Leaning Against the Wind: An Empirical Cost-Benefit Analysis

Financial Stability Considerations for Monetary Policy

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Disclaimer

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

Should countries lean against the wind? How?

When facing loosening of financial conditions, how do macroprudential-, monetary-, FX-, and CFM policies compare?

(i) Macropru vs. monetary policy

- Macroprudential better targeted, allows monetary policy to focus on inflation, output.
- Monetary policy "gets in all the cracks" (Stein 2013).
- Evidence so far does not favor LATW by monetary policy to reduce crisis probability (IMF 2015, Svensson 2016).
- Existing studies on monetary leaning against the wind focus on **the tail risk of crises.**

Should countries lean against the wind? How?

(ii) External shocks

- Exchange rate not always sufficient shock absorber (Rey 2013, Obstfeld 2015, Arregui and others 2018)
- In practice, countries use a range of policy tools to deal with changing external financial conditions.
- So far, no systematic empirical comparison of policies

New approach

- **Two steps**
  - **Quantile regressions** to estimate policy effects on the entire distributions of future growth and inflation

    - Build on the Growth-at-Risk approach (e.g., Adrian et al. 2018, 2019)
  - **Loss functions** to evaluate the net benefit of each policy

- **Key advantages**
  - Go beyond **tail risks** or crises
  - Capture **all channels** at work in the data

Our main findings

Leaning against loose financial conditions is…

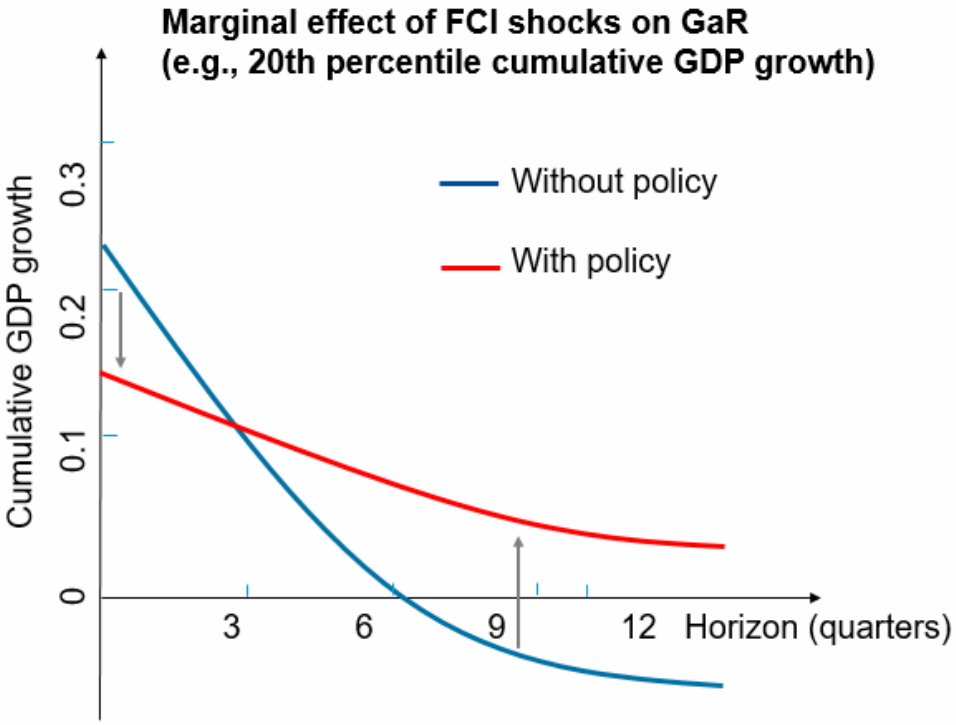
- **Beneficial** with **macroprudential policy**
- **Not beneficial** with **monetary policy**
- Only small net benefits with **CFMs** and **FXIs**

Empirical Approach

- Going beyond Growth-at-Risk –

Starting point: the Growth-at-Risk approach

- **Growth-at-risk (GaR) framework** forecasts the conditional distribution of GDP growth (e.g., Adrian et al. 2018, 2019)
- **GaR** is growth at a low percentile



