Leaning Against the Wind: An Empirical Cost-Benefit Analysis

ABFER Conference
May 24, 2022

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Should countries lean against the wind? How?

When countries face domestic or external financial shocks, how do macroprudential-, monetary-, FX-, and CFM policies compare?

Domestic developments - Macropru vs. Monetary policy:

- Macroprudential better targeted, allows monetary policy to focus on inflation, output.
- Monetary policy “gets in all the cracks” (Stein 2013)
- Analysis so far does not favor LATW by monetary policy to reduce crisis probability (IMF 2015, Svensson 2016).
- Evidence that macropru is effective, but no systematic comparison to macropru so far

Should countries lean against the wind? How?

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 address external shocks.
- So far, no systematic empirical comparison of policies

- Existing studies have limitations
  - Focus on **the tail risk of crises**, or **specific channels**

New approach

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

    - Built 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

Main findings

Leaning against loose financial conditions is…

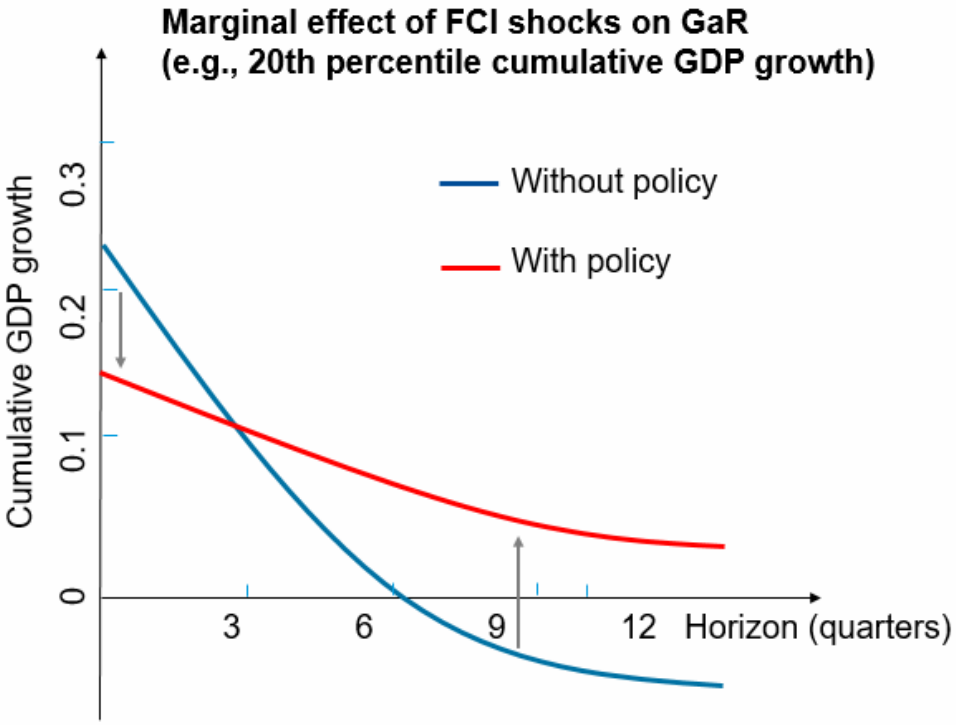
- **Beneficial** with **macroprudential policy**
- **Not beneficial** with **monetary policy**
- Only small net benefits with **CFMs** and **FXIs**

