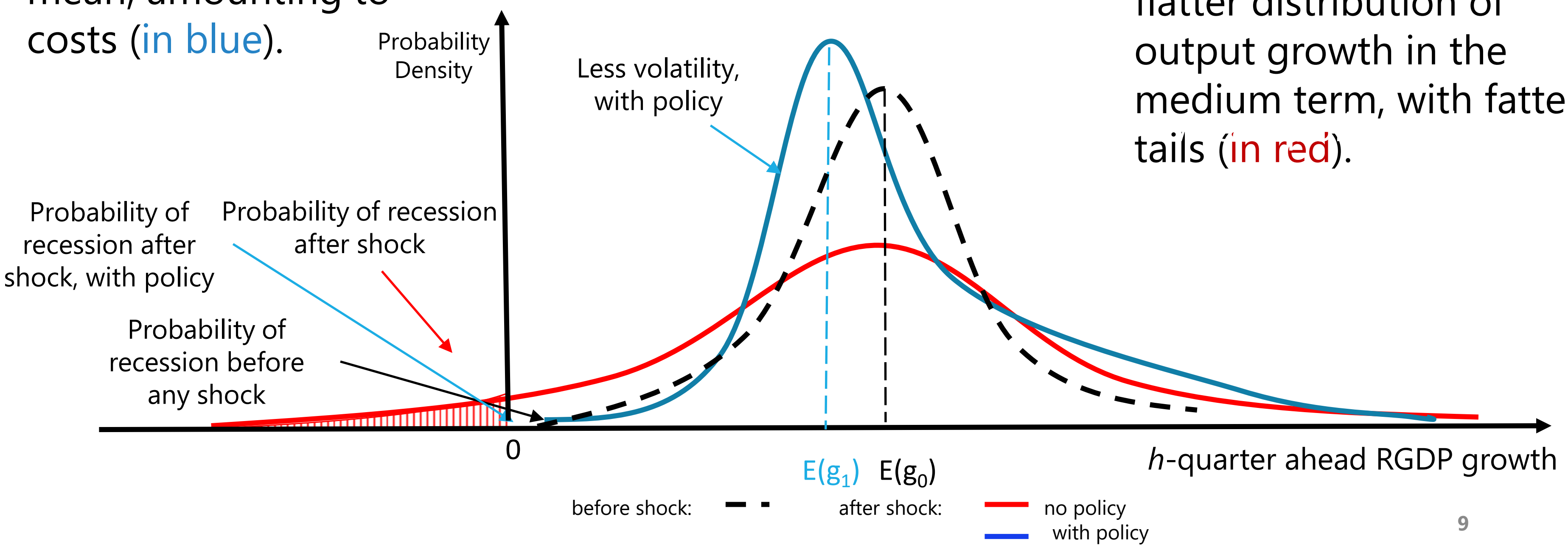
Can **policy** reduce **downside** risks?