Loose financial conditions today increase downside risks to GDP tomorrow

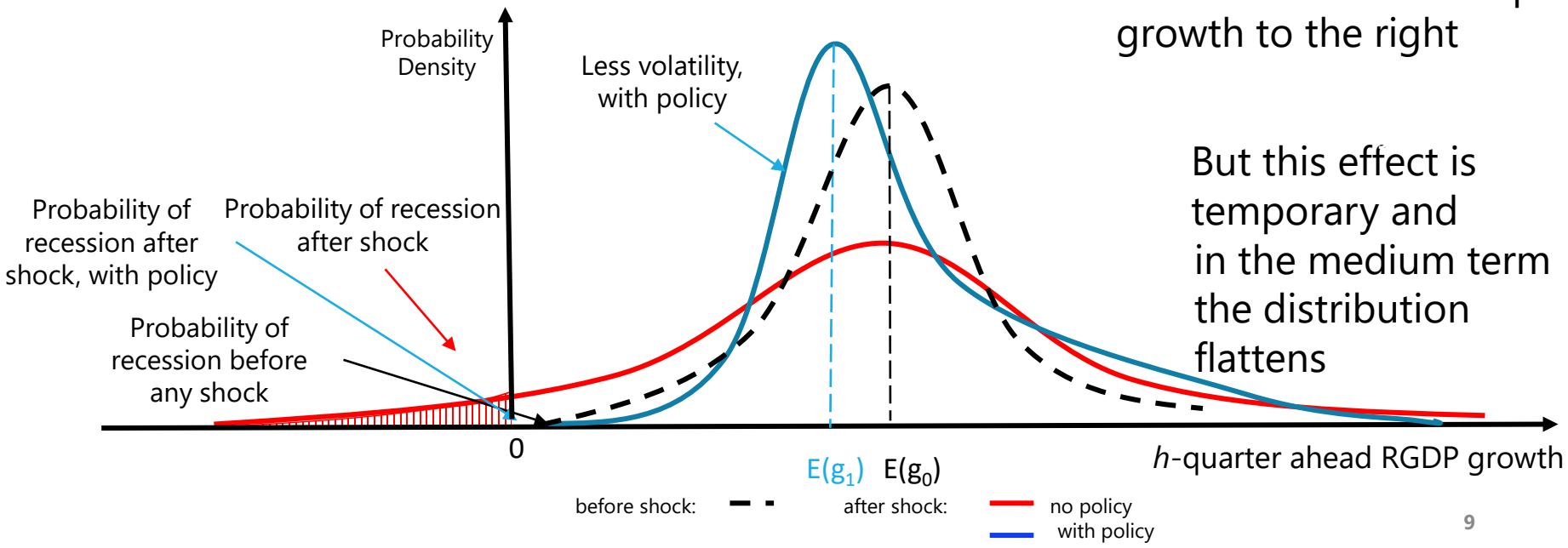
Step 1 in this paper:
Can any policy can reduce the **downside** risks?

Going beyond Growth-at-Risk

Step 2 in this paper:
Can any policy have net-benefits, reflecting the effects on the **entire** distribution?

Looser FCI first shifts the distribution of output growth to the right

But this effect is temporary and in the medium term the distribution flattens



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Step 1. Quantile regressions

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$$Q_{Yi,t+h}(q|Z_{it}) = \alpha_{0i}^{h}(q) + \beta_1^h(q) f_{it} + \beta_2^h(q) P_{it} + \boldsymbol{\beta_3^h(q)} P_{it} \cdot f_{it} + \boldsymbol{x_{it}}\, \Gamma$$

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 $\boldsymbol{\beta_3^h(q)}$ — interaction term of *f* with policy variable *P*
  - for *q* = 5th, … 95th quantiles and *h* = 1, …, *H* quarters
  - Sample of 37 countries (AE and EME), 1990Q1-2016Q4
  - Domestic financial condition index (IMF, 2018)
- Do the same estimation for **future inflation**

