The Responsiveness of Monetary Policy to Financial Stress
Evidence from a Dynamic Panel Threshold Analysis

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*Disclaimer: The usual disclaimer applies.
Motivation

- Is there a threshold level by which monetary policy responds directly to financial stress?
- Do central banks behave asymmetrically to output developments during increased financial turmoil?
Motivation

- Post-crisis paradigm: Knowledge of the interaction between financial stability and monetary policy rules is crucial in formulating appropriate policy.
- There has been more controversy on what the policy response is when financial stress are at “low” levels.
- New line of empirical research has started to focus on the non-linearity in the financial stress effect on monetary policy.
Research Agenda on non-linear aspect of monetary policy-financial stability nexus

- Vasicek (2012) uses single threshold regressions on Taylor rules augmented with financial stress indicator
- Milas and Nairadoo (2011) estimate non-linear Taylor rules with financial conditions index for Euro area
- Castro and Sousa (2010) use smooth transition regression in the Taylor rule functions of the U.S., the U.K., the BoE and the ECB
- Jawadi (2014) smooth-transition model to determine whether Brazil and China interest rate policy rules react to exchange rates
Shortcomings in the Literature

- Most papers deal with threshold effects of financial stress on monetary policy in individual countries.
- Evidence of threshold effects of financial stress in a panel context is largely missing.
Contribution

- Taylor rule estimation using panel regressions in a wider set of advanced and emerging market countries
- A first attempt to employ a panel threshold approach in Taylor rules where the level of financial stress determines the regime by which non-linear reactions of monetary policy to financial stress may arise
- Uses a comprehensive measure of the FSI developed by Dovern and van Roye (2014)
- Quantifies the intensity of monetary policy response during “high” and “low” financial stress regimes for advanced and emerging market countries
Key Equation

Let $i^*_{jt}$ = the interest rate determined from the following rule:

$$i^*_{jt} = \phi_g g_{jt} + \phi_{\pi} \pi_{jt}$$  \hspace{1cm} (1)

Interest rate smoothing consists of the following:

$$i_{jt} = \rho_1 i_{j,t-1} + (1 - \rho_1) i^*_{jt}$$  \hspace{1cm} (2)

Taylor rule augmented with the FSI

$$i_{jt}^{FSI} = c + \rho_1 i_{j,t-1} + (1 - \rho_1) [\beta_g g_{j,t+m} + \beta_{\pi} \pi_{j,t+n}] + \beta_b FSI_{j,t+k} + \mu_{jt}$$  \hspace{1cm} (3)
Consider the following general representation of the DPT regression model:

$$i_{jt} = c + x_{jt} \gamma + \beta^L d_{jt} I(q_{jt} \leq \chi) + \delta I(q_{jt} \leq \chi) + \beta^H d_{jt} I(q_{jt} > \chi) + \mu_{jt} \quad (4)$$

where

- $x_{jt}$ denotes the vector of exogenous and endogenous regressors for country $j$ at time $t$
- $d_{jt}$ is the set of exogenous, regime-dependent variables
- $\chi$ is the threshold variable
- $I(\cdot)$ is an indicator function taking the value of 1 if the value $q$ is below the threshold variable $\chi$, and zero otherwise
- Values below $\chi$ as those belonging to a “low stress” regime, and values above $\chi$ as those in the “high stress” regime
Threshold Value Estimation (Caner and Hansen, 2004, and Kremer et al., 2013)

- Forward orthogonal deviations transformation (Arellano and Bover, 1995) to remove country-specific fixed effects
- Estimation: Reduced-form regression (regress endogenous variables in $x_{jt}$ on its own lags)
- Replace the original regression in equation 4 by the fitted values for each threshold series $\chi$
- Threshold value $\chi^*$ is chosen as the one corresponding with the smallest SSR
- Estimate equation 4 with the chosen threshold $\chi^*$ via GMM
Balanced panel of 22 Countries; Period covered: 1996Q1-2013:Q3

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<td>Peru</td>
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Data for the Euro are covers the period 1999:Q1-2013:Q3
## The Financial Stress Index (FSI)

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see Dovern and van Roye (2014) for details
FSIs for Major Economies
Versions based on factor model