Going Beyond Growth-at-Risk

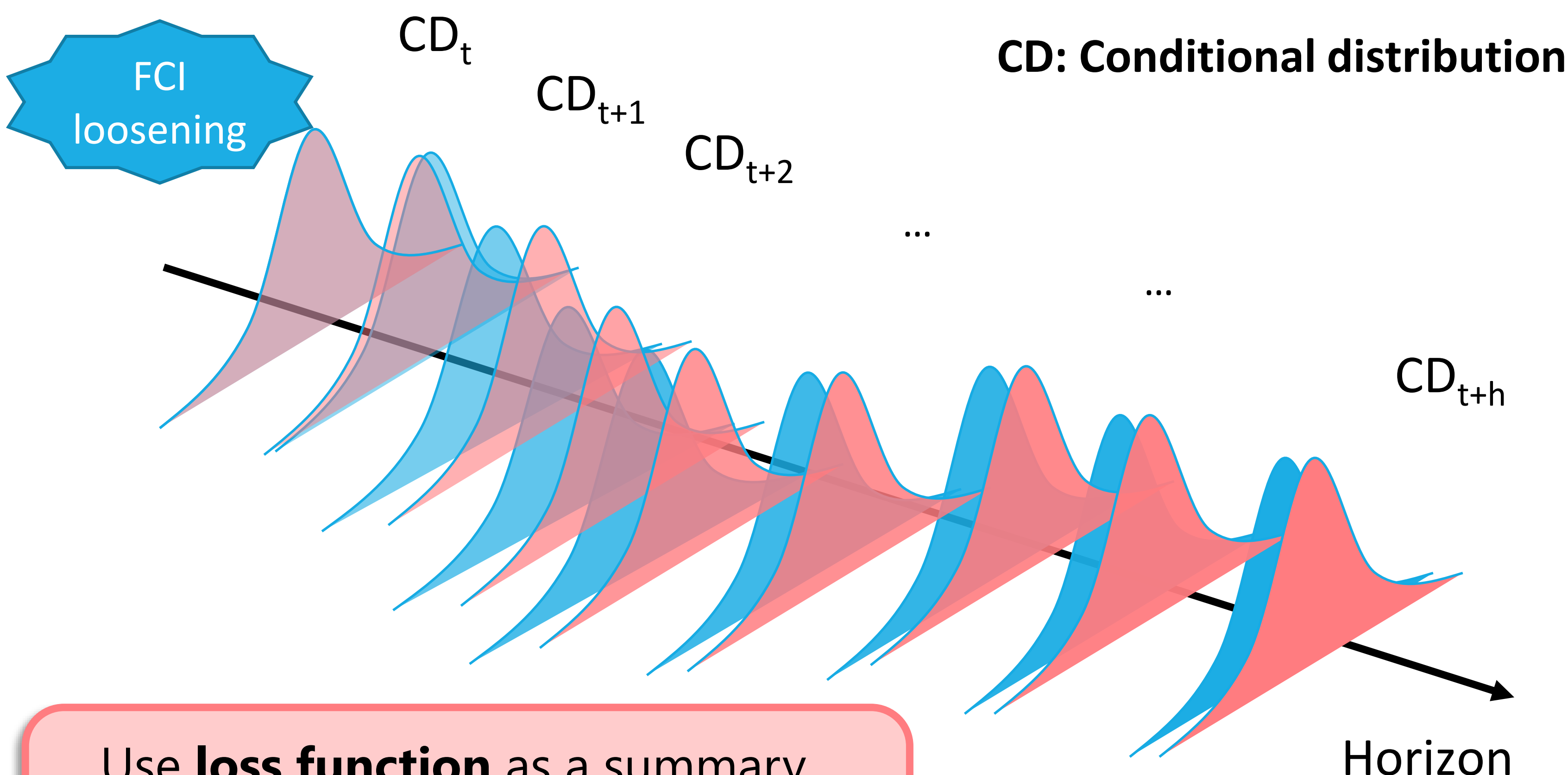
Can policy have **net-benefits**, reflecting the effects on the **entire** distribution?

Policy can pull in the tails of the distribution, but may also shift the mean, amounting to costs (in blue).

Looser FCI leads to a flatter distribution of output growth in the medium term, with fatter tails (in red).



Assessing Policy Effects Over the Medium-Term



Use **loss function** as a summary measure of how policy affects the **sequence** of the distributions.

Step 1: Implement Quantile Regressions

$$Q_{Yi,t+h}(q|Z_{it}) = \alpha_{0i}^{h}(q) + \beta_{1}^{h}(q) f_{it} + \beta_{2}^{h}(q) P_{it} + \boldsymbol{\beta_{3}^{h}(q)} P_{it} \cdot f_{it} + \boldsymbol{x_{it}}\, \Gamma$$

Conditional q^{th} quantile

Financial condition index (FCI)