Use policy shocks to address endogeneity

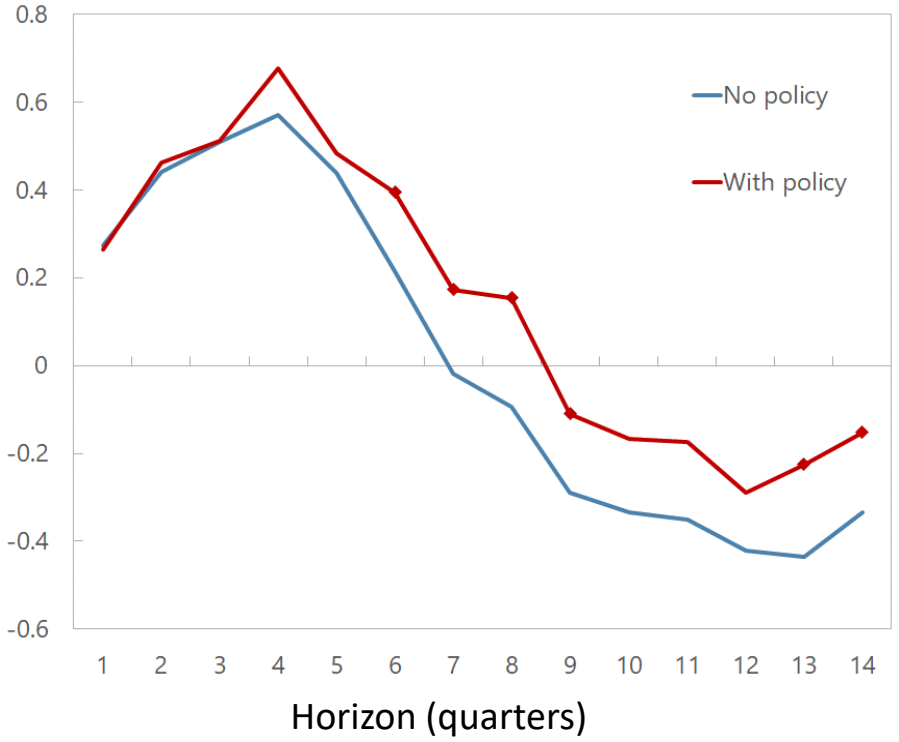
- Policy actions are **endogenous**
- Extract **unexpected variation** in policy variables
  - Estimate **policy response functions**
  - Compute **policy shocks** as residuals
  - Ordered probit for **Macroprudential policy** and **CFMs**
  - OLS for **Monetary policy** and **FX interventions**

Macroprudential tightening reduces downside risks

- Responses of the 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



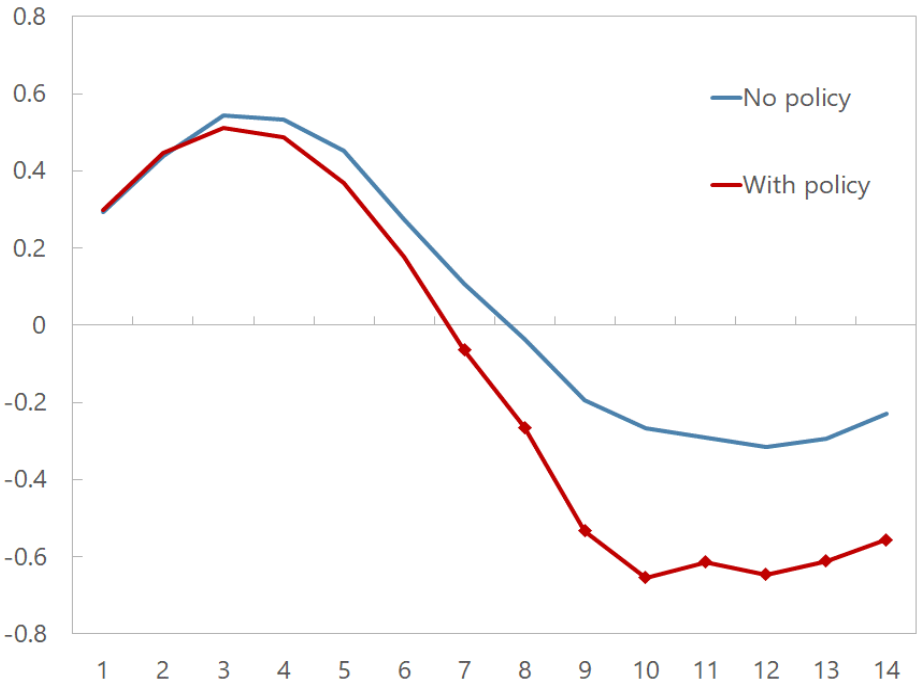
Notes: 10th percentile of the distribution of detrended RGDP growth.