United States
Argentina
Australia
Austria
Brazil
Canada
China
France

United States
Argentina
Australia
Austria
Brazil
Canada
China
France
FSIs for 20 Major Economies
Average Financial Stress and Monetary Policy in Advanced Countries, 1996-2013

[Graph showing changes in financial stress and monetary policy rates over time]
Average Financial Stress and Monetary Policy in Emerging Market Countries, 1996-2013

Financial Stress Index

Monetary Policy Rate in Percent
FSI as regime-dependent regressor and threshold variable

\[ i_{jt} = c + \rho_1 i_{t-1} + (1 - \rho_1) \left[ \beta_g g_{j,t+m} + \beta_\pi \pi_{j,t+n} \right] \]
\[ + \beta^L_b FSI_{j,t+k} I(\overline{FSI}_{j,t+k} \leq \chi_f) + \delta_1 I(\overline{FSI}_{j,t+k} \leq \chi_f) \]
\[ + \beta^H_b FSI_{j,t+k} I(\overline{FSI}_{j,t+k} > \chi_f) + \mu_{jt} \] (5)

- \( i_{jt} \) is the central bank’s short-term interest rate\(^2\)
- \( g_{j,t+m} \) is the growth rate at time \( t \), and we set \( m = 0 \);
- FSI is the Financial Stress Index, where we set \( k = 0 \)
- \( \chi_f \) is the threshold variable
- \( i_{t-1} \) is the lagged policy interest rate
- \( \pi \) is the inflation rate where we set \( n = 2 \)

- We tested for more than one threshold, but the results were mostly insignificant

\(^2\) \( g_{j,t+m} \) and \( i_{t-1} \) are assumed to be exogenous and regime-independent; FSI is exogenous and regime-independent; \( \pi \) is endogenous and regime-independent
Financial Stress Effect for Advanced Countries

Advanced Countries, 1996-2013

Advanced Countries, 2002-2013

Threshold: 0.74

Threshold: 1.00
Financial Stress Effect for Emerging Countries

Emerging Market Countries, 1996-2013

Emerging Market Countries, 2002-2013

Threshold 0.65

Insignificant

Threshold 0.362

Insignificant
Real GDP as the regime-dependent regressor and FSI as the threshold variable

\[ i_{jt} = c + \rho_1 i_{t-1} + (1 - \rho_1) \left[ (\beta^L_{g, j,t} + \delta_1) I(\hat{FSI}_{j,t} \leq \chi_f) + \beta^H_{g, j,t} I(\hat{FSI}_{j,t} > \chi_f) + \beta_\pi \pi_{j,t+2} \right] + \beta_b \hat{FSI}_{j,t} + \mu_{jt} \]  

(6)
Financial Stress Effect on Output for Advanced Countries

**Advanced Countries, 1996-2013**

- Threshold: 0.74

**Advanced Countries, 2002-2013**

- Threshold: 1.00
Financial Stress Effect on Output for Emerging Countries

Emerging Market Countries, 1996-2013

Percentage-point change in interest rates

Threshold 0.32
Insignificant

Emerging Market Countries, 2002-2013

Percentage-point change in interest rates

Threshold 0.362
Insignificant
Monetary policy response at the start of the zero lower bound from 2008-2013
Robustness

- Results are robust to dropping one variable at a time (i.e., countries with the highest and lowest FSI through time)
- Additional explanatory variables, such as dummy variables for the Asian financial crisis and the Global financial crisis
- The use of shadow policy rate series of Wu and Xia (2014) in order to replace the zero lower bound rates of the U.S. and the U.K
Financial stress is a source of non-linearity between financial stability concerns and monetary policy rules.

Heterogeneity between the reaction of advanced and emerging economies to financial stress below and above the estimated FSI thresholds:
- For AE central banks, the negative impact of financial stress on interest rate setting is more pronounced when financial stress is low, with this effect dissipating entirely as the economy moves toward a high-stress regime.
- For EME central banks, financial stress only figures significantly in EMEs’ reaction functions in the post-2001 estimation period.

AE central banks react to output developments countercyclically regardless of whether the economy is in a low or high financial stress regime.

EMEs responded to output in a uniformly countercyclical manner only when financial stress is low.
Variables underlying the stress index entered separately into the policy rule in a panel setting