Policy shock

Macro controls

- **Regress future GDP growth** on current economic and domestic financial conditions (Adrian, Boyarchenko, and Giannone, 2019)
- Interested in $\boldsymbol{\beta_{3}^{h}(q)}$ on the interaction term of *f* with policy variable *P*
    - for $q = 5^{th}$, … 95^{th} quantiles and $h = 1, \ldots, H$ quarters
    - Using the iMapp database (Alam and others) for P
    - Sample of 37 countries (AE and EME), 1990Q1-2016Q4
    - Domestic financial condition index (IMF, 2018
- Do the same estimation for **future inflation**

Treating Endogeneity by Distilling Policy Shocks

- Macroprudential and other policies are endogenous. We address this by distilling policy shocks.
- Estimate ordered probit of macropru policies (MPMs) using credit-to-GDP gap, house-price gap, and indicator of lagged policy action as explanatory variables (X)
- Policy shock is given by difference between actual policy indicator and its conditional expectation:

$$\hat{\varepsilon}_{it}^{mpm} = mpm_{it} - \sum_{k=-2}^{2} \hat{p}_k \left(x_{it} \right) k,$$

Step 2: Use a Loss Function to Evaluate Net-Benefits

$$L(\Theta, P) = \sum_{h=0}^{H} \beta^h \, \widehat{E_t}[l_{t+h} | \Theta, P]$$

where

$$l_{t+h} = \omega_y (y_{t+h} - \overline{y_t})^2 + \omega_\pi \pi_{t+h}^2$$

- **Quadratic loss function** (baseline) for **macro stabilization**
- ω_y and ω_π weights on relative importance of **output** and **price** stability

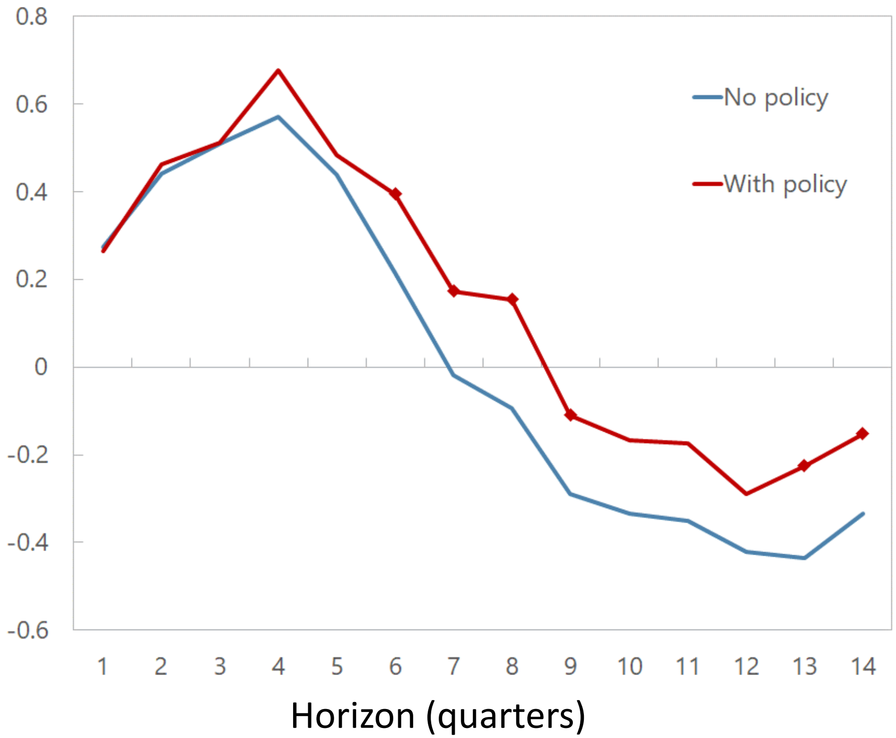
Compare losses for each policy *P*:

$L(\Theta, P = 0)$ **vs.** $L(\Theta, P = \sigma^P)$

Main Findings

Macroprudential Tightening Reduces Downside Risks

- Responses of Growth-at-Risk to a FCI loosening
  - **No policy:** $\beta_1^h(q)$
  - **With policy:** $\beta_1^h(q) + \boldsymbol{\beta_3^h(q)}\sigma^P$
- Tightening MaPP **mitigate** downside risks in the medium term
- Short-run effects are not significant

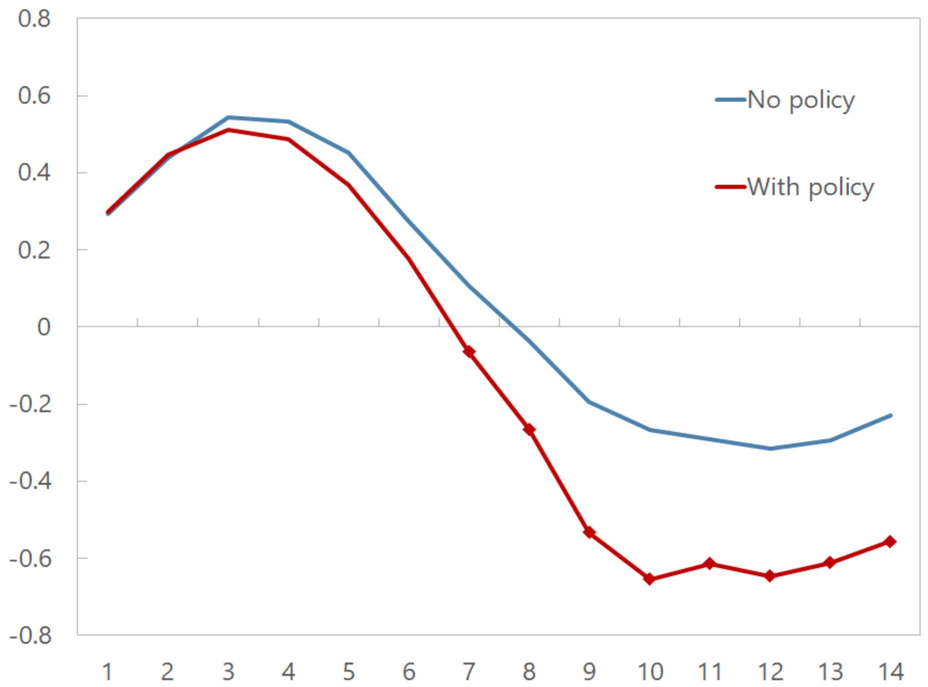


Notes: 10th percentile of the distribution of detrended RGDP growth.

σ^P: Standard deviation of *P*

Monetary Policy Tightening Increases Downside Risks

- Responses of Growth-at-Risk to a FCI loosening
  - **No policy:** $\beta_1^h(q)$
  - **With policy:** $\beta_1^h(q) + \boldsymbol{\beta_3^h(q)}\sigma^P$
- "Leaning against the wind" appears counter-productive in addressing **tail risks**
  - In line with Svensson (2017)



Horizon (quarters)

Notes: 10th percentile of the distribution of detrended RGDP growth.

σ^P: Standard deviation of *P*

Macroprudential Policy Tightening Reduces Losses, but Monetary Policy Tightening Increases Losses

	Domestic Shock		
	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=0.542, ω_p=1
MPM All	-0.089 ***	-0.085 ***	-0.083 ***
MPM Borrower-Based	-0.100 ***	-0.068 ***	-0.065 ***
MPM FI-Based	-0.053 **	-0.036 **	-0.035 **
MP	0.121 ***	0.115 ***	0.111 ***
FXI	-	-	-
CFM	-	-	-

Notes: Changes in losses by tightening P, in percent of losses without policy ($L_o(\Theta, P = 0)$). Confidence bands in brackets. Inference based on cluster bootstrap. *, **, *** means significance at 10, 5, 1 percent levels.