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 lower percentile



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

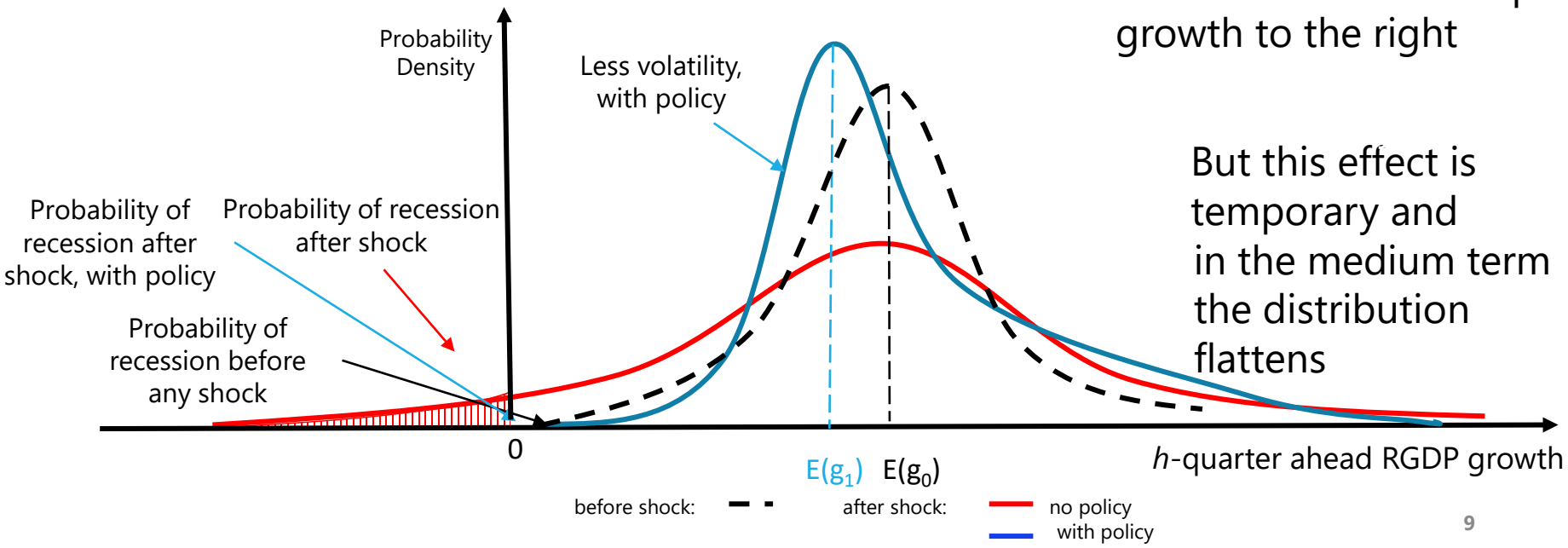
Step 1 in this paper:
Can any policy can reduce the **downside** risks?

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

Step 1: 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
  - 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

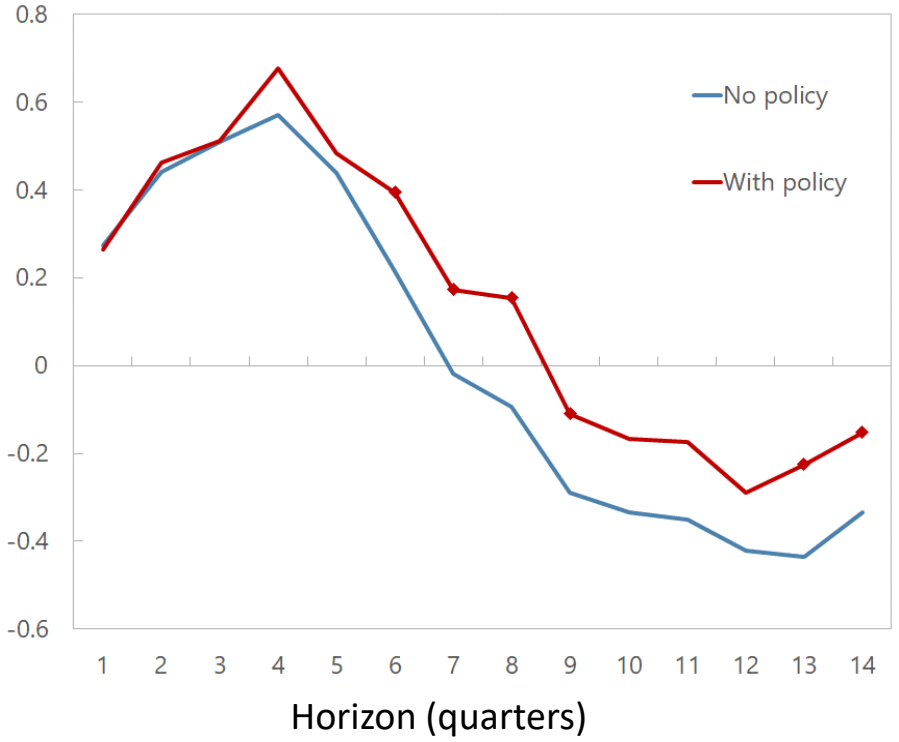
- Policy actions are **endogenous**
- Extract **unexpected variation** in policy variables
  - Estimate **policy response functions**
  - Compute **policy shocks** as residuals
  - Ordered probit for **Macroprudential policy** and **CFMs**
  - OLS for **Monetary policy** and **FX interventions**