σ^P: Standard deviation of *P*

However, monetary policy tightening rather increases downside risks

- Responses of the 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 counterproductive in addressing **tail risks**
  - In line with Svensson (2017)



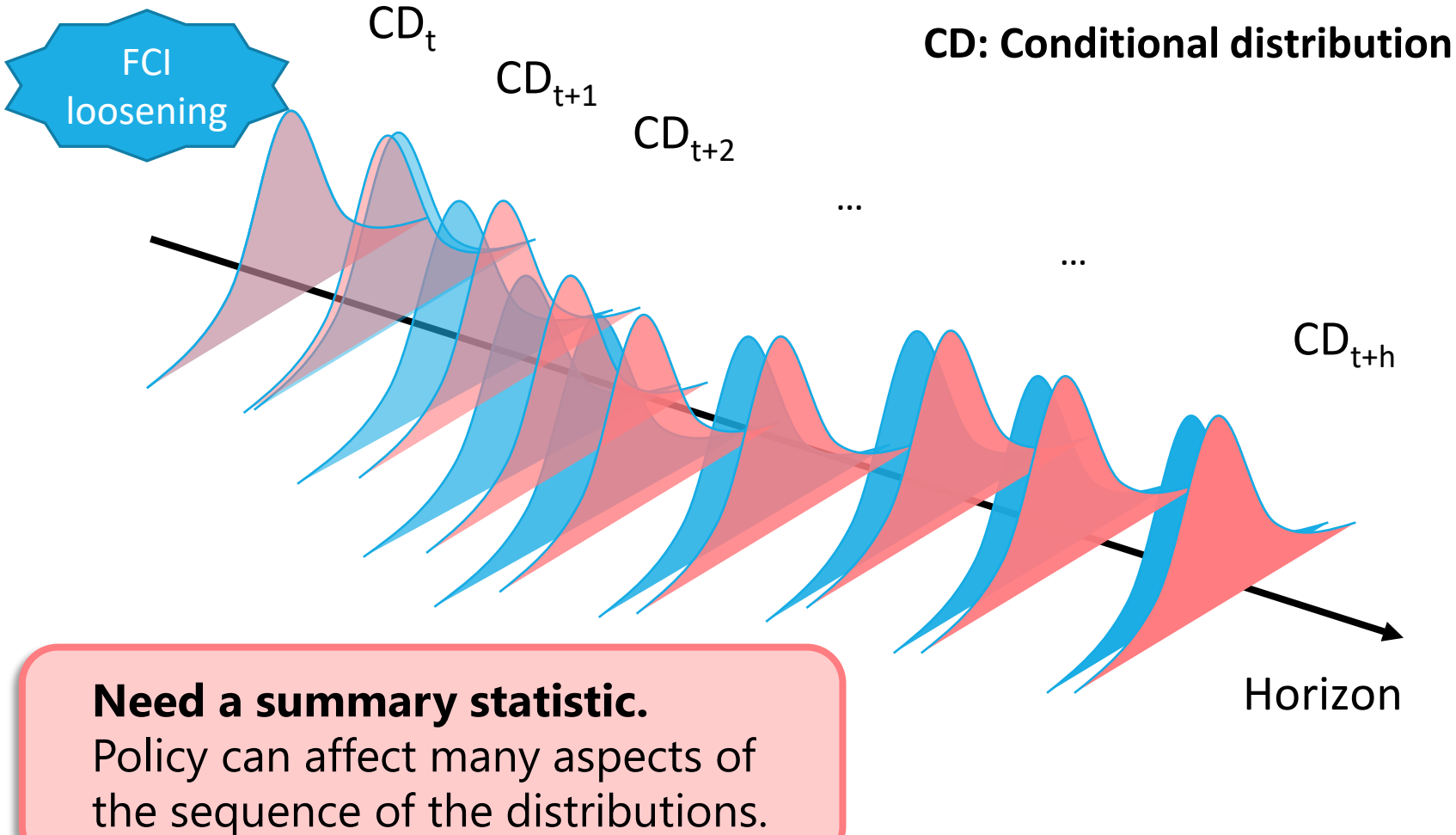
Notes: 10th percentile of the distribution of detrended RGDP growth.