Net Benefit of BB-based Tools is Greatest

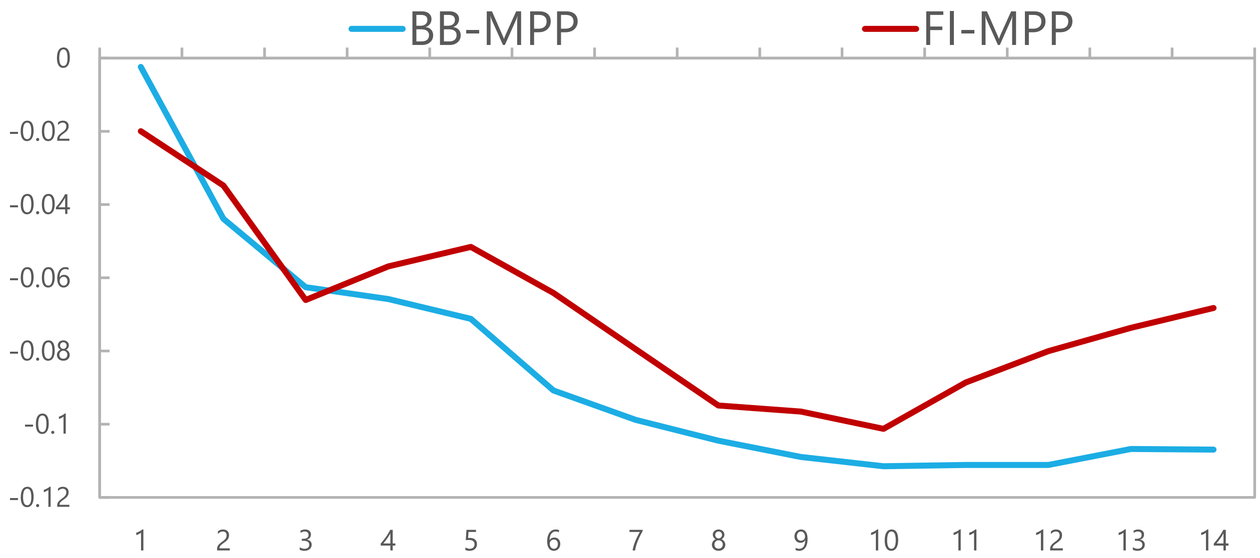
- Reduction in loss from Borrower-based (BB) tools is greater than that of Financial Institution (FI) -based tools, especially when credit is already high.
- Reduction in loss from FI based tools (capital and liquidity) can be stronger where credit is still low.

	Low Credit			High Credit		
	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=0.542, ω_p=1	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=0.542, ω_p=1
MPM All	-0.089 **	-0.086 **	-0.084 **	-0.099 **	-0.094 **	-0.090 **
MPM Borrower-Based	-0.033	-0.032	-0.031	-0.083 ***	-0.078 ***	-0.075 ***
MPM FI-Based	-0.076 **	-0.072 **	-0.070 **	-0.028	-0.027	-0.026
MP	0.137 ***	0.132 ***	0.129 ***	0.126 ***	0.120 ***	0.115 ***

Note: Confidence bands in brackets. Inference based on cluster bootstrap. *, **, *** means significance at 10, 5, 1 percent levels (first column only). Vulnerabilities measured by level of credit to GDP—high (low) vulnerabilities mean credit to GDP at 75^{th} (25^{th}) percentile.

Net Benefits of BB Tools Augment Over Time

- Reduction in loss from tightening BB tools persists and augments over time.
- Reduction in loss from tightening FI-based tools appear to wane with time.



Note: The charts show the cumulated change in the loss function when comparing a scenario of loose financial conditions without policy tightening to one where policy is tightened.

Summary

- **New empirical approach**, going beyond the tail risks
  - Estimate policy effects on the entire future distributions with **quantile regressions**
  - Treat endogeneity of policy—by **distilling policy shocks**
  - Evaluate the net benefit of each policy with **loss functions**
- **Results suggest** leaning against loose financial conditions is…
  - **Beneficial** with macroprudential policy
  - **Not beneficial** with monetary policy
- Benefits are greatest for BB based tools
- Benefits of BB tools increase over time

Thank you!