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



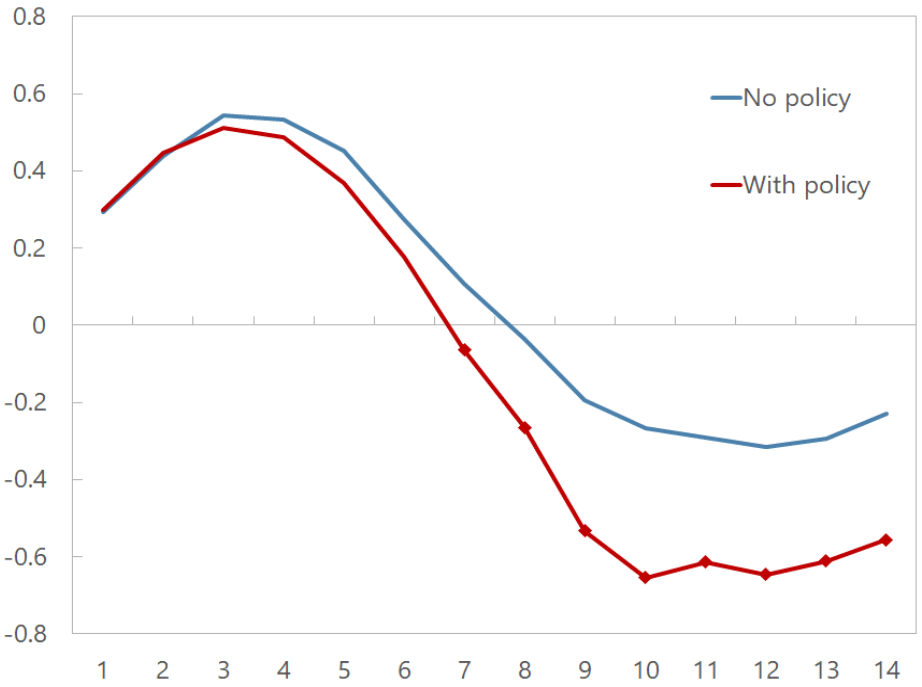
Notes: 10th percentile of the distribution of detrended RGDP growth.

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 counter-productive in addressing **tail risks**
  - In line with Svensson (2017)