σ^P: Standard deviation of *P*

Step 2. Analysis using loss functions

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

How can we compare the effects on the *entire* distribution over horizons?



Need a summary statistic.
Policy can affect many aspects of the sequence of the distributions.

Use a loss functions in evaluating 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 **output** and **price** stability

Compare losses for each policy *P*:

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

Calculate Benefits/Losses associated with each Policy

To estimate moments, fit skewed-Normal distribution using 19 quantiles and minimize distance between EQF and theoretical quantile function (TQF)

$$\theta^* = \arg\min_{\theta \in \Theta} \sum_{q=1}^{19} \left(EQF_i(\bar{x}) - SkewTQF(\theta) \right)^2$$

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.

Consider a loosening in global financial conditions

$$Q_{Yi,t+h}(q|Z_{it}) = \alpha_{0i}^{h}(q) + \beta_{1}^{h}(q) f_{it} + \beta_{2}^{h}(q) g_t + \beta_{3}^{h}(q) P_{it} + \boldsymbol{\beta_4^h(q)} P_{it} \cdot g_t + \boldsymbol{x_{it}}\, \Gamma$$

Domestic FCI

Global FCI

- **Modify** quantile regressions to examine **global FCI (g)** and proceed the loss function analysis for **non-US** sample
- U.S. FCI is used as a **global FCI**, which is exogenous for other countries
- Include analysis of effects of CFMs (capital controls) and FX Intervention

Macroprudential policy tightening reduces losses, but other policies do not

	Global FCI		
	ω_y=1, ω_p=0	ω_y=1, ω_p=1	ω_y=0.542, ω_p=1
MPM All	-0.112 ***	-0.107 ***	-0.104 ***
MPM Borrower-Based	-0.107 ***	-0.101 ***	-0.096 ***
MPM FI-Based	-0.068 ***	-0.067 ***	-0.065 ***
MP	0.038 *	0.036 *	0.036 *
FXI	-0.022	-0.021	-0.021
CFM	-0.039	-0.034	-0.030

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.

Effects may Depend on Vulnerabilities

- Effect of a loosening of financial conditions may be amplified when financial sector leverage is high
- Or: tightening policies may help when leverage is low (build resilience), but not when leverage is already high
- Augment quantile regressions:

$$Q_{\Delta y_{i,t,t+h}}(q|Z_{it}) = \alpha_{0i}^{h}(q) + \beta_1^h(q)\Delta y_{it} + \beta_2^h(q) f_{it} + \beta_3^h(q) P_{it} + \beta_4^h(q) P_{it} \times f_{it}$$
$$+(\beta_6^h + \beta_7^h(q) f_{it} + \beta_8^h(q) P_{it} + \beta_9^h(q) P_{it} \times f_{it}) \times CGDP_{it},$$
$$h = 1, \dots, H, \;\; q = 0.05, \dots, 0.95$$

Effects do Depend on Vulnerabilities

Tightening borrower-based macropru➔ stronger loss reduction if credit is high.

Tightening financial-institutions-based macropru ➔ larger benefits when credit is still low; does not have significant effects when credit is already high.

	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 ***

Results are robust to alternative setups

- Alternative loss functions
  - **Linear-quadratic** loss function to address **level effects**
  - **Linex** loss function to consider **asymmetric preferences**
- Alternative monetary policy shocks (Appendix 2)
  - **High-frequency identification** around policy announcements
- Advanced economies vs. emerging market economies

Summary

How should countries lean against the wind?

- **New empirical approach**, going beyond tail risks
  - Estimate policy effects on the entire future distributions with **quantile regressions**
  - 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
  - Only small net benefits with CFMs and FXIs

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.