Appendix 1: Robustness to Alternative Loss Functions. MPMs Reduce Losses, but Not Other Policies.

	External Shock		
	Linear-quadratic		Asymmetric
	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=1, ω_p=0
MPM All	-0.100 ***	-0.095 ***	-0.109 ***
MPM Borrower-Based	-0.097 ***	-0.089 ***	-0.100 ***
MPM FI-Based	-0.060 **	-0.058 **	-0.067 ***
MP	0.046 **	0.044 **	0.040 *
FXI	-0.029	-0.027 *	-0.024
CFM	-0.040	-0.033	-0.041

Notes: Reductions in losses by tightening P, in percent of losses without policy ($L_o(\Theta, P=0)$). Confidence bands in brackets. Inference based on cluster bootstrap. *, **, *** means significance at 10, 5, 1 percent levels.

Appendix 2: Robustness to Alternative Monetary Policy Shock. Monetary Policy is Not Helpful.

	Domestic FCI			External FCI		
	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=0.542, ω_p=1	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=0.542, ω_p=1
MPM All	-0.089 ***	-0.085 ***	-0.083 ***	-0.112 ***	-0.107 ***	-0.104 ***
MPM Borrower-Based	-0.100 ***	-0.068 ***	-0.065 ***	-0.107 ***	-0.101 ***	-0.096 ***
MPM FI-Based	-0.053 **	-0.036 **	-0.035 **	-0.068 ***	-0.067 ***	-0.065 ***
MP	0.121 ***	0.115 ***	0.111 ***	0.038 *	0.036 *	0.036 *
FXI	-	-	-	-0.022	-0.021	-0.021
CFM	-	-	-	-0.039	-0.034	-0.030
HF MP	-0.011	-0.011	-0.011	-0.025	-0.023	-0.022

Notes: Reductions in losses by tightening *P*, in percent of losses without policy ($L_o(\Theta, P = 0)$). Confidence bands in brackets. Inference based on cluster bootstrap. *, **, *** means significance at 10, 5, 1 percent levels. HF MP: High-frequency monetary policy shocks.

Appendix 3: Results Are Similar
Advanced Economies vs. Emerging Market Economies

	Domestic FCI			External FCI		
	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=0.542, ω_p=1	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=0.542, ω_p=1
			Advanced economies			
MPM All	-0.120 **	-0.116 **	-0.113 **	-0.139 **	-0.136 **	-0.133 **
MPM Borrower-Based	-0.141 **	-0.136 **	-0.132 *	-0.142 ***	-0.139 ***	-0.136 ***
MPM FI-Based	-0.027	-0.026	-0.025	-0.046	-0.045	-0.045
MP	0.127 ***	0.124 ***	0.122 ***	0.075	0.075	0.075
FXI	-	-	-	0.051	0.049	0.047
CFM	-	-	-	0.015	0.015	0.015
			Emerging economies			
MPM All	-0.081 ***	-0.078 ***	-0.075 ***	-0.143 ***	-0.062 ***	-0.038 ***
MPM Borrower-Based	-0.067 **	-0.064 **	-0.061 **	-0.136 *	-0.099 *	-0.089 *
MPM FI-Based	-0.074 **	-0.072 **	-0.070 **	-0.132 ***	-0.125 ***	-0.120 ***
MP	0.086 **	0.080 ***	0.077 ***	0.092 *	0.089 *	0.086 **
FXI	-	-	-	0.017	0.014	0.011
CFM	-	-	-	-0.065 *	-0.050	-0.040

Notes: Reductions in losses by tightening *P*, in percent of losses without policy ($L_o(\Theta, P = 0)$). Confidence bands in brackets. Inference based on cluster bootstrap. *, **, *** means significance at 10, 5, 1 percent levels.