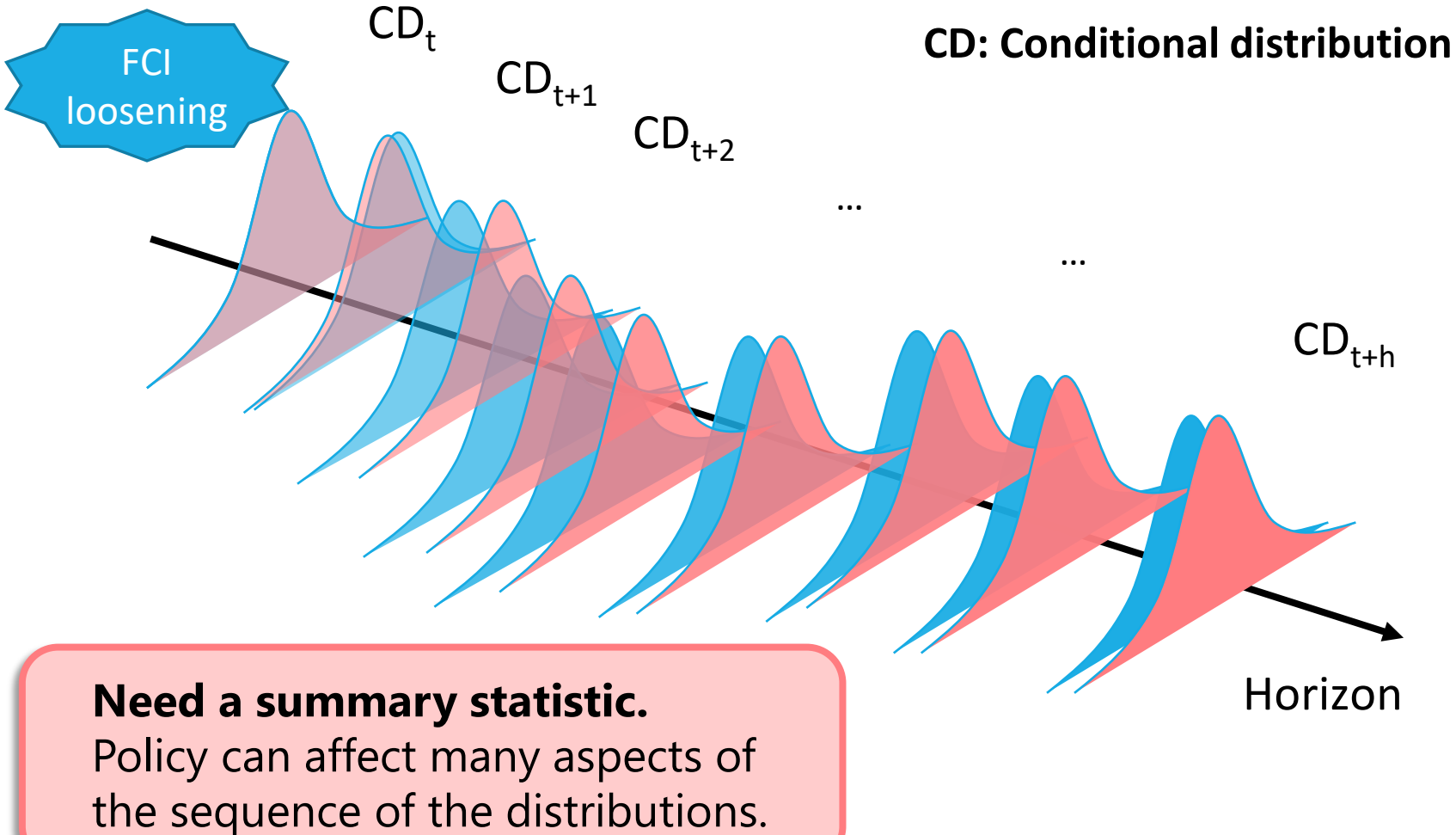
Notes: 10th percentile of the distribution of detrended RGDP growth.

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 relative importance of **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

- **CFMs** and **FXIs** are more likely to be used to lean against shocks to **external** financial conditions
- **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

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 some policies may depend on level of financial vulnerabilities
- For example, effect of a loosening of financial conditions may be amplified when financial sector leverage is high.
- Alternatively, tightening policies may be beneficial when private sector leverage is low (build resilience), but not when leverage is already high
- Augment quantile regressions and proceed as before

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

- **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 (Appendix 1)
  - **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 (Appendix 3)

Summary

How should countries lean against the wind?

- **New empirical approach**, going beyond the 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.